CitiObs - ENHANCING CITIZEN OBSERVATORIES FOR HEALHTY, SUSTAINABLE, RESILIENT, AND INCLUSIVE CITIES

DELIVERABLE D1.2

CO participation in multi-level governance toolkit (2/2)

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Abstract:	This deliverable provides the final version of the CitiObs "CO participation in multi-level governance toolkit". It can help users address specific participation dynamics, foster trust among stakeholders, and facilitate the integration of CO data into decision-making processes.		

VERSION LOG

Version	Date	Partner	Content and changes
0.1	Feb 2025	IHE Delft	Editorial edits throughout, based on feedback on D1.6 (version 1 of the toolkit)
0.2	August 2025	IHE Delft	Revision of toolkit structure and content
0.3	September 2025	IHE Delft	Draft version for review
1.0	September 2025	IHE Delft	Final version

CITIOBS

CitiObs is a four-year project funded under Horizon Europe by the European Commission. CitiObs will consolidate and apply tools and practice-based knowledge for co-creating data, knowledge and local action via Citizen Observatories (COs): these tools will enhance existing and new COs to engage citizens and marginalised communities, add value to environmental observations in the urban context, increase and validate COs of the urban environment as part of the existing in-situ Earth Observation systems, co-create inclusive local actions for sustainability and ensure that CO data contributes to research and policy development towards the objectives of the European Green Deal. To ensure broad use, the CitiObs tools and approaches will be developed in co-creation with COs in 5 Frontrunner cases, finetuned with 30 Alliance cases and showcased to 50 Fellow cases.

CitiObs will support COs in distinct cities to create/enhance/or scale up inclusive and diverse COs, fostering in particular an active role of citizens in the observation of the urban environment using low-cost sensor technologies and wearables, with a particular focus on air quality and related environmental measures. CitiObs will formalise, valorise and legitimise the role of COs.

The CitiObs methodology of using a large-scale demonstration, co-design and coaching approaches with CO stakeholders (citizens, scientists, policy/decision makers) in 5+30+50 cities in Europe explicitly builds on the Responsible Research & Innovation (RRI) dimensions as founding principles. Ethics consideration will be addressed consistently across all Work Packages.

- WP1. Social dimensions of Citizen Observatories for transition governance
- WP2. Tools, Technologies, and Data Services for Citizen Observatories
- WP3. Co-creation of data and actions for healthy, sustainable and resilient cities with Citizen Observatories
- WP4. Impact creation, Communication, Dissemination and Exploitation
- WP5. Project management
- WP6. Ethics

EXECUTIVE SUMMARY

A variety of issues relating to participation dynamics can pose key challenges to Citizen Observatories (COs), especially in multi-level governance contexts. For example, various barriers and incentives can influence participation of different stakeholders, interests of participants can conflict, and a lack of trust between participants can occur.

Many tools, approaches and methodologies exist to alleviate or address issues related to CO participation dynamics, but these are currently dispersed and not ready for strategic use to address specific issues. The aim of this deliverable is to help diagnose what distinct dynamics and issues may be at play in a CO and to support the process of addressing particular participation dynamics by means of directing users towards relevant, existing approaches. As such, it provides a "CO participation toolkit" that can guide users (namely, the CitiObs mentors in the first instance) through these issues, helping them to address participation dynamics, foster trust among stakeholders, and facilitate the integration of CO data into decision-making processes.

This deliverable presents the second version of the CO participation toolkit. It presents a revised and refined version of the first version of the toolkit which had been delivered as CitiObs deliverable D1.6. Feedback on version 1 of the toolkit had been received by the external project evaluators. During a dedicated workshop with CitiObs Frontrunner and Alliance cases, feedback was gathered that contributed to a better understanding of what users need from the toolkit. This led to an internal revision of the toolkit using a Miro board to map the implicit participation challenges behind each topic in the toolkit. When necessary, the topics presented in the toolkit were reordered and/or renamed to better reflect the needs of the future users (as represented by the Frontrunner and Alliance cases). Additional inputs were added through a search of citizen science and public participation repositories. This final toolkit (version 2 of 2) provides tools and methods that can help to strengthen trust, navigate participation dynamics, and address clashes in COs.

The resulting, final toolkit is structured as follows:

- **What are participation dynamics in a Citizen Observatory?**
- **How can we examine/understand the participation dynamics in our Citizen Observatory?**
- **How can we improve participation dynamics in our Citizen Observatory?**
  - *How can we (re)build trust and cultivate cooperation between stakeholders participating in the citizen observatory?*

- *How can we ensure that the views and interests of all stakeholders are taken into account?*
- *How can we manage decision making within our citizen observatory in the face of uncertainty and complexity?*
- *How can we manage and resolve conflicts between stakeholders in our citizen observatory?*
- *How can we identify the root causes of problems with stakeholder interactions in our citizen observatory?*
- *How can we ensure uptake of CO- generated data?*

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ACRONYMS

Acronym	Full name
CO	Citizen Observatory
D-CENT	Decentralised Citizens Engagement Technologies
DRM	Disaster Risk Management
ECSA	European Citizen Science Association
GDPR	General Data Protection Regulation
IAD	Institutional Analysis and Development framework
ICT	Information and communication technology
PD	Participation Dynamics
WP	Work Package

1. INTRODUCTION

1.1 Background

CitiObs is a four-year project funded under Horizon Europe by the European Commission. CitiObs will consolidate and apply tools and practice-based knowledge for co-creating data, knowledge and local action via Citizen Observatories (COs): these tools will enhance existing and new COs to engage citizens and marginalised communities, add value to environmental observations in the urban context, increase and validate citizen observations of the urban environment as part of the existing in-situ Earth Observation systems, co-create inclusive local actions for sustainability and ensure that CO data contributes to research and policy development towards the objectives of the European Green Deal. To ensure broad use, the CitiObs tools and approaches will be developed in co-creation with COs in 5 Frontrunner cities, fine-tuned with 30 Alliance cities and showcased to 50 Fellow cities.

