



# CLIMAS

CLIMAtE change citizens engagement  
toolbox for dealing with Societal resilience

## Deliverable No. 3.1 - Methodology for citizen-collaborative future scenario building for a climate-resilient society

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Authors: Havva Ebrahimi Pour (VUB), Carina Veeckman (VUB), Monika Mačiulienė (VILNIUS TECH), Gintarė Gulevičiūtė (VILNIUS TECH), Aelita Skaržauskienė (VILNIUS TECH), Kristina Kovaitė (VILNIUS TECH), Anna Maria Kotrikla (UAgean), Amalia Polydoropoulou (UAgean), and Kyriaki Maria Fameni (UAgean).

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## Consortium

Coordinator			
1	 VILNIUS TECH Vilniaus Gedimino technikos universitetas	VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS	Contact: Aelita Skaržauskienė <a href="mailto:aelita.skarzauskiene@vilniustech.lt">aelita.skarzauskiene@vilniustech.lt</a> Kristina Kovaitė <a href="mailto:kristina.kovaitė@vilniustech.lt">kristina.kovaitė@vilniustech.lt</a> Monika Mačiulienė <a href="mailto:monika.maciuliene@vilniustech.lt">monika.maciuliene@vilniustech.lt</a>
Partners			
2	 cambia changing MObility	CAMBIAMO SOCIEDAD COOPERATIVA MADRILENA	Contact: Floridea Di Ciommo <a href="mailto:floridea.diciommo@cambiamo.net">floridea.diciommo@cambiamo.net</a> , Maria Alonso Raposo <a href="mailto:maria.alonso@cambiamo.net">maria.alonso@cambiamo.net</a>
3		VRIJE UNIVERSITEIT BRUSSEL	Contact: Havva Ebrahimi Pour <a href="mailto:Havva.Ebrahimi.Pour@vub.be">Havva.Ebrahimi.Pour@vub.be</a> Carina Veeckman <a href="mailto:Carina.Veeckman@vub.be">Carina.Veeckman@vub.be</a>
4	 INSTITUT FÜR HÖHERE STUDIEN INSTITUTE FOR ADVANCED STUDIES Vienna	INSTITUT FÜR HÖHERE STUDIEN - INSTITUTE FOR ADVANCED STUDIES	Contact: Erich Griessler <a href="mailto:erich.griessler@ihs.ac.at">erich.griessler@ihs.ac.at</a> Elisabeth Frankus <a href="mailto:frankus@ihs.ac.at">frankus@ihs.ac.at</a>
5	 ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΙΓΑΙΟΥ UNIVERSITY OF THE AEGEAN	PANEPISTIMIO AIGAIU	Contact: Amalia Polydoropoulou <a href="mailto:polydor@aegean.gr">polydor@aegean.gr</a> Anna Maria Kotrikla <a href="mailto:akotr@aegean.gr">akotr@aegean.gr</a> Kyriaki Maria Fameli <a href="mailto:kmfameli@aegean.gr">kmfameli@aegean.gr</a>
6	 European Integrated Projects	EUROPEAN INTEGRATED PROJECTS	Contact: Lucia Cristea <a href="mailto:lucia.cristea@eiproject.eu">lucia.cristea@eiproject.eu</a> Liliana Denisa Andrei <a href="mailto:Liliana.andrei@eiproject.eu">Liliana.andrei@eiproject.eu</a> Iolanda Moldoveanu <a href="mailto:iolanda.moldoveanu@eiproject.eu">iolanda.moldoveanu@eiproject.eu</a>
7	 VILNIAUS PLANAS	UZDAROJI AKCINE BENDROVE VILNIAUS PLANAS	Contact: Rūta Balkė <a href="mailto:Ruta.Balke@idvilnius.lt">Ruta.Balke@idvilnius.lt</a> Agata Mackevičiūtė <a href="mailto:agata.mackeviciute@idvilnius.lt">agata.mackeviciute@idvilnius.lt</a>
8		DEEP BLUE Srl	Contact: Rebecca Hueting <a href="mailto:rebecca.hueting@dblue.it">rebecca.hueting@dblue.it</a> Sonia Matera <a href="mailto:sonia.matera@dblue.it">sonia.matera@dblue.it</a>
9		ASOCIACION PARA EL DESARROLLO DE LA DEMOCRACIA DELIBERATIVA Y PARTICIPATIVA	Contact: Yago Bermejo <a href="mailto:yago@deliberativa.org">yago@deliberativa.org</a> Carmen Nieto <a href="mailto:carmen@deliberativa.org">carmen@deliberativa.org</a> Arantxa Mendiharat <a href="mailto:arantxa@deliberativa.org">arantxa@deliberativa.org</a> Victoria Solé <a href="mailto:victoria@deliberativa.org">victoria@deliberativa.org</a>
10	 Zaļā brīvība	ZALA BRIVIBA BIEDRIBA	Contact: Ingrida Strazdina <a href="mailto:Ingrida@zalabriviba.lv">Ingrida@zalabriviba.lv</a> Ariana Apine <a href="mailto:ariana@zalabriviba.lv">ariana@zalabriviba.lv</a>

11		FUNDACIO EURECAT	Contact: Julià Vicens Bennasar <a href="mailto:julian.vicens@eurecat.org">julian.vicens@eurecat.org</a>
12		EXCO-GENCAT - DEPARTAMENT DE LA PRESIDÈNCIA - GENERALITAT DE CATALUNYA	Contact: Pablo García Arcos <a href="mailto:pablo.garcia@gencat.cat">pablo.garcia@gencat.cat</a> Núria Pérez Milán <a href="mailto:nuriaperez@gencat.cat">nuriaperez@gencat.cat</a>
13		IFOK GMBH	Contact: Julia Hoffmann <a href="mailto:julia.hoffmann@ifok.de">julia.hoffmann@ifok.de</a> Constantin Schäfer <a href="mailto:constantin.schaefer@ifok.de">constantin.schaefer@ifok.de</a>
<b>Associated Partners</b>			
14		Pilieciu mokslo asociacija	Contact: Eglė Butkevičienė <a href="mailto:info@pilieciumokslas.lt">info@pilieciumokslas.lt</a>
15		Laimikis.LT, Vsl	Contact: Jekaterina Lavrinec <a href="mailto:jekaterina.lavrinec@gmail.com">jekaterina.lavrinec@gmail.com</a>
16		RIGA MUNICIPAL AGENCY "RIGA ENERGY AGENCY"	Contact: Janis Ikaunieks <a href="mailto:ikaunieks.janis@riga.lv">ikaunieks.janis@riga.lv</a>
17		TECHNOVATIVE SOLUTIONS LTD	Contact: Mohammad Azizur Rahman <a href="mailto:aziz@technovativesolutions.co.uk">aziz@technovativesolutions.co.uk</a>
18		JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION	Contact: Ângela Guimarães Pereira <a href="mailto:angela.pereira@ec.europa.eu">angela.pereira@ec.europa.eu</a>
19		Gemeinde Edermünde	Contact: Thomas Petrich <a href="mailto:bgm.petrich@gemeinde.edermuende.de">bgm.petrich@gemeinde.edermuende.de</a>

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## Quality Reviewers

Name	Organisation
Monika Mačiulienė	VILNIUS TECH
Anna Maria Kotrikla	UAgean
Mohammad Azizur Rahman	TECHNOVATIVE SOLUTIONS LTD



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**List of Acronyms**

<b>Acronym</b>	<b>Definition</b>
AHP	Analytic Hierarchy Process
CA	Climate Assembly
FSW	Future Scenario-building Workshop
LL	Living Lab
SWOT	Strengths, Weaknesses, Opportunities, and Threads
VUB	Vrije Universiteit Brussel

## Project Overview

Climate change is one of the most critical issues to tackle today as it is foreseen to have detrimental social, environmental, and economic impacts in the near future. The last climate change events, such as flooding in Germany and Belgium in both Continental and Atlantic regions, heat waves and lack of water in both Mediterranean and Boreal regions, show that the policymakers, experts, and stakeholders' actions are not enough, and a 360° citizens engagement is urgently needed. Therefore, we must learn from the excellent experience in citizens' engagement in climate change action and build up citizens' supporting infrastructure for climate adaptation measures to help the 150 European regions and local communities resist. Climate assemblies and Living labs are considered sustainable and reasonable tools to stimulate deliberative democracy in climate policymaking.

The ambition of the CLIMAS project is to support a transformation to climate resilience by offering an innovative problem-oriented climate adoption Toolbox, co-designed with stakeholders by applying a values-based approach, design thinking methods and citizen science mechanisms. All that will be carried out with a gender and diversity approach. The Toolbox is expected to anticipate possible tensions, points of controversy, and dilemmas regarding the adaptation to resilience. Therefore, the Toolbox aims at enabling empowerment and engagement strategies that produce a society "resilient by design". In addition, CLIMAS will include the empirical component for testing this Toolbox and formulating scientific-based guidelines for policymakers on how to shift Climate Assemblies from technically based deliberations that belong to climate change experts to multi-stakeholder deliberations based on solving the dilemmas from a bottom-up, more societal, and value-based perspective. CLIMAS outcomes will positively influence policy development and awareness-raising processes and offer sustainable strategies to enhance the acceptance of citizens' led decisions by policymakers.



## Executive Summary

Deliverable 3.1, “Methodology for citizen collaborative future scenario building for a climate-resilient society” (D3.1) of the CLIMAS project, presents a methodology for citizen-collaborative future scenario-building process, as well as an elaborated report on the implementation of the designed method in Living Labs (LLs) to co-create future scenarios. The aim is to co-create and analyse alternative visions of the future of climate resilience in societies that can inform policy-making and social innovation. The emphasis will be on the long-term progression and future scenarios anticipated within 10 to 30 years.

Scenario building is a key method in foresight studies, and it involves several steps. Deliverable 3.1 of the CLIMAS project provides transparent methodologies and practical guidelines to understand and apply the scenario-building method in CLIMAS pilot cities: Vilnius (Lithuania) and Chios (Greece). The methodology draws on the field of 'Future Studies' (Bell, 2009) and elaborates on participatory 'future workshops' as a tool for engaging diverse stakeholders. The 'future workshop' is a technique of envisioning the future and serves as a structured framework to ensure effective, inclusive, and meaningful engagement in envisioning and planning for societal challenges (Jungk & Müllert, 1987). The main goals being followed by developing this tool include:

- **Facilitating Inclusivity:** ensuring the methodology is designed to be inclusive and incorporate diverse perspectives and stakeholders in the scenario-building process.
- **Encouraging Collaboration:** providing a collaborative environment where participants collaborate, share ideas, and build on each other's contributions to co-create scenarios.
- **Promoting creativity and innovation:** encouraging creative thinking and innovative ideas and incorporating techniques that stimulate imagination and visionary thinking.
- **Addressing Uncertainty and Risks:** developing approaches to acknowledge and navigate uncertainties, risks, and potential disruptions in future scenarios.
- **Encouraging Long-term Thinking:** promoting a forward-looking approach that considers the long-term implications of decisions and actions, improving resilience to future challenges.

Following the presentation of the methodology, the deliverable details how this approach was applied in organising two future workshops in the living labs of the two pilot cities. It summarises the results of the workshops, including the scenarios created and the criteria established for their assessment and prioritisation. The report discusses the insights gained from conducting these workshops and outlines the forthcoming steps for evaluating and prioritising these scenarios. Finally, based on the analytical outcomes of these two scenario-building workshops, a follow-up third workshop for scenario refinement was organised to collect experts' viewpoints about the clarity of the generated scenarios and evaluate uncertainties and risks associated with each scenario. The detailed implementation of the scenario prioritisation procedure and the developed decision-making tool is presented in Deliverable 3.4.

# 1. Introduction

This deliverable provides an in-depth description of the activities conducted in Task 3.1 of the CLIMAS project focusing on "Development of a Citizen-collaborative Future Scenario Building Methodology for a Climate Resilient Society." The deliverable provides a comprehensive overview of the methodology developed to guide the organisation of future participatory workshops. The purpose of the workshops is to gather different stakeholders to generate future scenarios depicting a climate-resilient society. The methodology has been developed by leveraging the Future Studies approach (Bell, 2009; Valciukas, 2017), and it has been designed to engage diverse societal groups in envisioning the future and co-creating scenarios and pathways.

The deliverable directly supports the CLIMAS project's overarching goals, aiming to improve climate resilience through problem-oriented approaches and by extensively involving citizens in decision-making. The participatory nature of the scenario-building process aligns with the project's ambition to transform climate adaptation measures by engaging citizens in deliberative democracy and co-designing tools with stakeholders. Effectively engaging citizens is expected to enhance the acceptance and effectiveness of climate policies and align them with societal values.

The insights gained from this task will significantly contribute to the other tasks of the CLIMAS project, including developing the tool in Task 3.4, which aims to provide an analytical framework for the systematic prioritisation of scenarios based on citizen and expert values.

Furthermore, this deliverable is closely related to other tasks in WP4 and 5 within the CLIMAS project. The developed methodology and the scenario prioritisation tool will be tested in Task 4.3 (Testing phase 2), and the final toolbox will be further calibrated and adapted to Climate Assemblies' (CAs) needs in Tasks 4.4 (Toolbox calibration and adaption to CAs) and Task 4.5 (Toolbox evaluation and validation). The iterative evaluation process, involving qualitative and quantitative methods, will validate and refine the developed scenarios and toolbox, ensuring they accurately reflect and address the values and priorities identified in this deliverable. Finally, for Task 5.3 (Recommendations for Policymakers and Definition of Strategies), the findings and methodologies from this deliverable will contribute to developing practical recommendations and strategies for policymakers. These will include guidelines and new tools to enhance the acceptance of citizen-led decisions.

The deliverable begins with an introduction to the project, including the fundamental concepts of climate resilience, the importance of citizen participation, and the research field of future studies. Next, a detailed description of a methodology for future scenario-building is provided, describing each phase from preparation to evaluation. This methodology was designed explicitly by VUB based on good practices found in the literature and adapted to the context of the CLIMAS project. The practical application of this methodology is demonstrated through case studies of two future co-creation workshops held in Vilnius and Chios, followed by a thorough analysis of the generated scenarios and identified evaluation criteria. Additionally, the document includes insights from the expert workshop on scenario refinement, offering an in-depth review of scenarios developed during the workshops. Finally, the deliverable concludes with a summary of lessons learned, recommendations, and future steps, ensuring a holistic understanding of the project's outcomes and providing guidance for further work.

## 2. Background

Climate change is a reality that affects everyone, and human actions are the leading cause of its rapid acceleration. No matter how much we try to reduce the sources of global warming, we have to face serious consequences—such as more frequent and intense weather events (heatwaves, wildfires, storms, floods), more extended periods of drought and heat, and other adverse effects of climate change. Our primary contribution is to co-creating and analysing alternative visions for the future of climate resilience by integrating diverse perspectives, with the ultimate goal of contributing to a more resilient society capable of withstanding the uncertainties of climate change. This collaborative process involves stakeholders from various sectors envisioning and evaluating scenarios that address climate change's challenges and opportunities. To this end, a future scenario-building methodology is designed, and guidelines are provided in the deliverable to implement the scenario-building workshops effectively. Before we dive into more details, one may wonder: What is the definition of climate resilience? What does a scenario-building workshop involve, and how does it help collectively envision the future and improve public participation in decision-making?

### 2.1 What is climate resilience? – resilience versus adaptation.

Climate resilience is the term that describes how well we can cope with, bounce back from, and adjust to the effects of climate change (Bahadur et al., 2013). Climate resilience is a key aspect of any effective climate action plan, and it is essential for reducing the risks and costs of climate change and enhancing our well-being and sustainability. The ability to work with uncertainty and change is a key characteristic of resilience. Bahadur et al. (2013) identified ten principal attributes of resilient systems, including high diversity, effective governance and institutions, the ability to work with uncertainty and change, community involvement and the inclusion of local knowledge, readiness and strategic planning for disturbances, high social and economic fairness, robust social values and structures, acknowledging non-equilibrium dynamics, continual and practical learning, and the adoption of a cross-scalar perspective.

Climate change is a global challenge that requires both international and local solutions. To cope with this complex and urgent issue and build a climate-resilient society, a collaborative and coordinated approach that involves multiple stakeholders and sectors is needed. This unprecedented effort demands a high level of professionalism and commitment.

Adaptation and resilience are two distinct but interconnected concepts in the context of climate change. Adaptation responses can both help to build resilience and undermine resilience. The amount of change may sometimes be beyond our ability to adapt, impacting the maintenance of system resilience. A timely focus on the interplay between adaptation and resilience will yield more efficient strategies for preparing and reacting to present and forthcoming changes (Nelson, 2011). While adaptation involves adjusting to change, resilience encompasses the ability to withstand and recover from it. Aspects of resilience that can be operationalised should be integrated into existing climate change adaptation concepts such as vulnerability and adaptive capacity. The most significant potential of resilience in climate adaptation is its capacity to shape a hopeful vision for the future, highlighting the significance of employing collaborative tools to encourage learning and innovation (Abeling, 2018).

## 2.2 Future studies and participatory future workshops

As an interdisciplinary field, future studies explore the trajectories of possible futures, anticipating and preparing for potential developments in various domains. It focuses on organised and clear thinking about different possible futures. Its goal is to help us understand what could happen and give us more control over future possibilities (Bell, 2009; Valciukas, 2017). Future studies have its foundations in understanding the dynamics of change and uncertainty. The work of futurists like Kahn & Aron (1962) and Toffler (2022) emphasised the need for systematic approaches to envision and prepare for plausible futures. As Kuhnt & Troxler (2007) discussed, future workshops are a method for developing a shared vision of the future, particularly among marginalised groups. This approach emphasises the equal status of participants, regardless of their background.