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WP1 'Social dimensions of Citizen Observatories for transition governance' provides the basis for consolidating, testing and refining the tools, approaches and guidance that will strengthen the social dimensions of COs. As part of this work, existing approaches are being consolidated for COs dealing with participation dynamics, fostering trust among stakeholders and supporting the uptake of data in decision making into a 'CO participation' toolkit that COs can readily draw on and apply to their specific conditions, socio-political context and purpose.

This document presents the second and final version of the 'CO participation in multi-level governance toolkit'. It presents a revised and refined version of the first version of the toolkit which had been delivered as CitiObs deliverable D1.6. For ease of reference, the 'CO Participation in Multi-level Governance Toolkit' will hereafter be referred to as the 'CO participation toolkit'.

1.2 Purpose of the toolkit

Participation dynamics in COs can significantly influence participant and stakeholder engagement, therefore impacting on CO activities and impact. It is key that these dynamics are

fully understood, in order to support participants and practitioners to design and implement strategies and measures to allow for meaningful participation, promote inclusion, ensure the sustained, long-term involvement of a wide range of stakeholders and maximise impact of project outputs.

This toolkit has been designed to allow practitioners to understand CO participation dynamics, what they are and how they affect COs. Users can also use the tools provided in the toolkit to diagnose issues present within their CO. Finally, they can remedy these issues with a range of tools and approaches structured by topic within the toolkit.

1.3 Structure of the document

The report is structured as follows. Section 2 presents the methodology including a review of the methodology for the first version of this toolkit which dealt with identifying and consolidating relevant tools, resources and guidelines and the current (2nd) version of the toolkit, namely addressing feedback and restructuring the toolkit, stakeholder interactions with the toolkit, and making the toolkit more accessible. Section 3 presents the final 'CO participation toolkit' which is broken into six subsections. Section 4 concludes with a reflection on the production process as well as implications for subsequent CitiObs activities, tasks and other WPs.

2. METHODOLOGY

This section recaps the methodology used to develop the first version of the CO Participation Toolkit (D1.6) before discussing the methodology used to develop the second and final version of the toolkit (D1.2, this deliverable).

2.1 Version 1 of the CO Participation Toolkit

The first step in the development of the CO Participation Toolkit was the identification of existing, known resources, several of which had been mentioned in the CitiObs project proposal, including: the MICS impact journey approach, the Shelter organographic technique for jointly creating governance maps, the Ground Truth 2.0 CO stakeholder interaction & CO data policy approach, and resources from the WeObserve Cookbook[1]. Following this, a targeted online search was conducted for other resources to complement those already identified. A range of further tools, toolkits, approaches, methodologies and resources were identified during this search (detailed list is presented in D1.6).

The CO participation toolkit was then structured into three main sections: i) *explaining* the terminology of CO participation dynamics; ii) *diagnosing* CO participation dynamics in order to identify specific problems; and iii) *providing entry points* into distinct issues regarding participation dynamics and CO data uptake, featuring specific tools and approaches for each. The set up of the detailed sections was done by drawing inspiration from the WeObserve Cookbook, with resources organised and presented in response to user-driven questions, e.g., “How do we ….”

Following the development of the draft toolkit with structured resources and tools, a workshop was held in June 2023 at the CitiObs plenary meeting in Barcelona with CitiObs project partners to provide detailed feedback on the first draft of the initial toolkit. A World Café session was held (in conjunction with the other two WP1 toolkits), with in total fourteen partners providing inputs. These inputs were captured, and feedback was used to make minor changes to the draft toolkit. No major changes were suggested to the toolkit structure or content.

[1] https://www.weobserve.eu/weobserve-cookbook/

2.2 Version 2 of the CO Participation Toolkit

The development of Version 2 of the CO participation toolkit was supported by contributions from the external CitiObs project evaluators, several CitiObs Frontrunner and Alliance cases providing input on implicit participation challenges and needs, and online citizen science and public participation repositories.

Feedback on version 1 of the toolkit (presented in D1.6) by the external project evaluators suggested that the toolkit text was too academic and hence not sufficiently accessible to a wider audience of CO practitioners. Therefore, the first step of the second version was to revise sentences and expressions that could be clarified in layman's terms. As part of the effort to make the content of the toolkit more accessible for a wider audience, "deep dive" boxes were added to spotlight more detailed and often academic explanations of certain concepts. Removing this content from the main paragraph text makes the text more digestible, and the reader can decide if they would like more in-depth information. Another change made for increasing accessibility was changing from in-text citations to footnotes, creating less congested paragraphs. The overall structure of the toolkit was maintained in version 2, presented in this deliverable in Section 3.In May of 2025, a workshop was held with 22 participants from the following 6 CitiObs Frontrunner and Alliance cases: Barcelona, Slovenia, Rotterdam, Athens, Ghent, and Budapest. The workshop focused on improving participation dynamics in a CO. Using the content and structure from version 1 of the toolkit, the workshop utilized a Miro board to facilitate interactions of workshop participants with the toolkit (see Annex 1). During the workshop the participants were taken through the online version of the toolkit, incl. a demonstration was given of how to navigate it. The goal of the workshop was twofold: Firstly, the workshop aimed to help participants realize the purpose of the toolkit and become comfortable using it and applying different approaches and tools in their CO's. Secondly, the workshop sought to collect feedback and insights from the participants about their most pressing concerns with respect to participation dynamics and how they might address them, in order to maximize the relevance of the toolkit presented in this deliverable. The workshop focused on three main topics of the toolkit given the time constraints and maintaining a meaningful group sizes for discussions. Using the Miro board, three breakout groups were formed around the topics: *How can we (re)build trust and cultivate cooperation between stakeholders participating in the CO, especially in contexts of past fragmentation or mistrust?; How can we identify the root causes of problems with stakeholder interactions in our CO and develop more effective and sustainable solutions?*; and *How can we ensure that the views and interests of all stakeholders are taken into account?* During this workshop, feedback

was gathered and observations made that contributed to a better understanding of what users need from the toolkit. This led to an internal revision of the toolkit using a Miro board (see Annex 2) to map the implicit participation challenges behind each topic in the toolkit. When necessary, the topics presented in the toolkit were reordered and/or renamed to better reflect the needs of the future users (as represented by the Frontrunner and Alliance cases).

Additional inputs were added through a search of citizen science and public participation repositories. The repositories were searched through Google Scholar, Google, and ChatGPT. Additionally, these efforts had significant overlap with a task in the sister project more4nature[2] in which a repository was created for strengthening the capacity of citizen science initiatives. Therefore, relevant tools identified in more4nature were also used in the toolkit. These tools include facilitation activities, templates, and session designs.

Below, table 1 provides an overview of the toolkit structure, outlining all (sub-)sections of the toolkit, and which approaches and tools are featured within each of these (sub-)sections. There are two levels: Level 1 guides via high level questions (i.e. whether users want to understand participation dynamics, diagnose participation dynamics-related issues, or improve participation dynamics within a CO), while Level 2 focuses on specific ways in which participation dynamics can be improved, and links to particular approaches and tools.

[2] https://www.more4nature.eu/. The more4nature project is funded by the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement 101133983. The UK participants are supported by UKRI grant numbers 10106638 UNEP-WCMC and 10110989 Earthwatch Europe.

Table 1 Overview of toolkit structure, approaches, & tools

Level 1	**Level 2**	**Existing (adapted) approaches** (proven methods adjusted to fit the needs of CO)	**Featured tools**
What are participation dynamics in a Citizen Observatory? (Section 3.1)		Context, process, impacts (CPI) framework	• Ground Truth 2.0 CPI framework
How can we examine/understand the participation dynamics in our Citizen Observatory? (Section 3.2)		Institutional Analysis and Development (IAD) framework	• Diagnostic questions
How can we improve participation dynamics in our Citizen Observatory? (Section 3.3)	How can we (re)build trust and cultivate cooperation between stakeholders participating in the CO?	Collaborative culture-building	• Open communication using tool which maps organisational culture
		Empathy and vulnerability recognition	• Roles clarification session - generate empathy and understand vulnerabilities. Relationship mapping and repair workshops using WINFY method/tool
		Acknowledging mistrust	• Mapping trust erosion using Broken Trust Timeline mapping
	How can we ensure that the views and interests of all stakeholders are taken into account?	Joint framing	• Joint problem identification sessions using Stakeholder Saliance mapping
		Seeking consensus	• Consensus-building workshops using 1-2-3-4-All Activity
		Deliberate inclusion	• Power Mapping using Chapati Diagrams
	How can we manage decision making within our CO in the face of uncertainty and complexity?	Adaptive management	• Flexible and iterative approach to decision-making within the CO using Plan–Do–Check–Act (PDCA cycle) - also known as the Deming or Shewhart cycle
		Polycentric negotiation	• Create multiple parallel spaces where different actors can advance solutions, which can later be aligned using Scenario building workshops

		Deliberative resilience	• Accepting that disagreement itself can be productive, and focus on building the capacity to stay engaged despite unresolved differences using Multi-Criteria Decision Analysis (MCDA).
	How can we manage and meaningfully resolve conflicts between stakeholders in our CO?	Facilitated and rule-based resolution	• Negotiation • Mediation • Arbitration
	How can we identify the root causes of problems with stakeholder interactions in our CO?	Collective reflexivity	• Problem tree methods, • 5 WHYS • Force-field analysis • Causal loop diagrams
	How can we ensure uptake of the CO generated data?	Building legitimacy and credibility in data through communication and recognition	• Feedback and recognition mechanisms - Showcasing small wins / celebratory events • Data storytelling and visualisation platforms to make results relatable using CSISTA • Boundary objects such as Dashboards that can be understood and used across stakeholder groups.

3. CO PARTICIPATION TOOLKIT

The success of COs relies on the active participation and commitment of all related stakeholders. COs can be seen as spaces for participants to meet and work together as they discuss and try to solve shared environmental problems. Key elements of a CO are the systems they have for tracking data, their resources, the activities they do, their shared values about the world/their community, the members' expectations, and trust among the members. Each CO stakeholder interprets the concepts of participation and governance through their own role and ideological lens and in connection with their own values.

There can sometimes be a lack of trust between the key actors in a CO[3] and clashes of expectations or motivations, such as regarding the timing, the types of results that a CO can deliver, the uptake of CO data in decision making, and subsequent changes in policy[4]. The CitiObs 'CO Participation Toolkit' provides the means to avoid or navigate such clashes (or even controversies, such as whether air quality policies result at any governance level) with tools and methods to strengthen the triangle of trust, - the mutual trust between citizens, institutions (authorities), and civil society - which is the key to COs achieving their full potential.