In recent years, integrating participatory future workshops has gained prominence as a method to engage diverse stakeholders in envisioning and shaping future scenarios. Future studies, a field that has evolved from utopianism to empirical predictions, are now characterised by a critical perspective that seeks to address the gaps in current visions of the future. Future studies in government and business are dominated by strategic planning, technology impact assessment, and risk analysis. In academia, there is a move towards a more analytical viewpoint. This involves concentrating on the gaps in specific ideas about the future and striving for a more balanced approach to future studies, considering diverse cultural issues. There is also a significant shift toward future studies as a framework for social emancipation (Milojevic, 2021).

Futures studies have mainly been adopted in different domains. Gabrielli and Zoels (2003) explore how human-centred design strategies can be used as a foresight tool. They claim that design can support planners in finding and mapping potential opportunities for future product or service development by enriching future scenarios with visual, spatial, and experiential aspects. Future studies have been eagerly adopted by planning departments in organisations and nations, seeking to open up the future and move from the 'likely' future to alternative futures. Inayatullah (2005) discussed that combining future studies and action learning, known as anticipatory action learning, can transform organisations. Godet (2006) introduced Future Scenario Planning as a strategic management tool and highlighted that people can learn how to create futures with the right tools and attitudes. The future depends on individual and collective decisions rather than prevailing trends. Vidal (2006) provides practical guidelines for conducting future workshops, emphasising the importance of facilitation and creative tools. These studies collectively underscore the potential of future workshops in creating desirable futures, particularly in promoting inclusivity and democratic problem-solving. Alminde (2020) extends the role of future workshops in democratic and inclusive research, particularly with vulnerable groups. Raider-Roth (2021) further explores the potential of future workshops in an online setting, highlighting the need for both synchronous and asynchronous processes.

The future workshop method engages small groups in envisioning and realising innovative ideas for addressing social issues. It has been applied in various domains, such as management, research, and citizen involvement. In the context of action research, the future workshop method has been adapted to facilitate collaborative research that empowers participants to create positive change in their communities (Alminde & Warming, 2020; Bell, 2009).

Future scenario building via participatory future workshops can be deployed as a deliberation tool in the ‘**pre-assembly preparation**’ and ‘**assembly agenda setting**’ phases (Gibb & Isack, 2003) (Zhang, 2022), helping organisers and facilitators -- of climate assemblies, living labs, or anybody who wants to organise a workshop -- to design and plan the process in a participatory way. Organisations and facilitators can use future scenario building to involve citizens/stakeholders’ perspectives in imagining and exploring possible climate action futures. This can foster a sense of ownership, engagement, and inclusion among the participants and generate diverse and creative ideas for addressing the climate crisis.

## 2.3 What are scenarios? - Scenario types and techniques

Scenarios are a way of imagining different futures. They answer the question of “What might happen in the future under different conditions?” and with what measures could we be better prepared to address future difficulties. Scenarios can offer alternative “what-if” stories of the future that can be used for strategic planning. By imagining the future, they can help cope with the inherent uncertainty that marks our societies. Scenario results in diverse future narratives that help understand risks, opportunities, and strategic options to find solutions. Scenarios are outcomes of a mix of experimental methods that are exploratory in nature. Therefore, they do not represent certain future events and are not the only possible future events. Scenarios help overcome mental biases by creating multiple futures, and they process possible, likely, and desirable visions of the future and focus on what could be. Scenario development enhances the capacity of organisations and institutions to deal with their unpredictable environments (Meinert, 2014). Scenarios should be *novel, multifaceted, believable, comprehensive, and never right or wrong*.

Ducot (1980) offers a three-dimensional classification of scenarios and the practical application of each type to a problem. The author first defines the scenarios and then classifies them along three axes: exploratory-mixed-anticipatory, descriptive-dynamic-normative, and trend-compound-peripheral. This detailed three-dimensional categorisation is depicted through a cube-shaped diagram that displays 27 distinct scenario types. Every type is exemplified by its application to a real-world problem. Alexander (2004) extends the scenario method to system design, emphasising the importance of user stories. Börjeson (2006) and Bishop (2007) comprehensively overview scenario types and techniques. Börjeson's typology is based on the user's need for knowledge, while Bishop's review categorises techniques into eight groups. Börjeson (2006) discusses various typologies and approaches to future studies. It distinguishes between *predictive scenarios, explorative scenarios, and what-if scenarios*. The classification is based on the principal questions a user may want to pose about the future. These are “*What will happen?*”, “*What can happen?*” and “*How can a specific target be reached?*”.

Predictive scenarios aim to predict “*what will happen?*” based on current trends. It distinguishes between two types of predictive scenarios: “forecasts” and “what-if” scenarios. “*Forecasts*” predict what will happen under the assumption that the likely development unfolds, often using probability and likelihood concepts. They are useful for planning and adapting to expected situations, providing valuable information for decision-makers, planners, and investors. On the other hand, “*what-if*” scenarios explore future developments based on specific, significant events. These events can be external, internal, or a combination of both. What-if scenarios can be seen as a group of forecasts, differing not just in degree but also in terms of various exogenous variables.

Explorative scenarios are focused on understanding and negotiating different possible futures. These are characterised by their response to the question “*What can happen?*” Two types of explorative scenarios are identified: external scenarios, which examine potential developments in external factors, and strategic scenarios, which investigate the outcomes of specific actions. Policies are not part of the scenarios but are developed and assessed based on the framework provided by the external scenarios. External scenarios aim to assist users in developing robust strategies that can withstand various external developments. Also, these external scenarios can have a broad target group and may cover general topics such as global energy or climate scenarios.

On the other hand, strategic scenarios are particularly relevant in strategic contexts, helping to address uncertainties and plan for a variety of potential futures. Strategic scenarios incorporate policy measures defined by the intended user to address the issue. These scenarios describe possible consequences of strategic decisions, focusing on both internal factors that can be influenced and external aspects. They consider how decision consequences may vary depending on future developments. Strategic scenarios involve defining target variables and testing different policies to study their impact on these variables. Overall, the primary goal of explorative scenarios is to explore situations or developments considered possible from various perspectives.

Normative scenarios address the question of “how a specific target can be reached?”. Normative scenarios can be of two types: “*preserving scenarios*” and “*transforming scenarios*”. Preserving scenarios focus on achieving the target by adjusting the current situation while transforming scenarios explore how the target can be reached when the existing system structure impedes necessary changes. In normative scenarios, explicit normative starting points guide the study, emphasising realising future situations or objectives. Preserving scenarios are suitable when the goal can be achieved within the current system structure. In contrast, transforming scenarios are used when a shift to a structurally different system is deemed necessary for goal attainment. The transforming scenario approach often rejects modelling the existing system structure, perceiving trends and the current structure as part of the problem.

Normative-preserving scenarios aim to efficiently meet a specific target, typically in a cost-effective manner. This can involve optimising modelling using tools like the MARKAL energy model or qualitative methods. In regional planning, for example, experts or planners assess various environmental, social, economic, and cultural factors to determine the most efficient path to reach specific targets (Börjeson et al., 2006).

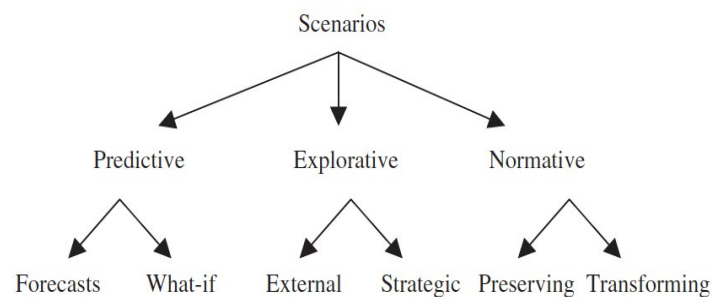


Figure 1. Scenario typology has three categories and types (Börjeson et al., 2006).

## 2.4 Why citizen participation? – the significance of citizen engagement in the scenario building

The future workshop aims to identify the vision of a desired climate-resilient future for people in their local neighbourhoods, cities, or regions and the steps needed to achieve it. In particular, organisers are keen to understand the people's demand for new climate services that can enhance their knowledge and capacity. Therefore, citizens should also be involved in the policy development process, considering their hopes and fears for the future.

Furthermore, to develop a national strategy that reflects the needs of the whole society, the national government needs to take broader participation very seriously. This requires an integrated approach that involves people from different sectors, levels and backgrounds. Governments are willing to listen to and learn from different perspectives that may challenge their assumptions and plans. This is a rare opportunity for constructive dialogue and collaboration on a crucial issue for a country's future (Alminde & Warming, 2020; Van den Ende et al., 2022).

Citizen participation is crucial in scenario building, as it enhances communication and fosters a sense of community (Lawrence, 1993). It is particularly important in local governance, where it can strengthen democracy and improve service delivery. The active involvement of citizens in local government matters will lead to the creation of development programs that directly engage the community and inspire them to be proactive and creative. Participatory mechanisms are essential for delivering the services that citizens demand. To foster citizen participation, local governments need a robust democratic structure that allows for meaningful engagement and accountability. Therefore, the government should design development programs responsive to the needs and preferences of the people at all levels (Zanna, 2015).

Head (2007) states that the shift towards community engagement should be viewed critically, as government agendas may drive it and have limitations. The importance of building effective capacity for citizens and all non-government organisations to participate should be emphasised. Citizen engagement is also a valuable learning experience, helping citizens and local government employees develop the skills to address challenges. True engagement involves reinforcing the sense of community and building up citizenship in a participatory process. Forums and methods used for community involvement have a strong learning aspect in developing the competencies of local government employees and citizens to cope with changing expectations and challenges in times of shrinking financial resources (Dobos, 2013).

### 3. Development of a Methodology for Participatory Future Scenario-building

This section elaborates on the methodological tool designed for future scenario building for the CLIMAS project. The tool builds upon existing literature on future scenario building, as discussed in the introduction. It draws inspiration from mature and recent contributions in the field, including the work by Kollosche & Florian (2021). While the best practices of the existing methodologies are adopted in the context of scenario-building for climate resilience to develop the methodology, there are fundamental differences from the existing works. Specifically, the developed tool proposes defining context-specific evaluation criteria in each workshop for assessing scenarios rather than relying on predefined and generic criteria. This approach facilitates a precise and meaningful evaluation of the generated scenarios, considering the most relevant criteria defined by users. Additionally, a comprehensive procedure is outlined to identify key drivers in scenario construction. Moreover, an extensive scenario prioritisation strategy is formulated to gather participant’s opinions on the most critical scenarios using survey tools and implement a data-driven decision-making tool to systematically prioritise scenarios using the Analytic Hierarchy Process (AHP). Lastly, we organised an expert workshop as a structured and collaborative process where experts from various fields come together to develop, critique, and improve scenarios.

Figure 2 depicts a generic structure of the future scenario-building workshop (FSW) from preparation to the evaluation phase. The workshop consists of four main phases, described in detail in this document.

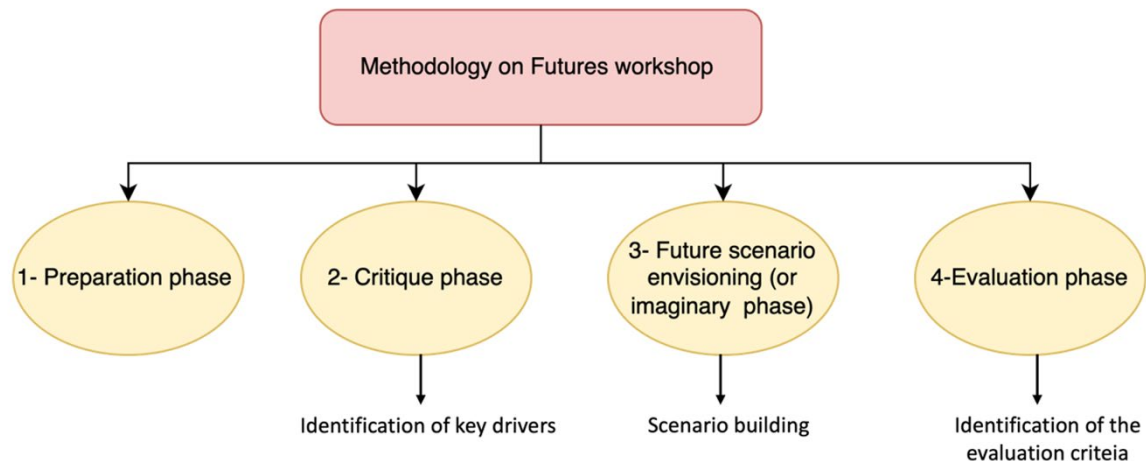


Figure 2. Structure of the future scenario-building workshop.

#### 3.1 Phase One: Preparation and Planning

The preparation phase of an FSW is crucial for ensuring its success and achieving the desired outcomes. Paying careful attention to the following steps of the preparation phase, a solid foundation for a successful future workshop, maximising participant engagement, and achieving the desired outcomes can be reached. Here are some key aspects to consider during the preparation:

**(a) Define the workshop objectives:** Clearly articulate the purpose and goals of the future workshop. *What specific outcomes do you hope to achieve?* This will guide the entire planning and execution process. For example, if you are identifying strategies for building a climate-resilient society, you should specify the specific outcomes you hope to achieve.

Defining a broader theme, such as “how to create a society that can be resilient to climate change” or “identifying strategies for building a climate-resilient society,” might be a better way to guide the workshop. This would allow us to explore different strategies for dealing with various challenges and opportunities related to climate resilience. General scenarios that are applicable to European society could be more valuable, and these can be later customised based on the needs of different European countries and regions.

**(b) Identify stakeholders/participants:** To ensure a successful and inclusive workshop, it is essential to identify the relevant stakeholders and participants who should be involved in the process. These could include experts, community members, decision-makers, representatives from various sectors related to the workshop's theme, and citizens (students, vulnerable groups, migrants, etc.).

Some criteria for selecting participants are:

*-What function do they have? Think about what role they play in the issue. Are they decision-makers, planners, implementers, or beneficiaries? Do they have relevant knowledge, experience, or resources?*

*-What scale are they interested in? Think about their level of concern and influence. Are they local, regional, national, or international actors? Do they care about the short-term or long-term impacts of the issue?*

*-Which group do they belong to? Think about their affiliation and network. Are they part of a specific theme or political orientation? Do they have common interests or goals with other stakeholders?*

*These criteria can help to ensure a balanced and diverse representation of perspectives and interests in the workshop.*

**(c) Conduct background research:** Collect and analyse relevant information and data related to the workshop topic. By doing so, you can facilitate informed discussions and explore future possibilities.

**(d) Design the agenda:** Develop a comprehensive agenda that outlines the flow of activities, discussion topics, and exercises for the workshop. Ensure the agenda balances information sharing, collaborative activities, and participant engagement. Developing a clear plan and timeline for the scenario-building process is also essential.

**(e) Prepare materials and resources:** Prepare any necessary materials, resources, or visual aids during the workshop. A presentation slide, handout, flip chart, or digital tool could be used. To facilitate the group work, appropriate venues and rooms should be secured. The space should be customised to the group's needs and preferences, creating a comfortable, casual, and stimulating environment. Refreshments such as fruits, cakes, soft drinks, tea, and coffee should be provided during the breaks.

Arrange for a tape recorder and microphones to capture the entire session when necessary. You will, of course, need to let the participants know about the recording setup. Other considerations include:

- Defining the duration of the workshop (Min half a day to one day - Max 3 Days)
- Defining the number of participants (Min 12 - Max 20).
- Defining the number of facilitators (two facilitators) and one note-taker
- Ensuring gender equality and diversity
- Plan a simple warm-up exercise for all the participants

**(f) Communicate with participants:** Contact workshop participants well in advance to inform them about the workshop's purpose, agenda, and pre-workshop tasks or readings. Be clear and concise in your instructions, and invite them to ask questions.

**(g) Scoping:** Defining the scope of the scenario-building exercise, including the geographic and temporal boundaries and time horizon. The scope also includes identifying the key focus areas relevant to the exercise, such as urban planning, agriculture, energy systems, etc. These focus areas should reflect the main challenges and opportunities the exercise aims to explore.

**(h) Articulating critical questions for each phase:** Define critical questions for each workshop phase. This also depends on who will participate and their backgrounds and motivations.

**(i) Assign roles and responsibilities:** Determine the roles and responsibilities of facilitators, note-takers, timekeepers, and any other supporting staff or volunteers. Clarify their tasks and ensure everyone is prepared for their respective roles.

**(j) Test technology and tools:** If technology or specific tools will be used during the workshop, test them in advance to ensure they work smoothly. This includes audio-visual equipment, presentation software, online collaboration platforms, or other technological solutions.

**(k) Rehearse and fine-tune:** Perform a run-through of the workshop's activities to identify potential problems or gaps. Provide participants with an engaging and seamless experience by making necessary adjustments (Kollosche & Florian, 2021; Luttamäki, 2016; Troxler & Kuhnt, 2007).

### 3.2 Phase Two: Identification of Key Drivers (Critique phase)

This phase is known as the warm-up phase of the workshops and is designed to help participants ease into the scenario-building process and foster a broad and active involvement. A key – and the most challenging – step in envisioning the future of the scenario topic is to identify the main factors that will influence it. What are the most relevant and uncertain factors that will affect the future of the scenario topic? What will be the main drivers of change? Moreover, what factors can we assume are more or less fixed for the time horizon we are considering?

Key drivers are the factors that influence the success or failure of a decision or a key question. For example, to create a climate-resilient society, we must consider the key drivers affecting its feasibility and impact. The drivers will shape our scenarios and stories to explore different possibilities and outcomes. They help us understand the challenges and opportunities that we may face in the future.