3.1 What are participation dynamics in a CO?

Why is it relevant?

Participation dynamics in your CO influence and shape the engagement of participants and other related stakeholders. Understanding these dynamics can help anyone involved in a CO to communicate more effectively, create a more inclusive environment and encourage long-term and meaningful participation, ultimately helping the CO have a stronger impact. By examining motivations, interests, and expectations of your CO members as well as the factors that act as barriers, you can tailor your approaches, activities, and communication channels to better meet the needs and preferences of your CO. This also helps you understand the potential challenges, such as unequal power dynamics or underrepresented voices. When these challenges are understood then you will be able to develop targeted interventions that help create a more equitable and inclusive CO. Moreover, analysing participation dynamics allows for continuous

[3] Hager et al., 2021

[4] Wehn and Almomani, 2019

learning, improvement, and adaptation of practices, resulting in stronger collaboration, increased data quality (through greater alignment of processes and procedures), and a greater sense of ownership and impact among participants.

What are participation dynamics in a CO?

Participation dynamics in your CO refer to the different ways participants, stakeholders, and the CO initiative engage and interact with one another. In other words, participation dynamics describe what it means to participate in a CO[5]. There is a range of participation levels within citizen engagement projects, based on factors such as the degree of involvement and engagement of participants in the different activities that the CO undertakes[6]. Some COs may require in-depth participant involvement in the design, running and monitoring of activities, while others involve participants only in data collection. It is therefore important to understand the level of participation expected of participants when examining participation dynamics. The explicit or implicit goals and objectives of a CO provide a key reference point when aiming to understand participation dynamics.

Deep Dive:

Participation Dynamics

As outlined in an analysis by Gharesifard et al. (2019) during the Ground Truth 2.0 project, participation dynamics are diverse, and can be impacted by a range of factors, such as the goals and objectives of COs, extent of participation, geographic scope, participant groups, effort required to participate, support offered for participation, communication patterns, and methods of engagement.

To make participation dynamics more tangible, we outline the following aspects as entry points for understanding:

- Effort and support: what participants are required to do to take part, and how this is facilitated
- Participant groups: how participants come together, collaborate, and organise within the CO

[5] Gharesifard et al., 2019

[6] Bonney et al., 2009a; Haklay, 2015; Kullenberg and Kasperowski, 2016

- Activities: the kinds of tasks participants are involved in (e.g., data collection, analysis, decision-making)
- Outcomes: how participation links to both individual benefits and the broader goals of the CO

Deep Dive: Communication Patterns

Communication patterns within a CO significantly shape participation dynamics. The initiative often acts as a medium for facilitating communication between various stakeholders, and understanding existing communication channels and information flow patterns is essential. Identifying patterns of unidirectional, bidirectional, or interactive communication helps assess how the CO affects and mediates interaction among participants, data aggregators, and policymakers (Liu et al., 2014; Wehn et al., 2015).

The **effort** required to participate and the **support** offered for participation are two interrelated factors that significantly influence participation dynamics. The level of effort needed from participants, such as time, expertise, or monetary investments, can impact their willingness and ability to engage in the CO. Simultaneously, the support provided by the initiative's organisers (or other community members), including communication methods, user-friendly platforms, incentives, and training materials, can enhance participants' engagement and facilitate their active involvement in the initiative[7].

Participant groups play a crucial role in shaping participation dynamics in your CO. As the name suggests, participants groups are the groups of individuals, organisations, or stakeholders who are actively involved in various aspects of the CO, including data collection, sharing, analysis, and utilising outputs for decision-making processes. Understanding the composition of participant groups allows for a deeper understanding of inclusion, representation, and potential gaps in stakeholder involvement, which can ultimately influence the effectiveness and outcomes of the initiative[8].

[7] Conrad and Daoust, 2008; Ciravegna et al., 2013; Liu et al., 2014; Gharesifard and Wehn, 2016

[8] Wehn et al., 2015; Ciravegna et al., 2013; Conrad and Daoust, 2008

Deep Dive: Geographic Scope

Geographic scope plays a significant role in influencing participation dynamics in a CO. The breadth of focus of an initiative determines the range of stakeholders involved and affected by the initiative, thus impacting the potential pool of participants. Changes in the geographic scope, whether due to growth or a shift in focus, can alter the composition and engagement

Methods of participation in your CO are vital factors influencing participation dynamics. Different modes of communication and decision-making, such as expressing preferences, developing preferences, deliberating and negotiating, and utilising technical expertise, shape how participants interact within the CO. Analysing these methods before and after the initiation of your CO (as explained in the following section 3.2) provides insights into how participants previously engaged in discussions and decisions related to the environmental issue at hand and how the CO may have influenced or altered these interactions[9].

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3.2 How can we examine/understand the participation dynamics in our Citizen Observatory?

Why is it relevant?

Examining and understanding the participation dynamics in your citizen observatory (CO) is important for several reasons. It allows CO participants or advisors to gain insight into the level of engagement, commitment, and involvement of (other) participants, which are crucial factors in the success and effectiveness of your CO. By understanding the dynamics of participation, you will be able to:

- Identify strengths and weaknesses of the CO,
- Explore potential gaps in stakeholder representation,
- Develop strategies to enhance inclusion and active engagement.

Also, examining participation dynamics helps assess the impact of the observatory on decision-making processes, policy development, and environmental management.

By understanding how fellow participants interact, communicate, and contribute, CO leaders and advisors can evaluate the effectiveness of the observatory in empowering citizens and influencing environmental outcomes. Lastly, examining CO participation dynamics provides valuable knowledge for the continuous improvement and evolution of the CO, enabling the adoption and refinement of approaches, communication methods, and support systems to foster meaningful and sustained participation in environmental monitoring, planning, and management.

How can this be done?

To address the question of how participation dynamics in your CO can be examined, we draw on two complementary frameworks: the Institutional Analysis and Development (IAD) framework and the framework for characterising social cohesion[10].

To broadly understand and conceptualise participation dynamics in citizen observatories, your CO can use the IAD framework[11]. By applying the IAD framework, CO leaders and advisors can gain a deeper understanding of participation dynamics within the CO, identify both barriers and facilitators of participation, and develop strategies to foster more effective and inclusive citizen engagement in your CO's activities.

[10] Fonesca et al., 2019.

[11] Ostrom, 2009

In the case of CitiObs, this often concerns air quality but also cover other environmental issues like water quality and noise pollution. In the context of your CO, the IAD framework can help you identify the key actors, their roles, and the rules governing their interactions. It allows for an examination of the design principles and governance structures that shape participation, as well as the external factors such as social norms, power dynamics, and resource constraints that influence engagement. By applying the IAD framework, you can gain a deeper understanding of the participation dynamics within your CO, identify barriers and facilitators of participation, and develop strategies to foster effective and inclusive engagement of fellow participants in the observatory's activities (find out more about inclusive engagement in the CitiObs Leave No One Behind Toolkit in deliverable D1.5).

Deep Dive: IAD Framework

The framework focuses on analysing the institutional arrangements and collective action processes that influence the behaviour of individuals and groups within a specific context related to common pool natural resources. In other words, both the rules and the ways people interact in a given setting. It also considers other factors that shape how communities manage shared resources.

Another way to understand participation dynamics is through the concept of **social cohesion**. If the participation within your CO is weak, this framework offers a starting point to check in with the other factors that could be having a negative impact. Social cohesion or group cohesion refers to a strong sense of community and a known place for oneself within the group or the integration of the individual and the community[12]. It is within that meeting point of the individual and the group, in this case your CO, that participation dynamics can be observed, understood, and strengthened.

[12] Friedkin, 2004

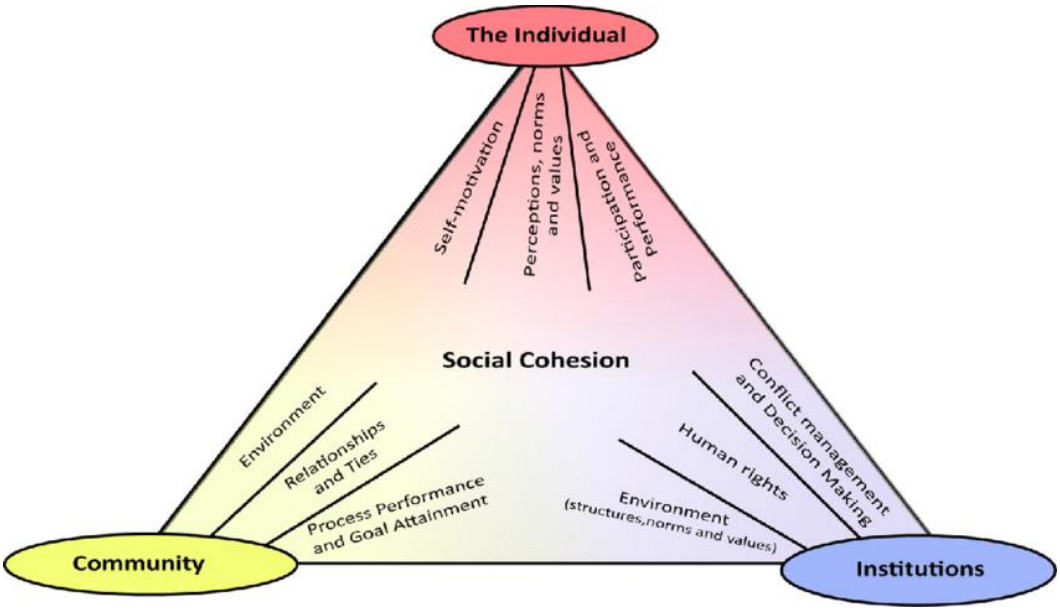

Figure 1 Framework to characterize social cohesion (Fonseca et al., 2019)

In the case of COs, they can be understood as the institution made up of rules, processes, established principles, while the community is the group of individuals who make up the CO. In this framework we see that participation of the individual is a necessary factor to building social cohesion within the CO and it is also influenced by the other factors such as the relationships within the CO, the CO's success, and conflict management. Participation dynamics are then the interactions of all these factors, enabling or hindering one another. In other words, for the CO to have strong social cohesion, it would also mean that there are positive and effective participation dynamics playing out.

To make use of the social cohesion framework by Fonseca et al., we encourage you to look at participation dynamics across three connected dimensions. First, consider the institutional side of the CO - the rules, processes, and decision-making structures that shape how people can take part. Next, pay attention to the community dimension - the quality of relationships, networks, and trust that hold the group together. Finally, reflect on the individual level - the motivations, perceptions, and sense of value that participants bring with them. By working through these three dimensions, you can begin to see whether participation is being strengthened or limited, and identify practical ways to build stronger social cohesion within your CO.