A guiding question can be: *“For a society to be resilient to climate change, what factors are crucial?”*  
Alternatively, *“What are the characteristics of a climate-resilient society?”*

*Goals of the critique phase:*

- a) Networking (opening of discourse and involvement of participants)
- b) Explorative (analysis of the target of study: resilient society against climate change)
- c) Defining key factors/drivers
- d) Reaching the standard narrative of discovered drivers/factors

*Outcomes of the critique phase:*

- a) A shared understanding of problem and scenario method
- b) Identification of key drivers/factors and uncertainties
- c) A list of documented and evaluated factors/drivers
- d) consensus on key factors/drivers (10-12 drivers)

### **3.2.1 Techniques of the critique phase**

Several techniques can be potentially used in the critique phase that are summarised as follows:

#### *a) Brainstorming/group discussion*

Brainstorming is the primary technique used in this phase. The group discussion can begin with some ice-breaking questions. Since our planet is facing a climate change crisis that impacts all of us, as a way to get the workshop started, we can ask the following climate-resilient society icebreakers:

- What extreme weather events have made you consider the importance of building a climate-resilient society? What can we do in the future to better prepare for such events?
- What actions can we take to promote resilience and achieve a more sustainable future in the face of climate change?
- How can individuals contribute to creating a climate-resilient society? What can we do to encourage more people to get involved in building resilience?

- How could our society be more climate-resilient? If you had to choose one aspect, what would it be? What would you do to make it happen?

#### b) STEEP technique

The STEEP framework is a standard tool for strategic planning and scenario building, which helps analyse the external factors affecting an organisation, project, or industry. The STEEP stands for five main clusters: Social, Technological, Economic, Environmental, and Political factors (Fisher et al. (2020)) These themes cover the different areas of application:

**Social:** factors including values, lifestyles, demographic influences, income distribution, education, health, population growth, migration, security

**Technology:** research, new technologies and trends, assessment of technology

**Economics:** economic growth, exchange rates, taxation, unemployment rate, business cycles, resource availability

**Environment:** climate change, pollution levels, quality of life

**Politics:** legislation, political stability, taxation, safety regulations, and subsidies.

### 3.2.2 Toward determination of critical drivers

The workshop participants are divided into smaller groups according to their preferred topics. Each group is assigned a separate room to work on their topic. The main objective of the group work is to identify and collect all the relevant factors that influence the climate resilience of their region or Europe as a whole. The groups are expected to work autonomously without any external guidance. They need to choose a moderator to facilitate the discussion and ensure that the outcomes are recorded (using flipcharts or boards).

A suggested method for group work is to start with a brainstorming session and then organise and categorise the factors. After completing the group work, the groups will reconvene in the plenary and present their findings. The facilitator will then cluster the factors from different groups and create a preliminary list of the key factors for climate resilience.

Considering the complexity of the problem and the large number of defined factors, a subset of the most relevant factors should be selected. To do this, a point allocation method could be used, where each participant will assign points to the factors that they consider most important. The question is, “Which factors are most significant in creating a resilient society versus climate change across Europe or their local neighbourhood/city/region?” This means how much a factor impacts the region and how much it is affected by other factors.

The workshop participants would agree on a set of 10 to 12 main influencing factors. These factors will be documented and finalised collaboratively. The final list of factors has clear definitions and descriptions for each item. These factors are interrelated and need to be considered together to promote climate resilience in societies. Moreover, different factors may be more or less relevant

depending on the context, culture, and characteristics of each society (Kollosche & Florian, 2021; Vidal, 2005; Luttamäki, 2016).

### 3.2.3 Assessing key drivers

The drivers/factors can be selected by assessing them based on their direct and indirect impacts as well as the uncertainty (Kollosche & Florian, 2021):

*A) Effect on the system:* This criterion assesses the degree to which a factor/driver significantly influences the overall procedure. For example, what are the most relevant factors for planning a climate-resilient society? Variables with a significant impact can highly change the system's behaviour. For instance, in the context of climate resilience, reducing greenhouse gas emissions directly impacts the climate system by mitigating global warming and its associated effects on weather patterns, sea levels, and extreme events. This factor has a high impact on the system.

*B) Effect through the system:* This criterion assesses that if some factors do not directly touch the core of the system, they can still strongly impact the system's behaviour by affecting other connected elements. This way, they can significantly change how the entire system works. For example, while education and awareness may not directly impact the climate system, they can indirectly influence individual and community behaviour, reducing energy consumption and lowering emissions.

*c) Uncertainty:* This criterion assesses the degree of uncertainty; in other words, some factors are more uncertain or unpredictable than others. This means they have less data available, depend on outside or random factors, or are hard to estimate. Knowing how uncertain a factor is is important because it helps assess the reliability and robustness of strategies or decisions based on it. For example, various economic and political factors can influence carbon markets and pricing mechanisms, making it challenging to predict the future price of carbon credits with certainty.

In general, these criteria can help us prioritise factors to be examined more closely based on their direct or indirect impact on a system and their level of uncertainty. Please note that the evaluation criteria for scenario assessment should be distinct from these three criteria.

## 3.3 Phase Three: Scenario generation or envisioning

The envisioning phase of an FSW is a collaborative and creative process that aims to collectively imagine and design possible future scenarios, usually related to a specific topic or challenge. This phase is crucial for stimulating innovation, facilitating dialogue, and building a shared future vision. This phase focuses on creating various forecasts for the future of a society that can adapt to climate change. This step aims to brainstorm different scenarios for the future of the focus areas based on the key drivers we identified before. In total, 4 to 5 raw basic scenarios might be developed considering the specified duration of the workshop. The key drivers will be shown again, as they are the basis for this and the following phases, where the scenarios and projections will be built on them.

*Goals of the phase:*



- Using the key drivers defined in the previous phase to identify a set of future scenarios. These scenarios should be manageable and realistic but, instead, reflect the uncertainty and complexity of the future. The scenarios should also be consistent, comprehensive, and logical.

*Outcomes of the phase:*

- List of 4 to 5 future scenarios/projections.

### **3.3.1 Techniques of Scenario Envisioning**

#### *3.3.1.1 Brainstorming*

This step aims to create multiple developments/projections for each key driver in small groups. The materials needed for this task are index cards, pens, and a handout with the key drivers in the columns and enough blank spaces in the rows.

The small groups will explore different developments/projections for the key factors. Each group will focus on 3 key drivers and come up with at least 2 different developments for each one. These scenarios should reflect the possible variations of the key factors in the specified time frame and be distinct from each other.

The guiding question for the group work is:

- *What are the potential future developments or specifications associated with the key factors we have chosen?*

The facilitator instructs the participants to write down each suggestion for each *development/projection* scenario on a card, along with a keyword. The facilitator then asks the participants to share their cards with the group and attach them to the corresponding key factor on the whiteboard. The facilitator then arranges the cards on the pinboard in a matrix format, creating a morphological box. Using the developments, the participant may develop possible scenarios via brainstorming. The leading question is:

- *Which possible scenarios are thinkable?*

Alternatively, the scenarios can be generated more systematically via a morphological box, as explained in the following subsection.

#### *3.3.1.2 Morphological Box*

The morphological box, also known as the morphological matrix, is a method for scenario building that explores and generates different factor or driver combinations. It allows for creating a range of scenarios by considering various possible element combinations.

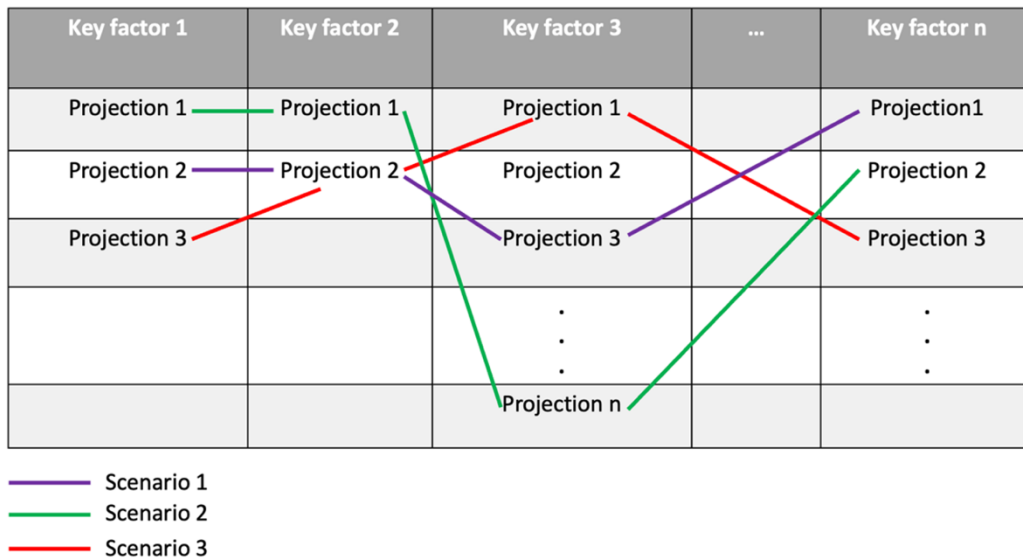


Figure 3. Example of a morphological box.

Several projections/developments (not scenarios) for each key driver should be defined to generate scenarios using the morphological box approach. After generating key drivers in the previous phase, we develop related developments for each driver, incorporating significant characteristics of that respective driver. These projections will be inserted in the table to be considered in conjunction with other projections of other key factors as components of possible scenarios. Each suggestion for development/projection should be recorded on a card with a keyword. Each key driver's corresponding cards should be displayed during the plenary session. Examples of the developments/projections can be found later in the following text.

The next step is to create a morphological box in the plenary by collecting and placing key drivers at the head of each column and their respective developments/projections in the subset rows (See Figure 3). A completed version of the morphological box with key factors and their corresponding predictions/developments is available.

Next, the task is to combine and generate coherent and practical combinations from the projections/developments into the most relevant scenarios (4 to 5) based on the participants' consensus. This step aims to integrate matching developments/projections of the key factors into scenarios. The primary tool for this step is the pinboard. Developments that do not fit should be set aside.

These raw scenarios form the basis for the scenarios. The guiding questions to the participants are (Kollosche & Florian, 2021):

- *Is there a relationship between the specifications of various key elements and their future estimates?*
- *In what ways do these relationships affect the climate resilience of society?*

The facilitator will then draw lines to connect corresponding specifications within the morphological box displayed on the pin board. As the final step, each scenario should be narrated clearly via consensus among the participants (Troxler & Kuhnt, 2007; Van den Ende et al., 2021; van den Ende et al., 2022; Vidal, 2005).

For further clarification, please refer to the following basic examples of key drivers and their possible developments:

#### *Key Driver 1: Renewable Energy Transition*

A transition to renewable energy sources with:

Development 1: moving away from fossil fuels.

Development 2: a clear focus on sustainability and social inclusivity.

#### *Key Driver 2: Education and Awareness*

Development 1: focusing on NGOs to increase awareness.

Development 2: designing specific courses for students on climate change.

Development 3: community workshops and training.

For example, Development 1 from Key Driver 1 and Development 2 from Key Driver 2 can be connected in the morphological box to create a scenario: designing specific courses for students to increase awareness of how to move away from fossil fuels. These can also be connected to several other developments from other key factors. Finally, this gives a raw scenario that can be further discussed to achieve a final scenario.

Please note that you might use brainstorming and strategies (other than the morphological box) to define the scenarios. This approach is a systematic method for scenario generation.

### **3.4 Phase Four: Identification of Evaluation Criteria**

Once the scenarios are generated, they should be reviewed, analysed and prioritised. This requires determining a number of key criteria that are crucial in evaluating the scenarios. These criteria are essential for assessing the scenarios in any situation, even if your goals, strategies, work, or management change. The criteria should match your goals, objectives, and context of the scenario-building exercise. They can help you and your stakeholders see the pros and cons of a scenario for your community. Having a list of essential criteria for ranking the scenarios will give you a clear and objective way to evaluate and compare them. It helps ensure that your analysis and decision-making process are based on relevant factors and considerations.

Each scenario should be evaluated for its feasibility, desirability and potential implications. This evaluation helps identify the most promising scenarios and understand each scenario's possible risks and opportunities.

*Goals of this phase:*

Identification and definition of the criteria. Criteria are a list of crucial key factors in evaluating the scenarios. These factors should be aligned with the goals, objectives, and specific context of the scenario-building exercise.

*Outcomes of this phase:*

A list of criteria for evaluating the scenarios.

The main techniques used in this phase are brainstorming and group discussions. When defining criteria for evaluation by brainstorming, you shift your focus to evaluating and comparing the scenarios you have developed. The criteria help you measure and rank the scenarios according to the objectives, goals, and strategic priorities of the scenario-building exercise. The criteria should cover aspects such as feasibility, desirability, alignment with goals, potential impacts, risks, resource requirements, stakeholder acceptance, or any other relevant factors for decision-making.

Therefore, the scenarios must meet the following essential criteria (Van den Ende et al., 2022; Wiek et al., 2014):

- Plausibility—the scenario team must find the projection plausible.
- Dissimilarity—the projections must be different from each other.
- Completeness—the projections within a descriptor must cover all possible outcomes.
- Relevance—the projection must be necessary for the future.
- Information content—the projection must add value to the projections within a descriptor.

## 4. Executing Participatory Future Scenario-building Method in Practice

Living Labs implements the future scenario-building methodology described in section 2 to organise participatory workshops for future scenario-building. The implementation details and outcomes of the workshops are summarised in the following subsections.

### 4.1 A Participatory Future Scenario-building Workshop in Vilnius Aukštamiestis LL

VILNIUS TECH, in cooperation with Vilniaus Planas, applied the guidelines to implement a workshop on October 8, 2023, in Vilnius Aukštamiestis Living Lab. VUB provided online support for the preparation steps with specific guidelines and by answering questions from the organisers. The questions (from organisers) and answers (by VUB) are provided in Annex A.

#### 4.1.1 Preparation steps for the workshop

##### Step 1: Discussions amongst the team on how to approach the task

With the guidelines thoroughly reviewed and clarifications in hand, the subsequent phase was marked by internal team discussions. These deliberations focused on strategising our approach, ensuring that the workshop would adhere to the guidelines and be tailored to the unique dynamics of our audience and setting.

1. **Kick-off meeting:** A dedicated kick-off meeting was organised to bring together all team members involved in the workshop. The primary objective of this meeting was to share the insights obtained from the clarification process and set the tone for subsequent discussions. It also included defining workshop objectives.
2. **Delineating responsibilities:** One of the foremost tasks was to assign specific roles and responsibilities. By ensuring that every team member had a defined role—be it facilitator, note-taker, or logistical support—smooth execution could be anticipated. Clear responsibilities also meant that each member could delve deeper into their specific areas, becoming experts who could guide the process seamlessly.
3. **Pinpointing stakeholders and participants.** We pinpointed stakeholders and participants in our Living Lab that were pertinent to the workshop. The spectrum spanned from experts, community figures, and policymakers to various sector representatives and citizens, encompassing students and vulnerable groups. Selection Criteria:
  - a. *Functionality:* We considered their role in the overarching issue, gauging their relevance and involvement.
  - b. *Interest scale:* We evaluated their influence and concerns, whether local, regional, or global.



- c. **Prompting Discussions:** The team set up a series of prompts and questions designed to spark thought-provoking and productive discourse among participants.
3. **Customizing to the audience:** The Vilnius Aukštamiestis Living Lab mandated a nuanced approach with its distinctive participant profile. Activities and discussions were adapted to anticipate the participants' knowledge background, expectations, and cultural moorings.

### Step 3: Setting up the scene

Understanding that the ambience and environment of the workshop can profoundly impact the outcomes, we were meticulous in our preparation. Here is a detailed breakdown of how we set the scene:

1. **Venue selection:** We chose a location accessible to our participants and conducive to focused discussions. The room we booked was spacious, well-lit, and insulated from external disturbances, ensuring participants could concentrate without distractions.
2. **Seating arrangement:** Considering collaboration, we opted for a semi-circular seating arrangement. This ensured every participant had a clear line of sight to the presenter and fellow attendees, promoting engagement and active participation.
3. **Technical setup:** We created a designated presentation space with a projector, screen, and reliable audio equipment. We tested all equipment beforehand to prevent any technical glitches during the workshop.
4. **Resource stations:** Dedicated areas were set up where participants could access stationery and workshop handouts. This enabled participants to quickly grab what they needed without disrupting the flow of the workshop.
5. **Refreshment zone:** We set up a designated area for refreshments with various snacks, fruits, teas, and coffee. Regular breaks were scheduled to allow participants to stretch, refuel, and engage in casual networking.

Setting up the scene was not just about logistics; it was about creating an atmosphere where participants felt valued, comfortable, and inspired. By paying attention to the most minor details, we aimed to provide an environment where creativity and collaboration could flourish.

### Step 4: Recruiting/inviting participants

Understanding that the success of our workshop hinged significantly on the participation and engagement of a diverse and relevant group, we put considerable thought into the recruitment and invitation process. Here is an in-depth look at our approach:

- **Identification of potential participants:** Our primary step was to draft a list of potential participants. We focused on identifying individuals and groups offering varied perspectives, be it experts in the field, community leaders, or stakeholders directly affected by the workshop's theme.

- **Personalized outreach:** We believed in a personalised approach instead of a generic invitation. Each potential participant received a tailored invitation, highlighting why their presence would be invaluable. This conveyed our genuine interest and emphasised the participant's potential contribution.
- **Preliminary tasks communication:** We shared preliminary tasks or readings for those who confirmed attendance. This step was crucial to ensure that all participants came prepared, allowing for more informed and meaningful discussions during the workshop.

Our recruiting and invitation strategy was designed to gather a group and curate a cohort that was informed, engaged, and excited about the workshop.

Our Future scenario-building workshop was attended by 12 individuals, 7 females and 5 males. Below is the anonymised list of participants and their affiliations.