Deep Dive: Applying the IAD

To apply the IAD, Strandburg, Frischmann, and Madison (2017) developed a set of questions, known as the Knowledge Commons Framework and Representative Research, in order to apply the framework to Knowledge Commons. The Knowledge Commons refers to the collective resources and knowledge that are available to a community and are managed and shared by that community and as such is closely related to the core concept and characteristics of COs.

This framework is meant to be used by CO leaders, practitioners, and researchers who wish to better understand participation dynamics in their COs. By working through the questions, you can explore how rules, community members, resources, and governance processes interact to shape participation. For instance, imagine a CO where citizens pool environmental data: the framework would help you examine what resources are shared (data), how they are governed (rules and processes), and how participation is enabled or hindered (roles and motivations of members).

These following guiding questions can also be adapted to reflect on participation dynamics in COs, as follows:

1. Background context
    - What is the broader context (legal, cultural, social, political) of this particular CO?
    - What is the default status of the resources in this context (e.g., are they considered private, public, patented, copyrighted, open)?
2. Attributes - Resources
    - What resources are pooled and how are they created or obtained?
    - What are the characteristics of the resources? Are they rival or nonrival, (• Rival resources can be used up or depleted (e.g., water, funds). Nonrival resources can be shared without loss (e.g., data, knowledge)] tangible or intangible? Is there shared infrastructure?
    - What technologies and skills are needed to create, obtain, maintain, and use the resources?
3. Attributes – Community Members
    - Who are the community members and what are their roles?
    - What are the degree and nature of openness with respect to each type of CO member and the general public?
4. Attributes - Goals and Objectives
    - What are the goals and objectives of the CO and its members, including obstacles or dilemmas to be overcome?
    - What are the history and narrative of the CO?
5. Governance
    - What are the relevant **action arenas** ((the settings where decisions are made and interactions occur) and how do they relate to the goals of the CO and the relationships among various types of participants and with the general public?

- What are the governance mechanisms (e.g., membership rules, resource contribution or extraction standards and requirements, conflict resolution mechanisms, sanctions for rule violation)?

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3.3 How can we improve the participation dynamics in our Citizen Observatory?

This section focuses on hands-on improvement in CO participation dynamics in distinct key improvement areas (e.g. rebuilding trust, ensuring inclusion, managing conflict). Each improvement area begins with a short explanation of why it is relevant, followed by practical approaches and tools that users can apply directly in their CO.

How can we (re)build trust and cultivate cooperation between stakeholders participating in the Citizen Observatory?

Why is it relevant?

(Re)building trust and cooperation among the participants of your CO is central to success and effectiveness. Trust serves as the foundation for meaningful collaboration, open communication, and active engagement. When fellow participants trust each other and your CO and the purpose

of participation, they are more willing to contribute their knowledge, expertise, and resources, creating a fertile ground for collective problem-solving and decision making. Trust also enhances cooperation by fostering a sense of shared purpose and mutual respect, enabling participants to work together towards common goals. Crucially, it also increases the perceived levels of transparency and accountability, because when participants see information being openly shared, commitments being followed up, and rules applied consistently, they are more likely to view their CO's decisions and actions as fair and legitimate. This strengthened legitimacy, in turn, increases the likelihood that the CO's outcomes are taken seriously in policy and governance processes. By building trust and cooperation, you can create a supportive and inclusive environment that encourages active participation, generates innovative solutions, and strengthens the overall impact and sustainability of your CO.

How can this be done?

When participants come together without a shared history, trust cannot be assumed; it must be intentionally established. The absence of trust often shows up as distance, uncertainty, or indifference, and a lack of confidence that collaboration will be meaningful. In these situations, the first step is to demonstrate reliability through consistent and transparent actions. Small but visible commitments, such as following up on agreed tasks or sharing information openly, signal that the process is dependable. Creating opportunities for participants to get to know each other's roles, motivations, and contributions further reduces uncertainty and builds familiarity. Low-stakes interactions, such as informal dialogues, co-learning sessions, or collaborative problem-scoping, help establish reciprocity without putting participants at risk. By gradually layering dependability, openness, and recognition, participants begin to see that their engagement matters. This foundation transforms absence of trust into initial confidence, upon which deeper collaboration can grow.

Existing (adapted) approaches	Featured tools
A. Collaborative culture-building	Open communication using tools which maps organisational culture
B. Empathy and vulnerability recognition	Roles clarification session - generate empathy and understand vulnerabilities. Relationship mapping and repair workshops using WINFY method/tool
C. Acknowledging mistrust	Mapping trust erosion by 'mapping the timeline of broken trust',

A. Collaborative culture-building

This approach involves bringing together various actors and public agencies to participate in decision-making processes that aim to achieve consensus and manage expectations[13]. This type of approach is often used to overcome issues with uncertain and disputed solutions. They can help build consensus or compromise when different groups have different perspectives, or when there are significant differences among the people involved in their beliefs about how to handle a particular issue or task[14].

A variety of factors can influence the success and effectiveness of collaborative culture-building. Face-to-face discussion, trust building, and creating commitments and shared understanding contribute to the sustainability of such approaches[15]. Suitable leadership models or methods should also be in place, to manage conflict and monitor objectives[16].

All of these tools are best conducted in-person, and in a place that is comfortable for the participants (which leads to increased accessibility and feelings of trust). Here, open communication plays a crucial role in building transparency and fostering trust and cooperation among participants of your CO. By establishing transparent channels and nurturing meaningful exchanges, you can cultivate an atmosphere of collaboration and engagement. Along with communication channels you should also keep in mind: a) communication styles ; b) language use , and c) audience. Because different language and style may be needed for different audiences. Complex language may not be accessible to some people, while simplistic language may be perceived as condescending by others. Therefore, several approaches can be taken in order to leverage open communication practices to build trust and cooperation.

Open communication practice ensures the active involvement of stakeholders, including citizen participants, from the beginning. If done successfully, it may not only address ethical concerns of citizen science projects but also, create a greater willingness among participants to contribute data that they may consider private[17]. Effective communication strategies can be created by identifying the needs, goals, and expectations of participants early on and maintaining ongoing two-way communication. In that regard, **Mapping Organizational Culture** serves as a tool that

[13] Ansell & Gash, 2008

[14] Gerlak & Heikkila, 2011

[15] Ansell & Gash, 2008

[16] Bianchi, Nasi & Rivenbank, 2021

[17] Eleta et al., 2019; Skarlatidou et al., 2019

helps shift focus from judgement to exploration where the participants explore and jointly identify your CO's culture through deep reflection. By openly understanding the group culture, needed change becomes clear and more easily justified. This tool can help your CO understand how they have been interacting and communicating and, in doing so, it becomes clear where there is a need to adopt different practices of open communication.

Steps:

1. **Prepare the Culture Map template -** Draw Strategyzer Culture Map layout featuring four key quadrants:
    a. Behaviours (actual actions and interactions)
    b. Outcomes (results of those behaviours)
    c. Enablers (factors supporting behaviours)
    d. Blockers (factors preventing positive behaviour or change)

Deep Dive:

Strategyzer Culture Map

The Strategyzer Culture Map is a visual tool that helps groups explore how their behaviours, outcomes, enablers, and blockers shape organisational culture. By mapping these elements together, participants can identify what supports or hinders collaboration and agree on changes needed to build a desired culture. Together, these four lenses help groups quickly spot patterns in how their culture works and where change is needed.

2. **Individual reflection -** Ask participants to individually fill in each quadrant with sticky notes, focusing first on observed behaviours, then on their outcomes, followed by enablers and blockers. Encourage specific, story-based examples, not generalizations.
3. **Small-group clustering and discussion -** Form small groups to cluster notes on the shared template, spotting patterns or contradictions. They should discuss how certain behaviours lead to specific outcomes, and what enablers or blockers influence them.
4. **Full-group synthesis -** As one group, review the clusters and explore contrasts between current and desired states. Discuss:
    a. Which behaviours foster collaboration?

b. Which outcomes signify health or dysfunction?
c. What cultural enablers can be strengthened?
d. Which blockers need addressing?

5. **Define desired culture -** Use insights to collaboratively map out aspirational cultural traits, such as transparent dialogue, shared leadership, or inclusive decision-making. Map how new behaviours could lead to different outcomes, supported by new enablers.

6. **Integrate into practice (living document) -** Place the resulting map in prominent meeting spaces or digital platforms where the CO convenes. Regularly revisit and update the map to assess progress, reinforce commitments, and adapt practices as needed.