*Table 1. List of the participants in the future scenario-building workshop of the Vilnius Aukštamiestis LL.*

Participant	Affiliation	Stakeholder group	Participant	Affiliation	Stakeholder group
P1 (M)	Vilnius University	Academia	P7 (F)	Military academy	Phd Student
P2 (M)	Vilnius Municipality	Municipality	P8 (M)	Active Vilnius Seniors' Community	Senior community
P3 (F)	INFOBALT association	NGO	P9 (M)	<a href="#">Bznstart.lt</a>	Industry
P4 (F)	Ministry of Environment	Governmental organization	P10 (M)	<a href="#">UAB Pandos</a>	Industry
P5 (F)	Vilnius Municipality	Municipality	P11 (F)	Mykolas Romeris University	Student
P6 (F)	Hospital of Lithuanian University of Health Sciences Kaunas Clinics	Governmental organization	P12 (F)	Lithuanian Citizen Science Association	NGO

During our Future scenario-building workshop, we intentionally incorporated participants from a broad spectrum of backgrounds to guarantee a comprehensive perspective. This diverse selection was rooted in our commitment to capturing various viewpoints and insights from multiple stakeholder groups. Each participant's unique affiliation brought forth a distinct dimension to the workshop's discussions, ensuring the outcomes were well-rounded and holistic.

The group also included 4 facilitators from VILNIUS TECH and Vilniaus Planas.

#### 4.1.2 Welcome and Warm-Up

Kicking off the session, the facilitators provided a comprehensive overview of the day's agenda (Annex 1), ensuring that all participants had clarity on the sequence of events, topics of discussion, and the objectives they aimed to achieve by the end of the workshop.

#### Step 1: Introduction to CLIMAS

Project coordinator VILNIUS TECH representative Dr Aelita Skaržauskienė presented the key goals and approaches of the CLIMAS project.

## Step 2: Presenting the future scenario-building approach

G. Gulevičiūtė (VILNIUS TECH) introduced the future scenario workshop method. Recognised as a powerful mechanism, this tool seeks to engage participants in crafting a vision for a resilient future and discerning the avenues to realise it. It is about envisioning and understanding what citizens demand regarding climate services, innovations, and policies. This is where scenarios play, enabling participants to hypothesise various future outcomes.

## Step 3: Introduction of participants and getting to know each other

We used an activating question: *“Have you ever experienced extreme weather events that made you consider the importance of building a climate-resilient society? How do you think we can better prepare for such events in the future?”* to ignite discussions and get to know each other. Each participant (including facilitators) spent 3-5 minutes presenting themselves and answering the activating question.

### 4.1.3 Identified key drivers

First, the facilitators explained that each group had to present 10-12 drivers at the end of the session. Then, the facilitators presented the key methods for this phase as defined in the guidelines: STEEP and brainstorming.

After the introductions, the two groups worked independently to identify the main factors influencing the guiding question. Each group chose a moderator who facilitated the discussion and ensured that the outcomes were recorded (using distributed flipcharts or notepads).

**Note:** During the group discussions, the participants were free to choose or combine the method. Both groups used a combination of the two in their work. The process was compiled of vivid discussions in the groups, and each team came up with the following lists of drivers.

### Reaching the standard narrative of discovered drivers

After the group work was done, the groups presented their findings in the plenary session with the help of facilitators. The facilitator (A.Skažauskienė) then clustered the factors from the two groups and created a preliminary list of the key factors for climate resilience.

Considering the complexity of the problem and a large number of defined factors, a subset of the most relevant factors needed to be selected. We used the criteria (based on the guidelines) summarised in section 3.2.3.

Based on the criteria, the workshop participants agreed on 12 main factors that influence implementing a climate-resilient society. These factors were documented and finalised collaboratively.

The final list of **influencing factors on climate-resilient societies** (with clear definitions and descriptions) is provided below:

1. Public education on climate change in general, clarification of the vocabulary, and standardisation of definitions between institutions and society are needed.
2. Education of target groups—more transparent communication to target groups in public institutions is needed. The example of green procurement was given, which is subject to confusion within institutions. New tools and workshops should be organised between the institutions to clarify all aspects.
3. Improving youth education – focusing on young people who are still growing up and do not have an established attitude towards climate change. According to research studies, young people have a different attitude and a more significant concern about climate change.
4. Improving urban infrastructure: managing sewers to absorb more water, purification systems, and wastewater systems adapted to urban levels and climate change.
5. A changing insurance market—There should be insurance coverage for unusual events, such as flooded houses, rain-damaged roofs, and other events caused by climate change.
6. Renewable energy—Renewable energy is very important because the most significant changes in climate change are due to the use of fossil fuels, with coal and oil refining generating the most CO<sub>2</sub>. Renewable energy must be used in the transport and heating sectors.
7. Pollution control – to limit pollution, regulation and a tax system must be established in the transport, manufacturing, and heating sectors.
8. Digitizing risks—More online tools should be available for finding information on climate events, such as when storms are coming.
9. Citizen engagement – involving citizens in climate change decision-making.
10. Policy decisions – mainly on mandatory afforestation, landscaping and other climate-friendly solutions.
11. Identity “Green Lithuania” – positioning Lithuania as a green and environmentally friendly country, starting with the resorts and moving towards the major cities.
12. Community initiatives – setting up transport systems in communities, for example, transporting children together to school. Municipal subsidies should be given to encourage such initiatives.

#### 4.1.4 Generated scenarios

**Objectives:** Using the key drivers defined in the previous phase, identify a set of future scenarios. These scenarios should not be too narrow or too optimistic but rather reflect the uncertainty and complexity of the future. They should also be consistent, comprehensive, and logical.

**Expected outcomes of the critique phase:** List of 4 to 5 future scenarios/projections.

#### Step 1. Facilitators explained the goal of the task for each group

Explanation of the task: work on 3 key drivers per group and develop at least 2 projections per crucial driver.

#### Step 2. Facilitators explained how to develop foresight for each group



Brainstorming and morphological box, a method for scenario building that explores and generates different factor or driver combinations is the morphological box, was employed. It allowed the creation of various scenarios by considering multiple possible element combinations.

### Step 3. Group work

The groups chose to develop 3 key drivers per group and develop at least 2 by combining the specifications in the morphological box.

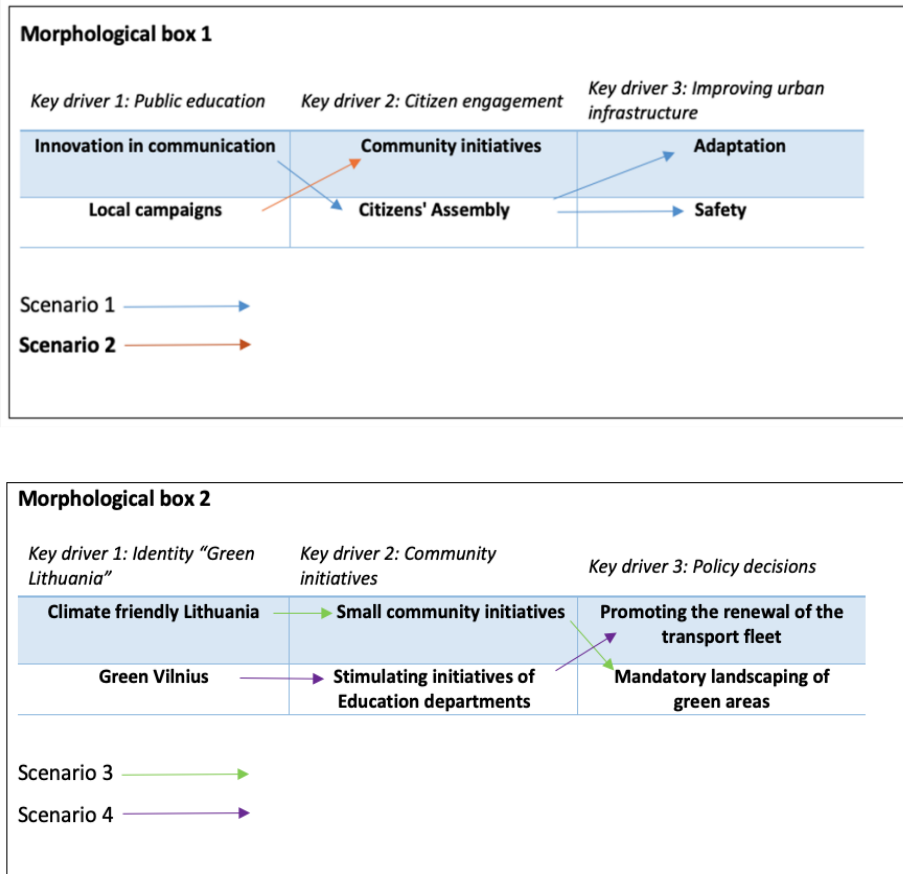


Figure 4. Example of the morphological boxes generated in the workshop

A list of scenarios is provided here:

**Scenario 1: Innovation (in communication)**

In this scenario, The Ministry of the Environment develops content focused on climate change, and other institutions integrate it. The revision of core content is done by scientific institutions. The focus is on developing new/non-traditional tools, and developing a customisation toolkit is being established. Communication innovation also focuses on citizen engagement by organising Citizens' Assemblies. Citizens cannot act independently; coordinating institutions should organise citizen engagement. Effective communication is essential for security reasons - citizens should get responsive information about dangerous situations connected to climate change (floods, strong winds and so on). Mobile communication should be implemented, and consistent, periodic

information should be guaranteed. The role of organisations is essential – students and the Rifle Union can be included in dealing with different climate change-connected situations (shovelling snow, etc.). This is how citizens can adapt more quickly to climate change.

### ***Scenario 2: Local campaigns***

In this scenario, local campaigns are focused on communities of citizens. Municipalities act as organisers of community meetings and analyse questions. Identification and demonstration of good examples are applicable. Wide dissemination plays an important role. Green Citizens can be the positioning message of community initiatives. Clear action initiatives are the most important because local campaigns should be implemented, not just discussions and meetings without actual results.

### ***Scenario 3: Climate-friendly Lithuania***

In this scenario, building a nationwide identity for Lithuania as a climate-neutral country is developed. The government's Strategic Communication Department shapes the identity of Lithuania and publicises, implementing UN and EU requirements. The scenario is linked to political decisions on the mandatory creation of green areas in new building complexes and other regions. Also, it is related to urban infrastructure improvement and citizen activation. All actions are focused on small community initiatives - bottom-up initiatives - the communities themselves initiate ideas. Communities prioritise goals, identify what is essential and allocate available resources (for example, a school buys its bus and solves infrastructure problems). Mandatory greening of areas involves citizens deciding which parts of the area should be greened and which areas should be developed. At the same time, the choice of plantings should also be made according to the needs of society.

### ***Scenario 4: Green Vilnius***

In this scenario, Green Vilnius is a specific case, a smart city in the climate-neutral sense. The monitoring system is implemented, and pollution, sound, and climate forecasting are done through digital systems. Innovative communication (such as smart monitors) is used to gather information. Action plans if climate phenomena occur to manage them (e.g. fires, drought (water bags near trees in Vilnius) are being created. Prevention plays an important role - communicating directly with citizens and developing action plans and commitments. Special attention is focused on initiatives to stimulate actions from education departments (for example, top-down parallel initiatives to motivate schools to buy their green transport by giving funding). Dissemination of good practices should be guaranteed. Encouraging the renewal of the transport fleet also has special attention - there are measures, but they are focused on the middle or upper class (those who can buy electric cars, etc.). Those with old vehicles should be encouraged to purchase newer ones. All social levels should be reached.

Groups in plenary presented the scenarios.

#### 4.1.5 Identified Evaluation Criteria

**Objectives:** Identification and definition of the criteria. [Criteria are a list of crucial key factors in evaluating the scenarios. These factors should be aligned with the goals, objectives, and specific context of the scenario-building exercise.]

**Expected outcomes of the critique phase:** A list of criteria for evaluating the scenarios.

The process:

- The facilitators presented the objectives;
- Groups worked on identifying evaluation criteria
- Presentation of decided criteria by each group.
- Weight and finalised the evaluation criteria (max 10)

A list of standard evaluation criteria is provided here:

1. Relevant – reflecting objectives that fit the local context and reflecting the future needs.
2. Adaptive – reflecting the possibility of adapting to changing situations, resources, systems, infrastructures, and other conditions.
3. Engaging – reflecting the engagement of institutions, local authorities, small communities and citizens.
4. Inclusive – reflecting on ensuring all members, especially vulnerable populations, benefit.
5. Sustainable – reflecting elements of transformations toward sustainability.
6. Tangible – reflecting clearly described objectives.
7. Motivational – reflecting the inspiration for change.
8. Shared – reflecting agreement by key stakeholders and community.

#### 4.2 A Participatory Future Scenario-building Workshop in Chios LL as a co-creation session

The University of the Aegean has organised the second workshop in Chios Living Lab (LL) on November 29, 2023, with the same aims and methodology.

The second future scenario-building workshop was conducted in Chios Living Lab on November 29, 2023, by the University of the Aegean. VUB provided online support for the preparation steps with specific guidelines and answered questions from the organisers. The questions (from Chios organisers) and answers (by VUB) are provided in Annex B.

##### 4.2.1 Preparation steps for the workshop

A crucial step in the realisation of a workshop is its preparation. In the case of the pilot activity in Chios Living Lab, a devoted and enthusiastic internal team was formed at the University of the Aegean, and the preparations were started one month before the workshop. The realisation of the workshop was based on the well-structured guidelines prepared by VUB that aimed to foster citizen-collaborative future scenario-building. The procedure was further clarified following the minutes and experiences of the co-creation workshop held by the Vilnius Aukštamiestis Living Lab on October 8, 2023. The preparation steps in Chios LL are outlined below:

### **Step 1: Guidelines received, reviewed and clarified**

The first preparation step was to receive the guidelines from VUB and thoroughly review them. These guidelines served as a guide for Chios LL workshop preparation, ensuring that the process was approached with clarity and direction. Special attention was given to understanding the purpose of the future scenario-building methodology and identifying the steps and possible related challenges. The purpose was not to leave room for ambiguity in understanding the process. As a result, a list of queries was compiled and sent to VUB, and further clarifications were provided in response to these queries.

### **Step 2: Discussions amongst the internal team on how to approach the task**

A devoted and enthusiastic internal team comprising three members of the faculty, one technical and one supporting staff member and four students at the University of the Aegean was formed to discuss the guidelines and achieve a common understanding and shared purpose. The different steps of the Living Lab were envisioned to identify challenges and propose solutions that will minimise the risks. Ideas for customising the content and the meeting flow according to the needs and capabilities of the specific audience were discussed, which were in line with the guidelines developed by VUB.

### **Step 3: Development of supporting material**

Providing baseline information to potential participants before the workshop was crucial to attracting their interest, inviting them to reflect on the issue in advance, and facilitating a seamless workshop flow. The material was developed in Greek and sent by e-mail or handed as hard copies to the potential participants with information about:

- The climate crisis,
- The specific challenges that the insular North Aegean region will face within a time horizon of 30 and 70 years,
- The general scope and specific purposes of the CLIMAS project,
- The objectives and methodology of the workshop.

A detailed list of the material developed and sent by e-mail or handed to the participants to invite them to the event follows:

1. Invitation to the workshop: The invitation provided summary information on the CLIMAS project, including its time horizon and an outline of the future scenario-building methodology that would be used in the first meeting of the LL.
2. The workshop agenda: The detailed agenda, including the venue, the phases of the workshop, and the timeline, was provided to the participants.
3. Leaflet on climate change: This two-page leaflet provides information on the drivers of climate change, the EU goals, and general strategies for mitigation and adaptation.
4. North Aegean Adaptation Plan: A seven-page document summarising the findings of the North Aegean Adaptation Plan (issued by the North Aegean Region in 2018 after deliberation with the local stakeholders) was prepared.

In addition, roll-ups and posters were printed and pinned at the venue entrance and inside the venue hall to guide and inform the participants of the event. DEEP BLUE prepared the material at the WP6 – Communication, Dissemination and Legacy of the project:

1. Two roll-ups (in English),
2. Two posters (translated into Greek).

Finally, forms and templates were prepared for the internal team to register the participants, ask for their consent to participate in CLIMAS actions, including the event, and take effective notes. The forms were based on the available documents prepared by DEEP BLUE at the WP6 – Communication, Dissemination and Legacy of the project and were translated into Greek:

1. Registration form,
2. Consent form,
3. Note-taking form.

#### **Step 4: Setting up the scene**

A workshop's ambience and environment can profoundly impact the outcomes; therefore, detailed preparation is needed. A space was set up where the participants felt free, comfortable, and inspired to express their opinions and collaborate with their fellow participants in plenary sessions or working in groups. The scene was set according to the recommendations and similar to what is explained in section 3.1.1.

#### **Step 4: Recruiting/inviting participants**

Care was taken to invite participants from a broad spectrum of backgrounds and affiliations to guarantee a comprehensive perspective during the future scenario-building workshop. This diverse selection aimed to capture multiple viewpoints and insights from various stakeholder groups. With their unique affiliation, each participant brought forth a distinct dimension to the workshop's discussions, ensuring the outcomes were well-rounded and holistic. For stakeholder engagement to be effective, there are some requirements: willingness and motivation of stakeholders to participate, inclusivity of all possible interests, and equal access to information and knowledge. Understanding that the success of the workshop hinged significantly on the participation and engagement of a diverse and relevant group, considerable effort was put into the recruitment and invitation process. Here is an in-depth look at the approach:

- **Identification of potential participants:** A preliminary list was drafted based on the Quadruple Helix model (representatives from citizens, business, academia, and public authorities). The list was built on the contacts of people who have already participated in Chios LL activities. It was further enriched with additional criteria such as gender and age balance and inclusion of members of vulnerable groups.
- **Invitation and informative material.** After ensuring an inclusive and balanced list of participants, the invitation, accompanied by information material, was sent to them by e-mail. As presented in detail in Step 3, the material included information on:
  - a. The climate change,
  - b. The North Aegean Region adaptation plan,
  - c. The CLIMAS project,

- d. The agenda of the workshop,
  - e. The future scenario-building methodology
- **Personalised outreach:** In addition to the invitation sent to the potential participants, all of them were reached by phone or in person to effectively communicate the purpose of the workshop and the main phases of the future scenario-building methodology. Time was dedicated to discussing their questions and clarifying vague points regarding the workshop's purpose, methodology, and input based on their experience and background. The value and meaning of their involvement in the process were conveyed, and they were engaged in reflection before the workshop. At the end of this step, a final list of stakeholders committed and interested in participating in the workshop was built.

Table 2. List of the participants in the future scenario-building workshop of the Chios LL.

Participant	Affiliation	Stakeholder group	Participant	Affiliation	Stakeholder group
P1 (F)	President of municipality unit (Northern Chios)	Public authority	P10 (M)	PhD student	Academia
P2 (M)	Citizen of Northern Chios	Citizen	P11 (M)	Chemist, Association of Chios <u>Mastiha</u> Growers	Business
P3 (M)	Retired military servant, citizen of southern Chios	Citizen	PM12 (F)	Regional councillor	Public authority
P4 (M)	Civil protection officer, Chios Regional Unit	Public authority	P13 (F)	Hotelier, Chios Hoteliers Association	Business
PM5 (M)	Head of environmental NGO Omicron	Citizen	P14 (F)	Environmentalist at North Aegean Region Authority	Public Authority
P6 (M)	Member of environmental NGO Omicron	Citizen	P15 (F)	PhD student	Academia
PM7 (F)	Science teacher at secondary school	Citizen	P16 (M)	Medicine doctor	Citizen
PM8 (M)	Retired seafarer	Citizen	PM17 (M)	Municipal councillor	Public authority
PM9 (F)	Civil engineer	Business	PM18 (F)	Maritime economist	Citizen

18 individuals attended the future scenario-building workshop: 8 females (44%) and 10 males (56%). Table 2 presents an anonymised list of participants with their affiliations and the respective quadruple helix model stakeholder group. Figure 5 displays the participants' stakeholder groups.

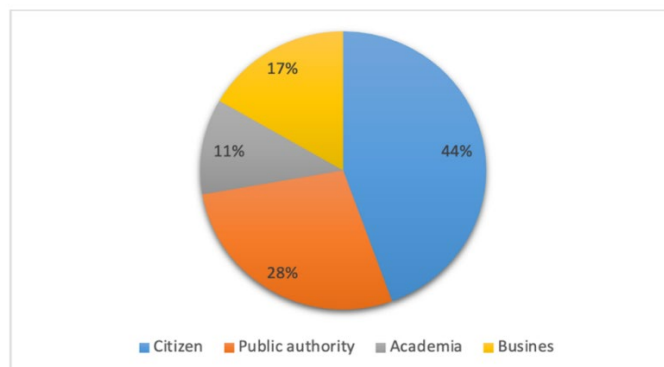


Figure 5. The participants' stakeholder groups in the future scenario-building co-creation workshop of Chios LL.

## 4.2.2 Identified key drivers

### Step 1. Networking and explorative

The participants were divided into 3 groups of 6 participants. Diversity in terms of gender, age, occupation, and stakeholder group was ensured in each group. Their work was supported by 3 facilitators (1 per each group) from the University of the Aegean. Each group chose a moderator who facilitated the discussion. One note-keeper of the outcomes of each session (University of the Aegean) was also responsible for tape-recording the session.

The guiding question was, *“What factors are crucial for a society to be resilient to climate change?”*

### Step 2. Defining key drivers

First, the facilitators explained that each group must present the factors or drivers they have selected at the end of the session. Then, the facilitators presented the key methods for this phase as defined in the guidelines: STEEP and brainstorming.

### Step 3. Reaching the standard narrative of discovered drivers

After the group work was done, the groups presented their findings in the plenary session with the help of facilitators:

The facilitators (Amalia Polydoropoulou, Anna Maria Kotrikla, and Sandy Fameli) then clustered the factors from the three groups and created a preliminary list of the key factors for climate resilience.

Considering the complexity of the problem and the large number of defined factors, we needed to select a subset of the most relevant factors. To do this, we used the criteria detailed in section 2.2.3. Based on the criteria, the workshop participants agreed on 10 main factors that influence implementing a climate-resilient society.

The final list of **influencing factors on climate-resilient societies** (with clear definitions and descriptions) is provided below:

1. Water preservation and forest resilience. These two factors depend on each other, so they were combined. Forests' resilience to forest fires (a typical threat for pine forests) is critical to water retention and the enrichment of the aquifer. On the other hand, water availability affects forests since very dry conditions are essential for forest growth.
2. Sea-level rise. A significant proportion of the human population lives in coastal areas. Sea-level rise will influence the coastal ecosystems and human infrastructure (cities, factories, ports, hotels). The insular areas are particularly vulnerable to sea-level rise.
3. Increase in temperature. Temperature increases are critical for ecosystem resilience, agriculture, and human welfare (e.g., temperature discomfort and the spread of diseases).
4. Population patterns. The increase in population may exert pressure on the natural resources and the ecosystem. On the other hand, the young population is more dynamic and more likely to seek and find innovative solutions to the problems that a society faces.

5. Policies and regulatory framework. Politicians must be able to look ahead and lead societies to a more sustainable future, irrespective of the political cost. The policies, informed by scientific findings and the needs of the society, must go beyond the time horizon of their governance. On the other hand, the regulatory framework must be enforced to have an effect.
6. People's values and way of living. Citizens need to be raised aware of climate change. This could be achieved through extensive campaigns and education and training on climate change at all educational levels (primary and secondary schools, universities, lifelong learning) and in all fields (natural science and engineering, social science, business studies, ICT, medicine, etc.).
7. Innovation in transport. Transport is a significant contributor to greenhouse gas emissions. Using new, environmentally friendly technologies and fuels and changes in people's transport behaviour will enhance climate mitigation.
8. Climate change highly affects new technologies and innovations in critical economic sectors (such as tourism and agriculture). In economies oriented to either the primary sector (agriculture) or the tertiary sector (tourism), it is essential to employ innovative technologies and operations to reduce their vulnerability, increase their resilience to future climatic conditions and reduce their climatic footprint.
9. Energy footprint. To achieve climate mitigation and neutrality, there is an urgent need to change the energy paradigm currently based on fossil fuel consumption in all economic sectors. There is no one-size-fits-all solution. The leading solutions are the production of electricity by renewable energy sources, the production of sustainable biofuels, and the research on innovative fuels such as hydrogen.
10. Resource consumption and circular economy. Our economies are based on overconsumption, which results in resource depletion and pollution, including greenhouse gas emissions. There is an urgent need for reduced resource consumption and circular economy solutions.

### 4.2.3 Generated scenarios

#### Step 1. Facilitators explained the goal of the task for each group

Explanation of the task: work on 3 key drivers per group and develop at least 2 projections per key driver.

#### Step 2. Facilitators explained how to develop foresight for each group

Brainstorming & morphological box, a method for scenario building that explores and generates different factor or driver combinations is the morphological box, was employed. It allowed the creation of a range of scenarios by considering various possible element combinations.

#### Step 3. Group work

The groups chose 3 key drivers per group, assigned at least 2 projections per key driver, and developed at least 2 scenarios by combining the specifications in the morphological box. The results of each group, i.e., morphological boxes, are presented below:

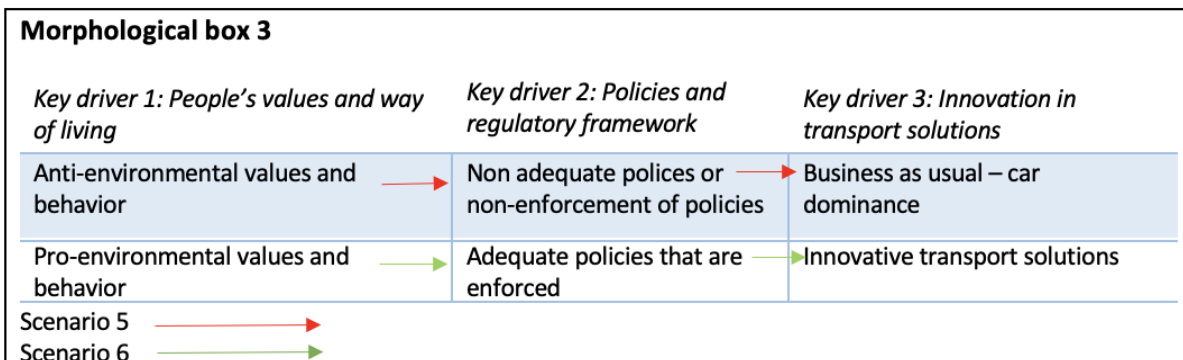
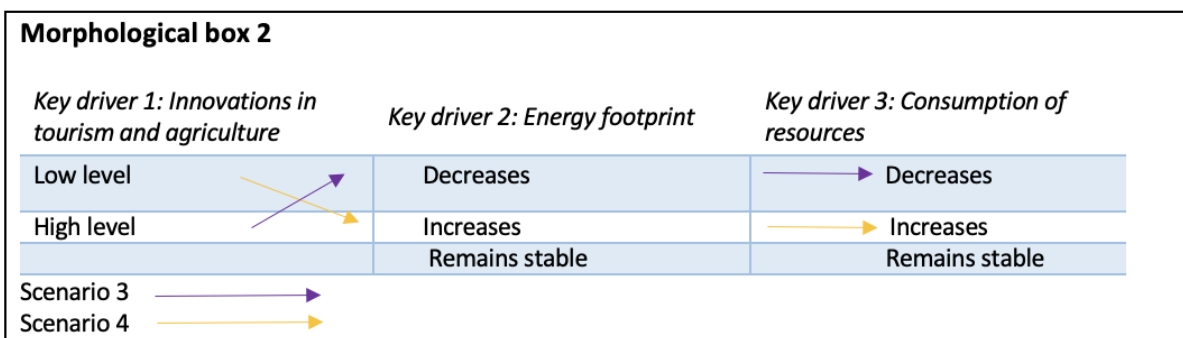
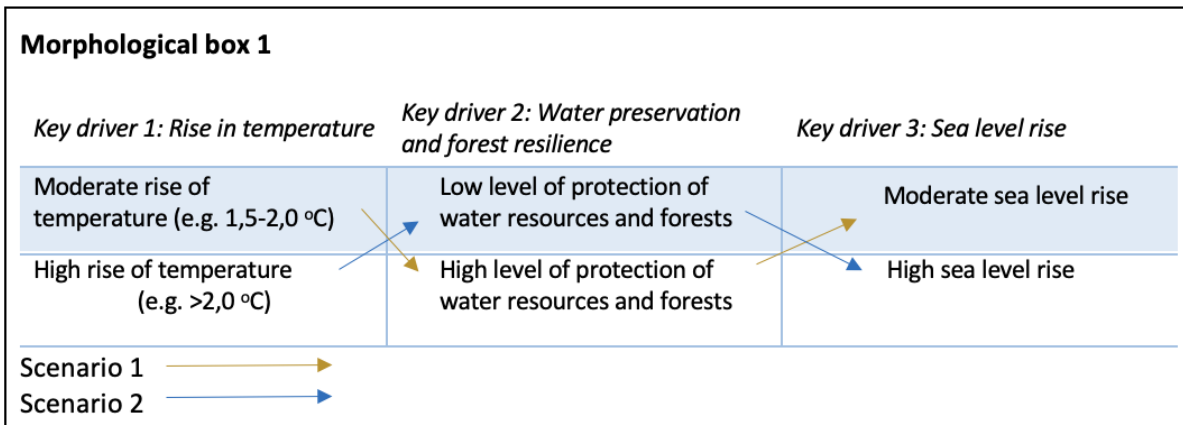


Figure 6. Example of the morphological boxes generated in the workshop in Chios LL.

A list of scenarios is provided here:

**Scenario 1: High level of response on climate change on a global and local scale.**

A high level of global cooperation among states and measures for curbing GHG emissions are effectively taken and implemented. As a result, the temperature rise is kept at moderate levels (1,5<sup>c</sup> – 2,0<sup>c</sup>), and the sea level rise is also moderate. Concentrated effort is placed on retaining the ecosystems intact and protecting water resources. Traditional techniques, such as controlled burning, and innovative ones, such as surveillance with drones and satellites, are implemented for the pine tree forests that are common in the Mediterranean ecosystems, and they are especially vulnerable to forest fires. Reforestation programs with fire-resistant plants indigenous to the ecosystems are organised (e.g., carob

trees in Chios). Forest preservation has multiple benefits, such as carbon sequestration (a critical climate change mitigation method), soil preservation, flood prevention, aquifer recharge, and surface and air temperature control (strengthening climate change adaptation). The management of water resources is also a priority. Actions such as freshwater-saving campaigns, maintenance of the leakages in the water supply systems, and reuse of treated wastewater for irrigation and desalination with renewable electricity are employed. The **traditional technique of the “fountanas”** used in the detached houses of Chios to collect and reuse rainwater revives. The sea-level rise is moderate, and drawing from the example of the Netherlands, technical projects are implemented in advance to protect critical infrastructure such as ports and airports, coastal cities, key industries, hotels and beaches, essential ecosystems, etc.

### ***Scenario 2: Digitation and artificial intelligence in agriculture.***

Technological innovations have been developed to a large extent till 2050. The agricultural lands have been digitised in high-resolution maps. Sensors are used to monitor the soil properties, the atmospheric or weather conditions and the growth of the plants, and the findings are displayed on high-resolution maps. In this way, tailored and informed interventions are made regarding irrigation, the use of fertilisers and pesticides and the protection of the crops from extreme weather events (e.g. the crops could be covered in case of hail). The plant growth is optimised with efficient energy use, irrigation water and chemicals. Thus, the environmental footprint of agriculture is reduced.

### ***Scenario 3: Sustainable tourism in the climate change era.***

Climate change in the Mediterranean Sea area results in increased temperatures, increased frequency of extreme weather events (droughts, floods, and fires), coastal erosion or coastal flooding and salinisation of freshwater resources. There are severe adverse effects on tourism, and the Mediterranean Sea area gradually becomes an unattractive destination for the summer. To face the problems that arise, long-term planning is being made to extend the tourist period and prioritise sustainability in the tourism industry. The hotel units embrace technological innovations to decrease their environmental footprint: energy-efficient cooling devices (air conditioners) and washing machines are used. Actions such as installing heat pumps and roof photovoltaics are employed while increasing the visitors' awareness of reducing their personal footprint. There is control of the water used for personal hygiene, and the amount of waste produced from single-use items, such as plastic bottles, is reduced. Moreover, fishing tourism (“blue tourism”, meaning that the visitors can rent a boat to take a tour and watch a demonstration of the fishing methods) is promoted in coastal areas, so the fishermen are given an alternative form of income. In that way, they only fish the quantities the sea can replenish. As a result, tourism has become a sustainable activity with adverse effects on the local and global environment.

### ***Scenario 4: Top-down policies and new technologies.***

The focus is on pro-environmental policies developed and enforced from the top (the governments) and the invention of innovative technologies to address the climate crisis. There is no fight against overconsumption; instead, the products have a long lifetime, and

there are alternatives to choose from with a low carbon footprint and high potential for reusing and recycling, reducing waste production. In transport, technological solutions such as drones for last-mile delivery and electric and autonomous cars help to keep the carbon footprint low.

***Scenario 5. A society on the path of sustainability.***

The values and lifestyles of people are aligned with the sustainability principles. This is achieved through education, lifelong training, and environmental campaigns. Consumption is reduced, and recycling and circular economy solutions are promoted. There is a bottom-up social revolutionary movement that informs people and inspires them to change their values and lifestyles towards sustainability. Politicians are forced by the society movement to adopt environmentally friendly legislation tailored to society's needs. In transport, innovative or more traditional solutions are adopted, such as active transport (cycling and walking), micro-mobility, sharing mobility, demand-responsive transportation, autonomous vehicles, and drones, which offer an overall reduction of fossil fuel use and carbon dioxide emissions, resulting in the improvement of environmental conditions.

#### **4.2.4 Identified evaluation criteria**

**A list of standard evaluation criteria** is provided here:

- Cost-benefit ratio. The most important criterion is the ultimate cost of the future scenario that the society would have to pay (sum of economic, environmental, and social costs) divided (normalised) by its probable/potential benefit.
- Environmental effect. Since the environment is the outer limit or the carrying capacity within which society and the economy operate, the environmental impact of a scenario is probably more important than the social and economic effects.
- Plausibility. The scenarios that are more reasonable and likely to become future reality must be given priority.
- Comprehensiveness. Excellent and valuable scenarios must consider all the relevant factors and projections.

## 5. Summary of Lessons Learned and Recommendations from the Future Scenario-building Co-creation Workshops

They are implementing the co-creation workshop in the living labs steps in the right direction, with room for enhancement and refinements. The learnings from these sessions provide an exciting opportunity to refine the approach, ensuring that future iterations are even more impactful, insightful, and engaging. Applying the workshop within these living labs has yielded essential observations and suggestions, contributing to a more seamless execution of future workshops. The key takeaways can be summarised as follows:

- **Recruitment:** Personal communication with citizens before the workshop is crucial for attracting interest and allowing time for reflection on the subject.
- **Inclusivity:** Actions like translating material into the local language and using simple language can help achieve a diverse gathering.
- **Workshop Scope:** Participants need to understand the purpose of their involvement and its societal impact.
- **Methodology Understanding:** The scenario-building methodology should be explained clearly during the workshop.
- **Time Restrictions:** A balance between exploring the subject and respecting adults' limited time is needed.
- **Evaluation Criteria:** Participants struggled to understand the evaluation criteria for the scenarios. Clearly defining the workshop's purpose can help determine the most relevant criteria.
- **Time Management:** More detailed time allocation for each activity is needed to avoid rushing or curtailing any segment.
- **Participant Fatigue:** An extended workshop with breaks could help maintain participant energy and engagement.
- **Module Clarity:** Each module, especially the morphological box, must be explained clearly.
- **Scenario Scope:** Participants tended to frame scenarios at a national level. Tools or prompts could help broaden their perspectives.
- **Positive Takeaways:** Participants left with a renewed sense of purpose and intent to incorporate climate considerations into their endeavours despite challenges.

Engaging in personal communication with citizens from diverse backgrounds is crucial to recruiting participants. This emphasises that everyone, regardless of their expertise, can provide valuable insights based on their experience and background. It is highly recommended that this diverse participation be maintained by translating supporting materials into local languages, using simple language, and providing physical information materials. This approach successfully gathered diverse people at the 1st Chios LL meeting.

It is also essential to communicate the purpose of the workshop and its societal impact to motivate participants. For example, inform them at the beginning of the meeting that the outputs will be communicated to the authorities to inform their policy-making process.

We should explain the scenario-building methodology in simple words to give participants an overall picture and then in detail before each phase, using real-life examples and allowing enough time for questions and discussion. This will ensure clarity in the following steps. For example, it is essential to clarify evaluation criteria and ensure they match the scenario-building exercise's goals, objectives, and context. The difficulty in understanding the use of the criteria during the workshop arises from the lack of a clear definition of the purpose of the scenario development workshop or its dual purpose. Therefore, each LL must define its goals, objectives, and context of the scenario-building exercise at the beginning to come up with the most relevant evaluation criteria.

In terms of time management, allocating sufficient time for each activity is essential to avoid rushing any segment. A more detailed breakdown of time for each segment might be necessary. Also, participants' fatigue can be controlled by incorporating breaks, especially a lunch break.

## 6. Expert Workshop on Scenario Refinement

Following the organisation of two future scenario-building workshops in Vilnius and Chios, the generated scenarios were analysed using the scenario-prioritization tool (developed in the context of task 3.4 activities). The outcomes revealed the most important scenarios based on stakeholders' viewpoints and highlighted points of consensus, disagreements, and uncertainties among workshop participants. A comprehensive analysis of the outcomes from both workshops is reported in document Deliverable 3.4.

The subjective inconsistencies may arise from differences in opinions and diverse interpretations of the generated scenarios. When inconsistencies stem from different interpretations, it is recommended that scenarios be iteratively refined through follow-up workshops. This approach ensures that scenarios become more concrete and actionable for policymakers.

One effective way to refine scenarios is to organise expert workshops to evaluate and enhance the generated scenarios. In subsequent steps, recommendations can be delivered to the living labs responsible for the initial scenario-building workshops. These insights can then be disseminated to workshop attendees to increase participant agreement. Moreover, this procedure can be iterative, reiterating surveys and scenario prioritisation analyses after each round of expert input and scenario enhancement.

The expert workshop methodology involves a structured and collaborative process where experts from various fields come together to develop, critique, and improve scenarios. As part of the CLIMAS project, a **third workshop** has been dedicated to refining the scenarios obtained from the two workshops in Vilnius and Chios. To achieve this, Vrije Universiteit Brussel (VUB) organised this expert workshop with the following objectives:

- (a) Critically assess and validate the underlying assumptions of each scenario.
- (b) Highlight and explore potential uncertainties and risks of different scenarios.
- (c) Provide feedback and recommendations to improve generated scenarios' quality, accuracy, and relevance through expert input.

### 6.1 Overview of the workshop structure

The expert workshop is implemented based on the SWOT technique to analyse Strengths, Weaknesses, Opportunities and Threats associated with each scenario. SWOT analysis was initially developed as a tool for strategic planning and has been most commonly used by businesses, policy, academics and organisations to design new strategies (Hill & Westbrook, 1997). Here, we used this technique to analyse future scenarios more comprehensively and combine it with scenario planning to identify key trends, uncertainties, and possibilities that may impact the future landscape. Moreover, the method gives decision-makers a holistic view of the potential outcomes. It helps in strategic planning by highlighting areas to leverage strengths, address weaknesses, capitalise on opportunities, and mitigate threats (Luoto & Lonkila, 2018).



The expert workshop was organised in the fourth CLIMAS consortium meeting in Chios (22-23 of May 2024), where the organisers of the two future scenario-building workshops were present. Before the workshop, participants were provided with the agenda, a scenario refinement template, and a compilation of scenarios developed and refined by Vilnius and Chios living labs contributors. The agenda and the template can be found in Annex C.

**Objective and Participant Composition:** The decision to involve project partners in this workshop was twofold: firstly, their expertise spans various disciplines, offering a variety of perspectives; secondly, their comprehensive knowledge of the project’s subject is helpful to adequately enhance the scenarios by providing relevant feedback. To avoid potential bias in evaluations, the Chios and Vilnius workshop organisers were asked to refrain from joining the group discussions, instead taking on observational roles. Efforts were also made to maintain gender balance within each small group. The workshop involved 16 experts, comprising 11 females and 5 males. The workshop started with presenting all the scenarios and the key drivers identified by participants. Next, insights from the Analytic Hierarchy Process (AHP) prioritisation tool were presented, highlighting the comparison of scenarios and the consistency of responses to scenarios evaluation.

**Breakout Sessions:** Experts were divided into 3 smaller groups for brainstorming and discussion on different aspects of the scenarios based on a scenario refinement template provided to them. Each group was tasked with providing feedback on three assigned scenarios. During their discussions, the experts were instructed to allocate 15-20 minutes to each scenario. Their first task in the template is to assess the overall clarity of each scenario and then to complete a SWOT matrix (as presented in Figure 7), highlighting each scenario's strengths, weaknesses, opportunities, and threats. Finally, they were asked to provide additional context to the scenario to make it more focused and effective. The template was filled in for each scenario separately. During the workshop, some confusion was raised regarding the interpretation of ‘opportunities’ within the scenarios. Therefore, further clarifications were provided to ensure a common understanding among participants. Additionally, one group could not complete their task within the allocated time, leading to a 10-minute extension given to all the groups to finalise their evaluations.



Figure 7. Scheme of the SWOT matrix used in the scenario refinement template.

**Concluding Session:** In the final phase of the workshop, the experts reconvened as a larger group to share their insights from the breakout sessions and integrate the collective feedback for scenario refinement.

## 6.2 Analysis of the scenarios generated in the Vilnius workshop

This subsection summarises the inputs to the experts' SWOT templates for each scenario during the workshop. The tabular structure of the SWOT template is transferred to the following text for better readability. The expert feedback on each scenario includes an evaluation of the overall clarity, followed by highlighting the strengths, weaknesses, opportunities, and threads of the scenarios, accompanied by recommendations for further improvement.

### 6.2.1 Scenario One: Innovation (in communication)

In this scenario, The Ministry of the Environment develops content focused on climate change; other institutions integrate it. Revision of core content is done together with scientific institutions. The focus is on developing new/non-traditional tools, and a customisation toolkit is being established. Communication innovation also focuses on citizen engagement by organising Citizens' Assemblies. Citizens cannot act independently; coordinating institutions should organise citizen engagement. Effective communication is essential for security reasons - citizens should get responsive information about dangerous situations connected to climate change (floods, strong winds and so on). Mobile communication should be implemented, and consistent, periodic information should be guaranteed. The role of organisations is essential – students and the Rifle Union can be included in dealing with different climate change-connected situations (shovelling snow, etc.). This is how citizens can adapt more quickly to climate change.

#### A. Clarity and Understanding

**How clear is the scenario presented to you?** Overall, the scenario is unclear and can benefit from further refinements to better convey the objective and future targets.

#### B. SWOT Analysis

##### **Strengths (Internal factor):**

- This scenario's strength lies in deploying citizen assemblies to disseminate information, which empowers citizen participation in decision-making and builds community resilience.
- The scenario employs a holistic approach toward climate awareness/ adaptation by involving different stakeholders, including the Ministry of the Environment, scientific institutions, and coordinating bodies.
- The scenario aims to focus on developing innovative and non-traditional tools that enhance communication and engagement.

##### **Weaknesses (Internal factor):**

- While the scenario emphasises effective communication, it does not specify how information will be disseminated. Citizen Assemblies might not be the optimal solution for mass-scale communication, and other communication mediums can be discussed.

- Relying solely on coordinating institutions for citizen engagement may lead to bureaucratic delays and inefficiencies. This can lead to slow implementation of the decisions, especially when timely responses are required to specific climate challenges.

#### ***Opportunities (External factor):***

- Developing new and non-traditional tools and a customisation toolkit provides opportunities for personalised and targeted climate change communication strategies.
- Involving various organisations in climate-related activities, including students and the Rifle Union, provides a sense of community responsibility and action.
- Organizing Citizens' Assemblies provides a platform for public participation, allowing citizens to voice their concerns and contribute to climate change solutions.

#### ***Threads (External factor):***

- The scenario does not explicitly address how it will ensure inclusivity, particularly for marginalised groups that may be unfairly affected by climate change. The reliance on innovative communication mediums assumes widespread access to technology, which may not be accurate for all citizens, leading to unequal access to information.
- Citizens' Assemblies and other activities require sustainable engagement and commitment. In the long term, engagement fatigue could reduce participation and impact. Therefore, the scenario should explain how active participation will be encouraged and sustained over time.

### **C. Additional Context**

#### ***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

The scenario description can **include local context** and adopting the solutions to specific regions. For example, considering the technology infrastructure and specifying how to deal with the challenges of providing widespread access to innovative technologies are essential. For **sustainable engagement** of the citizens, it is vital to ensure foreseeing procedures to maintain active participation. This can also be done in collaboration with behavioural scientists to understand citizen behaviour and promote sustainable practices. The scenario should also consider **marginalised groups** and foresee **education and training** for citizens. The scenario can extend to exploring **other communication channels**, such as community meetings, radio, etc, as not all citizens rely on mobile devices. By incorporating these additional contexts, the scenario can create a more robust and adaptable framework for climate change adaptation.

#### **6.2.2 Scenario Two: Local campaigns**

In this scenario, local campaigns are focused on communities of citizens. Municipalities act as organisers of community meetings and analyse questions. Identification and demonstration of good examples are applicable. Wide dissemination plays an important role. Green Citizens can be the

positioning message of community initiatives. Clear action initiatives are the most important because local campaigns should be implemented, not just discussions and meetings without actual results.

## A. Clarity and Understanding

**How clear is the scenario presented to you?** The scenario should become more apparent and needs further refinements to convey the objective and future targets better. The text is short and needs more context.

## B. SWOT Analysis

### **Strengths (Internal factor):**

- The scenario considers municipalities to organise community meetings, increasing local government commitment. Their involvement also provides more legitimacy to community initiatives.
- Positioning citizens as “Green Citizens” creates a sense of identity and purpose and encourages sustained engagement in environmental initiatives.
- The scenario prioritises an action-oriented strategy, which ensures result-oriented plans through the local campaigns.

### **Weaknesses (Internal factor):**

- < UNK> Generally, the scenario description is too broad and lacks real and thematic focus.
- It focuses on community engagement but does not explain how to deal with the related challenges, such as the lack of motivation of citizens to engage.
- -The scenario lacks a description of how the impact of the local campaigns will be evaluated, which is a crucial action to learn and improve.

### **Opportunities (External factor):**

- Using local campaigns can increase citizen engagement and induce a sense of responsibility and unity.
- The identification of good examples can lead to knowledge sharing, which can inspire and educate other communities
- The “Green Citizens” message can become a powerful brand that unites individuals under a common goal, enhancing community identity and pride.

### **Threads (External factor):**



- There is a threat that campaigns might become discussion-heavy and action-light, decreasing engagement if precise results are not achieved.
- The scenario lacks a precise mechanism for measuring the success of the campaigns, which is essential for continuous improvement and accountability
- The scenario should consider different communication channels to address the risk of the campaigns reaching all community members.

### C. Additional Context

#### ***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

The scenario is rather **generic** and can benefit from additional context. It may discuss assessment methods to understand specific environmental challenges each community faces to ensure that targeted campaigns are used. Involving diverse stakeholders beyond municipalities can also improve collaboration. Engaging **youth** through school programs, eco-clubs, and youth councils can create lasting impacts. **Defining clear, measurable goals for each campaign** and establishing channels for ongoing citizen feedback can increase responsiveness.

#### 6.2.3 Scenario Three: Climate-friendly Lithuania

In this scenario, building a nationwide identity for Lithuania as a climate-neutral country is developed. The government's Strategic Communication Department shapes the identity of Lithuania and publicises, implementing UN and EU requirements. The scenario is linked to political decisions on the mandatory creation of green areas in new building complexes and other regions. Also, it is related to urban infrastructure improvement and citizen activation. All actions are focused on small community initiatives - bottom-up initiatives - the communities themselves initiate ideas. Communities prioritise goals, identify what is essential and allocate available resources (for example, a school buys its bus and solves infrastructure problems). Mandatory greening of areas involves citizens deciding which parts of the area should be greened and which areas should be developed. At the same time, the choice of plantings should also be made according to the needs of society.

### A. Clarity and Understanding

***How clear is the scenario presented to you?*** The scenario has clear objectives, but the explanations are generic and broad. To enhance clarity, consider organising the objectives into bullet points, categorising them by environmental, social, and economic areas, and specifying actions for each location. Additionally, the roles of different actors in implementing the scenario still need to be clarified. It might be helpful to distinguish between government-led actions and citizen contributions. Furthermore, the scenario needs more detailed descriptions. Once citizens agree, the time horizon of the actions described and who will implement the measures will still be determined. Notably, the described actions need to be revised to achieve climate neutrality, as they need to address critical aspects such as building thermal efficiency, vehicle electrification, or robust mass transit systems to combat traffic-related pollution.

## B. SWOT Analysis

### ***Strengths (Internal factor):***

- The scenario has a clear objective.
- A nationwide strategy and vision are solid points.
- Encouraging citizen participation in decision-making processes empowers communities to take ownership of local environmental initiatives. Prioritising bottom-up initiatives ensures that ideas and actions originate from the communities themselves, which can increase relevance and effectiveness.

### ***Weaknesses (Internal factor):***

- The scenario is too broad about the mentioned measures, which are too narrow.
- Continual bottom-up initiatives require sustained citizen activation. Therefore, it should be foreseen how to encourage active and long-lasting participation.
- Involving citizens in greening decisions is appreciated, but balancing diverse opinions and reaching consensus can be challenging.

### ***Opportunities (External factor):***

- The scenario can activate systemic change towards a climate-neutral country if the objectives are addressed seriously. Establishing Lithuania as a climate-neutral country creates a strong national identity
- This scenario can be calibrated in areas of action and, therefore, can be easily understood by everyone.
- It addresses the heat-island problem (not explicit) but with explicit actions of regreening urban areas.

### ***Threads (External factor):***

- Mandatory greening could face issues, such as deciding which areas to develop, potentially leading to stakeholder conflicts.
- Ensuring the sustainability of bottom-up initiatives over time can be difficult, as they often rely on consistent community motivation and funding.

## C. Additional Context

***Are there any additional details or contexts that should be included in the scenario to make it more effective?***



Overall, the **scenario is precise**, but additional context can be included in the description to make it more accurate and concrete. **Implement educational programs** in schools and communities to raise awareness about climate neutrality. **Climate neutrality efforts can be monitored** and evaluated to ensure the effectiveness of the decisions.

#### 6.2.4 Scenario Four: Green Vilnius

Green Vilnius is a specific case in this scenario, a smart city in the climate-neutral sense. The monitoring system is implemented, and pollution, sound, and climate forecasting are done through digital systems. Innovative communication (such as smart monitors) is used to gather information. Action plans if climate phenomena occur to manage them (e.g. fires, drought (water bags near trees in Vilnius) are being created. Prevention plays an important role - communicating directly with citizens and creating action plans and commitments. Special attention is focused on initiatives to stimulate actions from education departments (for example, top-down parallel initiatives to motivate schools to buy their green transport by giving funding). Dissemination of good practices should be guaranteed. Encouraging the renewal of the transport fleet also has special attention - there are measures, but they are focused on the middle or upper class (those who can buy electric cars, etc.). Those with old vehicles should be encouraged to purchase newer ones. All social levels should be reached.

#### A. Clarity and Understanding

**How clear is the scenario presented to you?** The main objectives are clear, but there needs to be more information about the role of political parties.

#### B. SWOT Analysis

##### **Strengths (Internal factor):**

- The scenario focuses on smart cities, which demonstrate forward-thinking.
- The scenario offers comprehensive, real-time monitoring by covering various aspects (pollution, sound, climate), enhancing timely responses.
- Motivating schools to buy green transport through funding encourages sustainable practices. Education plays a crucial role in shaping future environmental actions. Prioritising the renewal of the transport fleet also aligns with climate resilience goals.

##### **Weaknesses (Internal factor):**

- While the scenario aims to reach all social levels, there is a risk that initiatives may disproportionately benefit the middle or upper class. Therefore, it is essential to ensure that vulnerable populations are also considered. The scenario does not explicitly address how to engage low-income communities in climate-friendly actions. Moreover, encouraging citizens to transition from old cars to newer ones might face resistance due to financial constraints or lack of awareness.

- Transitioning the entire transport fleet to newer, cleaner vehicles is complex. Infrastructure for electric vehicles needs careful planning.

#### ***Opportunities (External factor):***

- Transition to a smart city which monitors climate factors in real-time and can bring timely and data-driven decisions.
- Direct communication with citizens increases trust and encourages responsible behaviour. Action plans and commitments ensure that climate-friendly practices are followed.

#### ***Threads (External factor):***

- Relying on smart systems can create disparities among citizens who do not have access to technology, leading to unequal benefits from the smart city facilities.
- The focus on encouraging the middle or upper class to renew their transport fleet with electric cars may not consider the financial barriers of lower-income citizens in upgrading their vehicles. Moreover, keeping high levels of citizen engagement may be problematic over time, especially if they do not see immediate results.

### **C. Additional Context**

#### ***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

Additional contexts could be integrated to refine the “Green Vilnius” scenario further to enhance the city’s approach to becoming climate-neutral. The scenario could benefit from **investing in modernising public transportation**, which reduces the need for private cars. Other options include **investing in smart grid technology** to optimise energy consumption and integrate more renewable sources and solar projects into the city’s energy plan. The scenario can also address the **challenges of expanding electric cars**, including environmental impact, infrastructure needs, and battery disposal. The scenario can also consider **multimodal mobility** by integrating various modes of transport (walking, cycling, micro-mobility) for a comprehensive mobility system.

## 6.3 Analysis of the scenarios generated in the Chios workshop

### 6.3.1 Scenario One: High level of response on climate change on global and local scale

A high level of global cooperation among states and measures for curbing GHG emissions are effectively taken and implemented. As a result, the temperature rise is kept at moderate levels (1,5<sup>C</sup>-2,0<sup>C</sup>), and the sea level rise is also moderate. Concentrated effort is placed on retaining the ecosystems intact and protecting water resources. Traditional techniques, such as controlled burning, and innovative ones, such as surveillance with drones and satellites, are implemented for the pine tree forests that are common in the Mediterranean ecosystems, and they are especially vulnerable to forest fires. Reforestation programs with fire-resistant plants indigenous to the ecosystems are organised (e.g., carob trees in Chios). Forest preservation has multiple benefits, such as carbon sequestration (a critical climate change mitigation method), soil preservation, flood prevention, aquifer recharge, and surface and air temperature control (strengthening climate change adaptation). The management of water resources is also a priority. Actions such as freshwater-saving campaigns, maintenance of the leakages in the water supply systems, and reuse of treated wastewater for irrigation and desalination with renewable electricity are employed. The traditional technique of the “fountanas” used in the detached houses of Chios to collect and reuse rainwater revives. The sea-level rise is moderate, and drawing from the example of the Netherlands, technical projects are implemented in advance to protect critical infrastructure such as ports and airports, coastal cities, key industries, hotels and beaches, essential ecosystems, etc.

#### A. Clarity and Understanding

**How clear is the scenario presented to you?** The scenario should become more apparent in objectives. It covers too much information and is a mixture of ideas that needs more focus.

#### B. SWOT Analysis

##### **Strengths (Internal factor):**

- It is a current issue for the Chios and is designed for the local context.
- The rich content addresses multiple aspects (temperature, water, ecosystems) but could focus more on specific problems.
- The scenario starts from a local focus and extends to the global.
- Combining traditional techniques (controlled burning) with innovative methods (drones, satellites) is essential.

##### **Weaknesses (Internal factor):**

- The content might be formulated more clearly. More clear objectives should be defined and explained.
- There is not enough information for non-experts to fully grasp the objectives of the scenario.

- The scenario concerns implementing multiple initiatives (forest preservation, water management, etc.) requiring substantial resources. Explaining how climate justice is considered when distributing resources is necessary.

#### ***Opportunities (External factor):***

- The use of drones and satellites for ecosystem surveillance represents technological innovation, offering new opportunities to protect and manage natural resources.
- Implementing the initiatives mentioned in the scenario can stimulate economic growth by creating green jobs and promoting sustainable tourism.

#### ***Threads (External factor):***

- Maintaining a high level of global cooperation over time can be challenging due to changing political climates, economic pressures, and varying national interests.
- Unfair distribution of resources for climate change mitigation and adaptation across different regions is a threat.
- Using traditional water collection techniques like the “fountanas” might not be advocated by the younger generation and provide practicality issues or lack of adoption.

### **C. Additional Context**

#### ***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

It is recommended that the scenario be recontextualised and made more realistic. The scenario can also include integrating green infrastructure into urban planning. Investing in a public transport system and educating residents on the impact of climate change can add value to the scenario.

### **6.3.2 Scenario Two: Digitation and artificial intelligence in agriculture**

Technological innovations have been developed to a large extent till 2050. The agricultural lands have been digitised in high-resolution maps. Sensors are used to monitor soil properties, atmospheric or weather conditions and the growth of the plants, and the findings are displayed on high-resolution maps. In this way, tailored and informed interventions are made regarding irrigation, the use of fertilisers and pesticides and the protection of the crops from extreme weather events (e.g. the crops could be covered in case of hail). The plant growth is optimised with efficient energy use, irrigation water and chemicals. Thus, the environmental footprint of agriculture is reduced.

### **A. Clarity and Understanding**



**How clear is the scenario presented to you?** The subject is clear and focused. However, the scenario is too technical and lacks local context and sustainability descriptions. The issues are apparent, but how to tackle them needs to be better explained. The scenario mainly focuses on automation, but more information on ethics and the role of citizen participation must be provided.

## B. SWOT Analysis

### **Strengths (Internal factor):**

- The focus and objectives are clear.
- Using data to protect crops during extreme weather events (e.g., hail) ensures resilience and minimises losses.

### **Weaknesses (Internal factor):**

- The scenario deploys a technocratic and unsustainable approach (using chemicals and fertilisers, even though more efficient). It is an efficiency scenario, not a sustainable scenario. What about regenerative agriculture? While optimised use of fertilisers and pesticides is beneficial, there is a risk of overreliance. Balancing chemical inputs with sustainable practices is essential
- Context framing and why digitation is needed are missing. It is also not clear how the impact can be measured. Does the scenario aim to change the entire agriculture system or only part of it?
- It is unclear to what extent AI and technology will be used and who will control these decisions, technologies, and efficiency levels.
- The cost of implementing high-resolution mapping, sensors, and AI systems may be prohibitive for small-scale or resource-poor farmers.

### **Opportunities (External factor):**

- The use of AI is an actual opportunity, clearly stated. It can reduce the loss of potential resources and costs and lead to efficient land use.
- Farmers and businesses can make informed decisions based on real-time data, leading to better management and timely remedial choices in case of environmental issues.

### **Threads (External factor):**

- The use of AI is not linked to the use of local resources and human skills in human areas; skills are moved from urban to rural areas, but they are top-down. It can threaten the local communities, traditions, and local knowledge.

- Farmers must acquire new skills to use digital tools and interpret data effectively. Bridging the knowledge gap is essential for successful adoption.
- AI algorithms can inherit biases from training data, affecting decision-making. Ensuring fairness and transparency in AI models is crucial.

### C. Additional Context

#### ***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

To add more context, one can consider **what policies** will be needed to **govern the use of AI**, what educational programs will be necessary to train the next generation of farmers, and how the long-term sustainability of these technologies will be ensured.

#### **6.3.3 Scenario Three: Sustainable tourism in the climate change era**

Climate change in the Mediterranean Sea area results in increased temperatures, increased frequency of extreme weather events (droughts, floods, and fires), coastal erosion or coastal flooding and salinisation of freshwater resources. There are severe adverse effects on tourism and the Mediterranean Sea area gradually becomes an unattractive destination for the summer period. To face the arisen problems, long-term planning is made towards extending the touristic period and prioritising sustainability in the tourism industry. The hotel units embrace technological innovations to decrease their environmental footprint: energy-efficient cooling devices (air conditioners) and washing machines are used. Actions such as the installation of heat pumps and roof photovoltaics are employed while the awareness of the visitors towards the reduction of their personal footprint increases. There is control of the water used for personal hygiene and the amounts of waste produced from the use of single use items, such as plastic bottles, are reduced. Moreover, the fishing tourism ("blue tourism", meaning that the visitors can rent a boat to take a tour and watch a demonstration of the fishing methods) is promoted to coastal areas, so the fishermen are given an alternative form of income and in that way, they only fish the quantities of fish that the sea can replenish. As a result, tourism becomes a sustainable activity with adverse effects on the local and the global environment.

### A. Clarity and Understanding

***How clear is the scenario presented to you?*** The scenario is framed correctly, posing challenges, setting goals and describing the activities. However, a long-term horizon or ambition needs to be included. In addition, the scenario needs to be contextualised in terms of policies. The causes, actions, and involved parties are defined, but no policy areas are restricted. The scenario also looks too implicit: the terms 'tourism' and 'fishery' are mentioned, but information needs to be available on the existing infrastructure and its necessity. The scenario also relies too much on individuals and market actors.

### B. SWOT Analysis



**Strengths (Internal factor):**

- Operational goals with clear actions are defined. The objectives, strategy, and measures can be quickly followed.
- It is a systemic approach to appropriately address the problems of a very intensive tourism destination.
- The outcomes raise awareness among tourists and encourage responsible behaviour.

**Weaknesses (Internal factor):**

- All measures are directed solely towards the sustainability of the tourism industry; the implications of extending the tourist season are unclear.
- There is no clear link established to illustrate how to increase tourism while decreasing its impact.
- It is essential to Consider how local initiatives and communities can be safeguarded.
- The strategy is not ambitious enough; it should aim further towards regenerative tourism.
- Predicting how tourist behaviour can be influenced or regulated is challenging.
- It is unclear who is responsible for each action.
- The focus on climate change is too narrow; it should encompass global change, social vulnerability, and biodiversity. Identifying which sectors are most at risk and which can benefit from sustainable practices is vital.

**Opportunities (External factor):**

- Actions are easily manageable and can be deployed effectively.
- Starting from this scenario, the local community can develop more extensive narratives.
- It can integrate the actions of different actors; each stakeholder and rights holder can address climate change to some extent.
- The scenario sets an example for other regions facing climate challenges. Policymakers can learn from its success and replicate similar strategies

**Threads (External factor):**

- The scenario lacks a quantified goal; achieving net zero is impossible. While the described actions effectively address behaviour, it remains unclear how to quantify their actual impact.



- The lack of resources in the current context raises questions. Where do these resources come from? A strategy should briefly mention funding sources to enhance the trustworthiness of the “scenario”. For instance, it could be related to the regional innovation strategy.
- Implementing and maintaining sustainable technologies may be costly, potentially posing challenges for smaller businesses to adapt.

### C. Additional Context

#### ***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

Since this is a future scenario, it should **be formulated to look more towards the future** rather than the present or current situation. It would also be beneficial to add more context on **involving local communities in decision-making and utilising** their traditional knowledge to help achieve sustainable tourism. Developing **tourist educational programs** that emphasise responsible behaviour, cultural sensitivity, and environmental awareness are also attractive assets.

#### **6.3.4 Scenario Four: Top-down policies and new technologies**

The focus is on pro-environmental policies developed and enforced from the top (the governments) and the invention of innovative technologies to address the climate crisis. There is no fight against overconsumption; instead, the products have a long lifetime, and there are alternatives to choose from with low carbon footprint and high potential for reusing and recycling, reducing waste production. In transport, technological solutions such as drones for last-mile delivery and electric and autonomous cars help to keep the carbon footprint low.

### A. Clarity and Understanding

***How clear is the scenario presented to you?*** The presented scenario is unclear and lacks specific details regarding the geographical context, such as the city or country. It appears to be an exaggerated scenario with inconsistencies, particularly in aspects like recycling, and it needs to be more inclusive.

### B. SWOT Analysis

#### ***Strengths (Internal factor):***

- The long lifetime of the products is a strength. Longer lifetimes mean fewer replacements, conserving resources and reducing overall environmental impact.
- Top-down policies demonstrate a solid commitment to environmental protection. Governments can set ambitious targets, allocate resources, and enforce regulations.
- Using Technological solutions (Electric and autonomous cars) contributes to cleaner transportation, and drones for last-mile delivery reduce emissions.

**Weaknesses (Internal factor):**

- People may not accept policies that are imposed through a top-down approach. Top-down policies may encounter resistance from various stakeholders, which can make their implementation challenging across different regions and sectors
- This is a technocentric approach. The approach does not permit a discussion on consumption and production patterns among the people.

**Opportunities (External factor):**

- The scenario prioritises new technologies, encouraging the use of innovative solutions. This stimulates economic growth and job creation.
- Emphasizing products with long lifetimes reduces waste. Longer lifetimes mean fewer replacements, conserving resources and reducing overall environmental impact.

**Threads (External factor):**

- Not everything can be resolved with a technological solution. We need a broader vision that is not solely focused on technology.
- The governance model is excessively top-down; a bottom-up approach is also recommended. Managing global environmental risks may be challenging with top-down approaches alone. Therefore, more localised solutions are needed.

**C. Additional Context*****Are there any additional details or contexts that should be included in the scenario to make it more effective?***

The scenario should specify at what level the methods should be implemented. **Is this at the city or national level?** What are the **impacts of the scenario on the labour market's economic** conditions? **How do we engage industries and businesses** in the transition to encourage responsibility and partnership? How do we raise awareness through **educational programs?**

**6.3.5 Scenario Five: A society on the path of sustainability**

The values and lifestyles of people are aligned with the sustainability principles. This is achieved through education, lifelong training, and environmental campaigns. Consumption is reduced and recycling and circular economy solutions are promoted. There is a bottom-up social revolutionary movement that informs people and inspires them to change their values and lifestyles towards sustainability. The politicians are forced by the society movement to adopt environmentally friendly legislation tailored to the society needs. In transport, innovative or more traditional solutions are adopted, such as active transport (cycling and walking), micro mobility, sharing mobility, demand responsive transportation, autonomous vehicles, and drones, which offer an overall reduction of fossil fuel use and carbon dioxide emissions, resulting in the improvement of environmental conditions.

## A. Clarity and Understanding

**How clear is the scenario presented to you?** The sustainability principles need to be clarified and further explained.

## B. SWOT Analysis

### **Strengths (Internal factor):**

- The legislation is tailored to society's needs. The society movement holds politicians accountable. Environmental legislation becomes a priority, reflecting the will of the people.
- The scenario emphasises education and lifelong training, ensuring that sustainable practices are ingrained from an early age and continuously reinforced.

### **Weaknesses (Internal factor):**

- Relying solely on politicians to take measures is not the most effective way to govern.
- While politicians adopting environmentally friendly legislation is crucial, effective implementation is equally critical. Bureaucratic hurdles may hinder progress

### **Opportunities (External factor):**

- A society-wide acceptance of sustainability principles can lead to a significant cultural shift, where environmental preservation becomes a core value.
- Education and lifelong training can equip individuals with the knowledge and skills to live sustainably and make informed decisions.
- Politicians responding to societal pressure to adopt environmentally friendly legislation can align laws with the public's sustainability goals.

### **Threads (External factor):**

- Autonomous vehicles and drones are considered suitable modes of transport for reducing fossil fuel.
- Maintaining the motivation of a bottom-up social movement over time can be challenging. As priorities shift, there is always a risk of loss of interest.
- The movement should be inclusive and cover diverse groups. There is a threat of marginalising certain groups or not addressing their specific needs.

## C. Additional Context



***Are there any additional details or contexts that should be included in the scenario to make it more effective?***

More context can be added to the scenario to make it more transparent and focused. It is essential to explain **why we focus on sustainability** instead of adaptation or resilience. **Involving local communities** in creating and carrying out sustainability projects is crucial; their contributions guarantee that the initiatives are applicable and owned by the community. It is also worth considering the expansion of **sustainability education into workplaces and online platforms**.

## 7. Conclusions and Future Steps

The implementation of the workshops in the living labs was performed in the right direction, with room for enhancement and refinements. The learnings from these sessions and the feedback from the third workshop provide an exciting opportunity to refine the approach, ensuring that future iterations are even more impactful, insightful, and engaging. Applying the workshop within these living labs has yielded essential observations and suggestions, contributing to a more seamless execution of future workshops. These well-defined scenarios can finally be applied as invaluable and practical pathways assisting policymakers in making informed decisions that are aligned with the goals and values of society. The key takeaways can be summarised as follows:

- Personal communication with citizens from diverse backgrounds is crucial to recruiting participants. To maintain this diverse participation, it is highly recommended that everyone, regardless of their expertise, provide valuable insights based on their experience and background. Supporting materials should be translated into local languages, used in simple language, and supplied with physical information materials. This approach successfully gathered diverse people at the 1st Chios LL meeting.
- It is also essential to communicate the workshop's purpose and societal impact to motivate participants. For example, inform them at the beginning of the meeting that the outputs will be communicated to the authorities to inform their policy-making process.
- We should explain the scenario-building methodology to give participants an overall picture and then in detail before each phase, using real-life examples and allowing enough time for questions and discussion. This will avoid confusion in the following steps. For example, it is essential to clarify the use of evaluation criteria and ensure they match the goals, objectives, and context of the scenario-building exercise. The difficulty in understanding the use of the requirements during the workshop arises from the lack of a clear definition of the purpose of the scenario development workshop or its dual purpose. Therefore, each LL must define its goals, objectives, and context of the scenario-building exercise at the beginning to come up with the most relevant evaluation criteria.
- Regarding time management, allocating sufficient time for each activity is essential to avoid rushing any segment. A more detailed breakdown of time for each segment might be necessary. Also, participants' fatigue can be controlled by incorporating breaks, especially a lunch break.
- The primary outcomes of the future workshop are **a set of possible scenarios and the evaluation criteria** for scenario evaluation and prioritisation. These outputs will be used to formulate a questionnaire, conduct a survey as the next step, and initiate tasks for designing and developing an AHP tool.
- Facilitators should contact the participants and inform them about the next step after the workshop. This means they will receive a survey based on scenarios and criteria they identified and defined during the workshop.

The two participating living labs of Vilnius Aukštamiestis and Chios could successfully implement the scenario-building methodology and have generated engaging multifaceted and comprehensive scenarios covering a wide range of local and global needs. Comparing the scenarios, Chios LL scenarios are more generic, considering global and local scales. They cover a wide range of topics from climate change response, digitisation in agriculture, tourism, and overconsumption to sustainability. On the other hand, Vilnius Tech scenarios concern specific areas such as communication, local campaigns, and specific geographical locations (Lithuania and Vilnius) focusing on specific initiatives and actions. Vilnius scenarios seem more localised, and initiatives and actions are discussed at the community and city levels. Chios scenarios cover various sectors, including environment, agriculture, tourism, and transport. This is connected to the fact that the economy in Greece is primarily related to tourism and agriculture and the related and supporting sectors of transport and the environment. Vilnius Tech scenarios focus mainly on the communication sector.

Chios scenarios involve many stakeholders, including states, local communities, farmers, tourists, consumers, and transport users. They highlight the role of these stakeholders in addressing climate change and promoting sustainability. Vilnius Aukštamiestis LL scenarios involve mainly government institutions, communities, and citizens. They highlight the role of these stakeholders in promoting climate-friendly practices and building a sustainable future.

Regarding the complexity of the generated scenarios, Chios' results are more complex as they consider various factors and their interrelationships. They discuss the impact of global phenomena on local ecosystems and economies and propose comprehensive solutions that involve technological innovations, policy changes, and societal transformations. Vilnius Aukštamiestis LL results, on the other hand, are more focused and more accessible, especially in the scenario prioritisation step, where the scenarios should be compared with each other based on a defined criterion.

The scenario prioritisation tool helps participants in the "scenario evaluation" and the "recommendation generation" phases, and it can make the setting more realistic and improve decision-making. Higher-ranked scenarios are likely to be in the final proposals and policy recommendations. Therefore, the following steps after the workshop include a survey to collect the participant's opinions on the priority of the scenarios, followed by deploying a multi-criteria decision-making tool such as the Analytic Hierarchy Process (AHP) for scenario prioritisation. The forthcoming steps from scenario building to scenario prioritisation are depicted in Figure 8. More details on the developed scenario prioritisation tool, together with the outcomes of the analysis of the workshops, are provided in Deliverable 3.4.



Figure 8. Steps from scenario building to scenario prioritisation.

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## 9. Annexes

### 9.1 Annex A. Questions and answers on the future scenario-building methodology (Vilnius Aukštamiestis LL)

**Q1. The topic.** *It is unclear whether we should define a context-specific problem or continue with a more general “identifying strategies for building a climate-resilient society”?*

**Reply:** A broader theme, such as “how to create a society that can be resilient to climate change” or, as you said, “identifying strategies for building a climate-resilient society,” might be a better way to guide the workshop. This would allow us to explore different strategies to deal with various challenges and opportunities related to climate resilience. General scenarios that are applicable to European society could be more useful at this stage, and these can be later customised based on the needs of different European countries and regions.

**Q2. The evaluation criteria.** *The workshop programme lists 3 criteria for factor selection: effect on the system, effect through the system, and uncertainty. However, they are not defined in the text. Could you please elaborate on this?*

**Reply:** To evaluate the factors according to the following criteria, we assess them based on their direct and indirect impact as well as the uncertainty. Please find explanations as follows :

A) Effect on the system: This criterion assesses the degree to which a factor directly and significantly influences the overall procedure. For example, What are the most relevant factors when planning a climate-resilient society? Variables with a significant impact can profoundly alter or mould the system's behaviour when altered or manipulated.

For instance, In the context of climate resilience, reducing greenhouse gas emissions directly impacts the climate system by mitigating global warming and its associated effects on weather patterns, sea levels, and extreme events. This factor has a high impact on the system.

B) Effect through the system: This criterion assesses that even if some factors do not directly touch the system's core, they can still substantially impact the system's behaviour by affecting other connected elements. This way, they can cause significant changes in how the whole system works. For example, while Education and Awareness may not directly impact the climate system, they can indirectly influence individual and community behaviour, leading to reduced energy consumption and lower emissions. Another example is government policies that promote sustainable practices, and green technologies can cascade through various sectors of the economy, ultimately impacting climate resilience by reducing pollution and resource depletion.

c) Uncertainty: This criterion assesses the degree of uncertainty; in other words, some factors are more uncertain or unpredictable than others. This means they have less data available, depend on outside or random factors, or are hard to estimate. It is essential to know how uncertain a factor is because it helps assess the reliability and robustness of strategies or decisions based on it. For

example, various economic and political factors can influence carbon markets and pricing mechanisms, making it challenging to predict the future price of carbon credits with certainty.

In general, these criteria can assist you in prioritising factors to be examined more closely based on their direct or indirect impact on a system and the level of uncertainty associated with them. (Please note that the evaluation criteria for scenarios assessment should not be confused with these three)

**Q3. The drivers/factors.** *The title of section 3.2 is focused on the drivers, but in the text, the word factor is used. Should we only focus on what is driving the change towards a climate-resilient society, or should the barriers be considered, too?*

**Reply:** To achieve a climate-resilient society, we must adequately understand current obstacles and barriers. With this knowledge, we seek to define the drivers that play the key role in achieving a resilient society. These drivers (as the main focus and outputs of the first phase of the workshop) span across different areas, and their significance and weighting need to be evaluated by applying 3 evaluation criteria that I explained previously.

Indeed, the main focus of this section is on identifying the key drivers, while the barriers help to identify and define these key drivers better. The factors and drivers are the same in the text.

**Q4. The morphological box.** *This section is unclear to me. In phase 1, we need to generate 10 drivers, and then during the brainstorming, we need to create 2 scenarios for each driver (so 20). So, should the morphological box be used to group and connect scenarios? How should the 4-5 scenarios be selected by the end of the envisioning phase? Those who address the most of the drivers?*

**Reply:** I think there has been some confusion. If we want to define the scenarios by deploying the morphological box approach, we have to define two projections/developments (not scenarios) for each driver. These projections will be inserted in the table to help create the scenarios. Examples of the developments/projections can be found later in the following text.

After generating 10 key drivers in phase 1, we develop related developments for each driver, incorporating significant characteristics of that respective driver. So, in this initial step within the groups, we are solely focused on generating potential developments or projections for each key driver in the future. These projections will then be considered in conjunction with other projections of other key factors as components of possible scenarios. Each suggestion for development or projection should be recorded on a card with a keyword. Each key driver's corresponding cards should be displayed during the plenary session.

The next step is to create a morphological box in the plenary by collecting and placing key drivers at the head of each column and their respective developments/projections in the subset rows (a figure is available in the guideline). At this point, a completed version of the morphological box with key factors and their corresponding projections/developments is available.

Next, the task is to combine and generate coherent and practical combinations from the projections/developments into scenarios (4 to 5 scenarios). This step aims to integrate matching developments/projections of the key factors into scenarios. The primary tool for this step is the pinboard. Developments that do not fit should be set aside.

For further clarification, please refer to the following example of key drivers and their possible developments (just an example): key driver 1: Renewable Energy Transition

a transition to renewable energy sources with:

Development 1: moving away from fossil fuels.

Development 2: A clear focus on sustainability and social inclusivity.

Key Driver 2: Education and Awareness

Development 1: focusing on NGOs to increase awareness

Development 2: designing specific courses for students on climate change

Development 3: Community workshops and training

For example, Development 1 from Key Driver 1 and Development 2 from Key Driver 2 can be connected in the morphological box to create a scenario: designing specific courses for students to increase awareness on how to move away from fossil fuels. These can also be connected to several other developments from other key factors. Finally, this gives a raw scenario that can be further discussed to achieve a final scenario.

Please note that you might use brainstorming and other strategies (other than the morphological box) to define the scenarios. This approach is a systematic approach for scenario generation.

**Q5. The evaluation phase.** *Again, it's a bit unclear. Should we define the criteria for scenario evaluation during this step in the workshop? But do we have to evaluate them based on the criteria? Should we define the criteria for each scenario, or should we have a common set of criteria for all scenarios?*

**Reply:** The main goal of this stage of the building workshop is to define a list of criteria that the participants believe are important in assessing the scenario. So in this phase, we don't need to evaluate scenarios based on criteria and need to define and generate the evaluation criteria. The evaluation and prioritisation will occur through a survey study in the following steps after the workshop.

We should define all criteria for each scenario. Instead, a standard set of criteria should be described for evaluating and later comparing the scenarios.

*Also, one of the criteria listed is “Completeness—the projections within a descriptor must cover all possible outcomes”. Does this mean it must address all drivers identified in Phase 1?*

**Reply:** The criteria listed in the guidelines are just some exemplary set of criteria (like diversity, novelty, plausibility, strategic value, impact scale, adaptability, etc.) for your reference. This means that participants may identify a new and different list of criteria that they believe need to be considered as evaluation metrics of scenarios. As I explained in the previous questions, scenarios are generated by combining related and interconnected developments or projections of a key driver or several key drivers. Therefore, the criteria evaluate only the scenarios and not the drivers. The primary outcomes of the workshop should be (a) several scenarios and (b) standard evaluation criteria for scenario prioritisation.

**Q6. The outputs.** *What kind of outputs do you expect us to submit after the workshop? I understand we need to provide the 4-5 scenarios, but what background would you need for further work? Notes on the processes (how detailed they should be), pictures, etc.?*

**Reply:** Indeed, the main outputs to continue the tasks are a) a list of scenarios (4-5) and (b) a list of standard evaluation criteria (8-10)

These outputs will be used to formulate a questionnaire and conduct a survey as the next step and initiate task 3.4 for designing and developing an AHP tool.

In addition, the following info is useful for drafting the report and the deliverable for T3.1 such as:

- a) Workshop minutes.
- b) Photos of the different steps, plenary sessions, pinboards, participants, a morphological box with connected lines, etc.
- c) Recordings of each phase of the workshop (optional)

Attention: Facilitators should keep in touch with the participants and inform them about the next step after the workshop. This means they will receive a survey based on scenarios and criteria they identified and defined during the workshop.

Note-taking is critical, as it will give us a more in-depth understanding of what was discussed during the workshop. Each phase's final output and notes will be implemented in the deliverable (M18) and final report.

## 9.2 Annex B. Questions and answers on the future scenario-building methodology (Chios LL)

**Q1.** *Are brainstorming and morphological boxes equivalent to methodologies? May we choose one of them, or do you suggest using morphological boxes as a more structured technique?*

**Reply:** Due to the general approach of the workshop, it is co-creating future scenarios, so using both is recommended; start with brainstorming in small groups to generate a wide range of ideas, then use morphological boxes to refine and structure those ideas. A combination of brainstorming and morphological boxes could be a powerful approach. However, you can still use only the brainstorming if you think you will achieve sound scenarios without deploying a more structured approach with morphological boxes.

**Q2.** *Do you think we need to guide the participants to include key drivers from all STEEP categories? We think this would be useful so that we do not focus on specific areas only (e.g., social drivers only, such as immigration or population growth, or environmental drivers only, such as floods and droughts).*

**Reply:** Certainly, guiding participants to consider key drivers from all STEEP categories can be valuable in creating comprehensive and well-balanced future scenarios. The STEEP framework encompasses Social, Technological, Economic, Environmental, and Political factors, and including drivers from each category helps ensure a holistic exploration of the potential future landscape.

**Q3.** *We are unsure how to use the evaluation criteria for the key drivers (pp 17 and 18). Examples of using them (please advise):*

*Do we have to try to include key drivers that fulfil all the 3 criteria (some drivers with an effect on the system, some drivers with an effect through the system, some with high and some with low uncertainty? With the purpose to have a balance and fulfil all the criteria?*

**Reply:** To have a balanced approach, it can be beneficial to include key drivers that fulfil all three criteria. Including drivers with different characteristics ensures a well-rounded set of considerations, capturing both direct and indirect influences on the system and accounting for uncertainties.

*And/or do we have (at the end of the workshop, in desktop work) to categorise the key drivers (that have come up by the participants) according to the above 3 criteria?*

**Reply:** Yes. One way is to allow participants to freely generate key drivers and then guide them in categorising them based on the three evaluation criteria (either they have direct or indirect impact or uncertainty exists). This can be done by inviting participants to collaboratively discuss and decide which drivers meet the specified criteria in the plenary session.

(Please note that the evaluation criteria for scenarios assessment should be distinct from these three criteria for evaluation key drivers ).

*And/or must we exclude key drivers with high uncertainty?*

**Reply:** Eliminating drivers with high uncertainty is not necessary; rather, the emphasis can shift towards devising strategies to monitor, adapt to, or mitigate the impact of these uncertainties. For example, you might want to develop scenarios that can mitigate the uncertainty of drivers.

**Q4.** *Let's suggest to the participants to assign 3 states/projections/developments for each key driver: negative, BAU, and positive. Will this help or limit the analysis?*

**Reply:** Yes, you can increase the number of key drivers as long as it does not overcomplicate the scenario building within the morphological box.

**Q5.** *We would like to focus the discussions on Chios Island based on the information about resilience mentioned in the Adaptation Plan for the North Aegean Region (to which Chios Island belongs) because we think this might be more interesting for the participants. In addition, citizens of Chios have implicit knowledge about their island regardless of their educational or professional background. Is this within the frame of the tool's guidelines?*

**Reply:** Although centring the discussions on Chios Island aligns with the principles of community engagement, utilisation of local knowledge, and practical considerations of resilience planning, it is important to maintain a balance between focusing on Chios and the broader regional and global contexts to maintain a balanced perspective.

**Q6.** *On pages 17 and 3.2.2, it is suggested that "The groups are expected to work autonomously, without any external guidance." I thought that one of us (UAegean) would be present in each group to facilitate this. Am I wrong?*

**Reply:** According to the suggestion, participants should be able to express their ideas freely, but you, as the facilitator, should be available within each group for assistance if needed.

*Some general suggestions:*

**Q7.** *A preliminary workshop could be organised in advance to explore the problems that a specific area faces. In this workshop, experts and/or stakeholders could give a few interactive presentations to set the scene, inform and activate the citizens, and ideate on what is at stake. The Adaptation*



*Plan for the North Aegean region (which highlights the main areas that would be affected by climate change in the future) could be presented.*

**Reply:** Organizing a preliminary workshop to explore the problems of a specific area and engage citizens is an excellent idea. The structure you proposed, including interactive presentations by experts and stakeholders, aligns well with promoting citizen awareness and participation.

**Q8.** *The morphological box could be prepared in advance by desktop search by the UAegean or CLIMAS team (with the help of some key stakeholders) to include all possible key drivers and their states. Then, it could be discussed in the Future Scenario Building Workshop to add and specify what is missing (validation and filling in the gaps). This approach could help citizens cope with limited time and resources and avoid fatigue. Disadvantage: It will guide them in specific directions (it is a top-down approach).*

**Reply:** As you correctly observed, the pre-prepared morphological box might steer participants toward particular directions, potentially constraining the emergence of innovative ideas. This represents a trade-off between efficiency and the aspiration for a fully bottom-up approach.

**Q9.** *We must give a purpose to the participants of the Workshops on Scenario Building and Scenario Prioritisation to have a sense of usefulness of the process, meaningfulness for allocating their time and efforts and ownership of the results. After realising the (1st) workshop for scenario building and the (2nd) workshop for scenario prioritisation, a final (3rd) workshop could be organised (with citizens, stakeholders and experts) to present the results to the policymakers and the public and (most importantly) to discuss the methods of response and their implications. This way, we envision and explore ways to cope with the future!*

**Reply:** Organizing a workshop to present the results will be very useful and necessary to inform the participants about the workshop's outcomes. Please note that only one workshop will be organised to generate (a) a list of scenarios and (b) Common evaluation criteria (to compare these scenarios). After you provide me with this information (meeting minutes), I will formulate two online surveys you will distribute among the participants. Therefore, there will not be a second workshop for scenario prioritisation, but this will be done through online surveys that participants can fill in at their convenience. After all participants have completed the questionnaires, I will analyse them and provide you with the outcomes of the analysis. Then, you can have a second workshop to report the results to the participants.

[Reminder: Facilitators should keep in touch with the participants and inform them about the next step after the workshop. This means they will receive a survey based on scenarios and criteria they identified and defined during the workshop. A consent form will also be provided for the participants to sign for ethical approval of the surveys.]

### 9.3 Annex C. Workshop 3 Agenda and Template

#### Workshop Agenda

Goal	Tasks	Duration
Welcome, Warm-Up & Agenda	<ul style="list-style-type: none"> <li>- Welcome participants to the workshop.</li> <li>- Introduction to the purpose of the workshop: “to collect feedback and suggestions for improving scenarios.”.</li> <li>- Outline the agenda and the scenario improvement form.</li> </ul>	5 mins
Overview of the AHP results for scenarios analysis	<ul style="list-style-type: none"> <li>- Present a summary of the scenarios to be discussed.</li> <li>- Highlight key points and the context for each scenario.</li> <li>- Present the AHP tool results.</li> </ul>	15-20 mins
Scenarios improvement	<ul style="list-style-type: none"> <li>- Divide participants into small groups.</li> </ul>	50 mins

	- Instruct the participants to collectively provide feedback and suggestions for improving each scenario, considering the SWOT analysis.	
Break	- Provide a short break to stretch and refresh.	5 mins
Sharing and Consolidation	- Ask each group to share their key findings, action plans, and potential strategies for improving the scenarios.	15 mins
Wrap-Up	-Thank participants for their contributions and active participation.  - Informing the participants about the next steps and how their feedback will be used.	5 mins

## Scenario Improvement Form

Please use the following form to share your thoughts and suggestions.

Scenario title:

<b>1. Clarity and Understanding:</b>
<p>On a scale of 1 to 5, how clear is the scenario presented to you? (1 being not clear at all, 5 being very clear)</p> <p>Are there any parts of the scenario that you found confusing or difficult to understand? Please provide details.</p>
<b>2. SWOT Analysis:</b>
<p><b>Strengths:</b> Identify the strengths of the current scenarios, such as well-defined objectives, relevant content, etc.</p> <p>1.</p> <p>2.</p> <p>...</p>
<p><b>Weaknesses:</b> Identify the weaknesses or areas of improvement within the scenarios, such as unclear instructions, unrealistic situations, etc.</p> <p>1.</p> <p>2.</p> <p>...</p>
<p><b>Opportunities:</b> Identify opportunities that the scenarios provide, such as incorporating new technologies, including diverse perspectives, etc.</p> <p>1.</p> <p>2.</p> <p>...</p>
<p><b>Threats:</b> Identify potential threats or challenges that could impact the effectiveness of the scenarios, such as changes in regulations, technological limitations, etc.</p>

1.

2.

...

**3. Additional Context:**

Are there any additional details or contexts that you think should be included in the scenario to make it more effective? Please specify.

Thank you for your feedback!