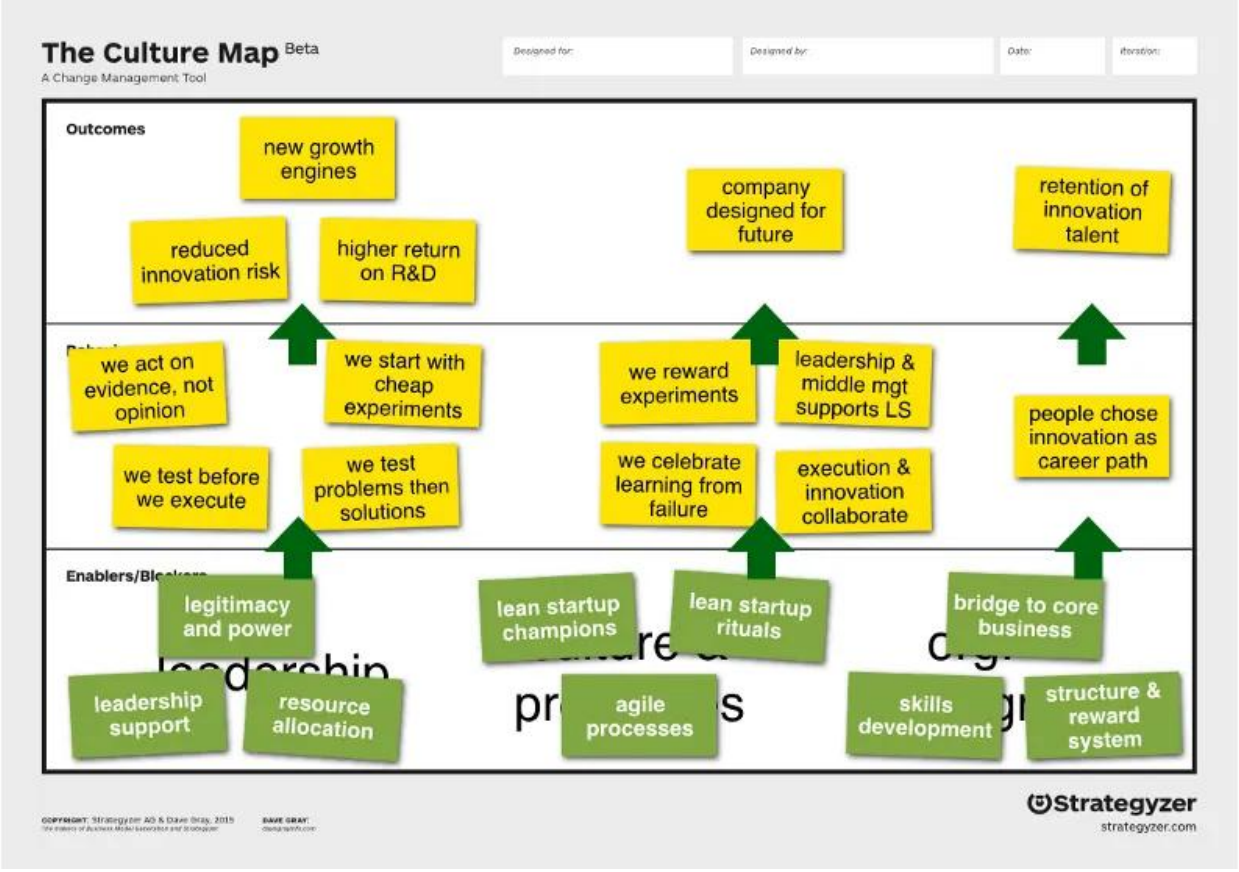

Figure 2 Example of a Culture Map
Source: https://jwokittel.medium.com/the-culture-map-64baef6fd576

B. Empathy and vulnerability recognition

Recognising and naming feelings such as betrayal, powerlessness, and abandonment is a necessary step to build trust, because it validates lived experience and opens a path to emotional healing and renewed collaboration[18]. Empathy in practice means creating facilitated spaces where people can safely voice harms and vulnerabilities, and where leaders and convenors respond with care, transparency, and follow-through; this signals respect and helps participants re-engage[19]. In low-trust contexts across government, expert, and social relations, empathetic facilitation within deliberative processes is especially important: it reduces defensiveness, builds social capital among stakeholders, and strengthens the perceived legitimacy of decisions[20].

One tool that can put this into practice (i.e. cultivate empathy and understanding) is the What I Need From You (WINFY) activity. This group activity is designed to help people working together in different roles clearly communicate what they need from others for the organization/system/group to succeed. In doing so, the struggles and goals of others are illuminated and the interdependency of the group is highlighted. Through greater clarity about the different individual efforts happening in the CO, relationships can be strengthened and a greater willingness among fellow participants to help meet the collective needs of the CO can be established.

Steps:

A. **Set the invitation** - Frame the exercise around a shared goal (e.g., “What do we need from each other to make this observatory work?”). Clarify that responses must be “Yes,” “No,” “I will try,” or “Whatever” (meaning more clarity is needed).

B. **Cluster reflection** - Small groups generate a list of their key needs from other groups, then select two priority needs and nominate a spokesperson.

C. **Sharing needs** - Spokespeople gather in a central circle and state their cluster’s two needs aloud. Other groups listen and take notes - no responses at this stage.

[18] Awan, 2014

[19] Awan, 2014

[20] Tsang, Burnett, Hills, & Welford, 2009

D. **Crafting responses** - Spokespeople return to their groups to decide on responses to each request using the four allowed answers.

E. **Structured replies** - Spokespeople reconvene in the central circle and deliver their group's responses to each request, without debate or elaboration.

F. **Debrief** - As a whole group, reflect on the process using "What? So What? Now What?":
- What happened? So, what insights emerged about needs and vulnerabilities? Now what actions can we take to strengthen mutual support?

WINFY externalises unspoken needs and vulnerabilities in a structured way that minimises defensiveness. By enabling participants to hear and respond clearly to each other's requests, it fosters empathy, mutual recognition, and collective responsibility. This strengthens trust and enhances willingness to collaborate in the CO.

C. Acknowledging mistrust

Trust building and repair begins with explicitly recognising the presence of mistrust, deficit of trust and the harm it has caused. Rather than bypassing or suppressing tensions, acknowledging them validates the experiences of stakeholders and opens the possibility for dialogue. Trust repair is a two-way process where all parties engage to rebuild confidence in one another, which cannot happen unless past issues are recognised[21]. This perspective enables different sides to better understand each other's positions, which is essential for repairing strained relationships[22]. Furthermore, participatory governance and emotional healing depend on naming the feelings of betrayal and abandonment that accompany broken trust, so that constructive processes of recovery can begin[23]. In participatory settings such as COs, openly acknowledging mistrust lays the foundation for genuine engagement, emotional healing, and cooperative rebuilding of relationships.

One way to begin repairing trust is by openly acknowledging where it has been shaken or broken. This can be done **by *mapping the timeline of broken trust***, a participatory tool in which participants anonymously or collectively place moments on a shared timeline where they

[21] Kim, Dirks, and Cooper, 2009

[22] Williams, 2010

[23] Awan 2014

experienced trust being built, shaken, or broken in the CO process. The activity draws on timeline mapping methods that demonstrates how visualising life events in sequence helps participants narrate sensitive experiences, identify resilience, and gain agency in reflecting on their past[24]. By using this method for trust repair, the timeline becomes a safe way to externalise experiences of distrust without attributing blame to individuals. It enables participants to collectively identify patterns, missed opportunities for repair, and underlying dynamics that may otherwise remain hidden. This adaptation also considers that trust repair in conflict-affected contexts requires processes that explicitly recognise past violations and invite dialogue about unmet expectations[25]. By using the timeline not only to record incidents but also to facilitate reflection sessions, the activity provides a structured means of acknowledging past wounds while re-establishing a shared narrative. In this way, the collective '*mapping the timeline of broken trust' tool, serves* both as a diagnostic tool to identify when trust was weakened and as a reparative tool to support rebuilding it.: It helps participants see trust as a dynamic relational history and creates a foundation for moving forward together.

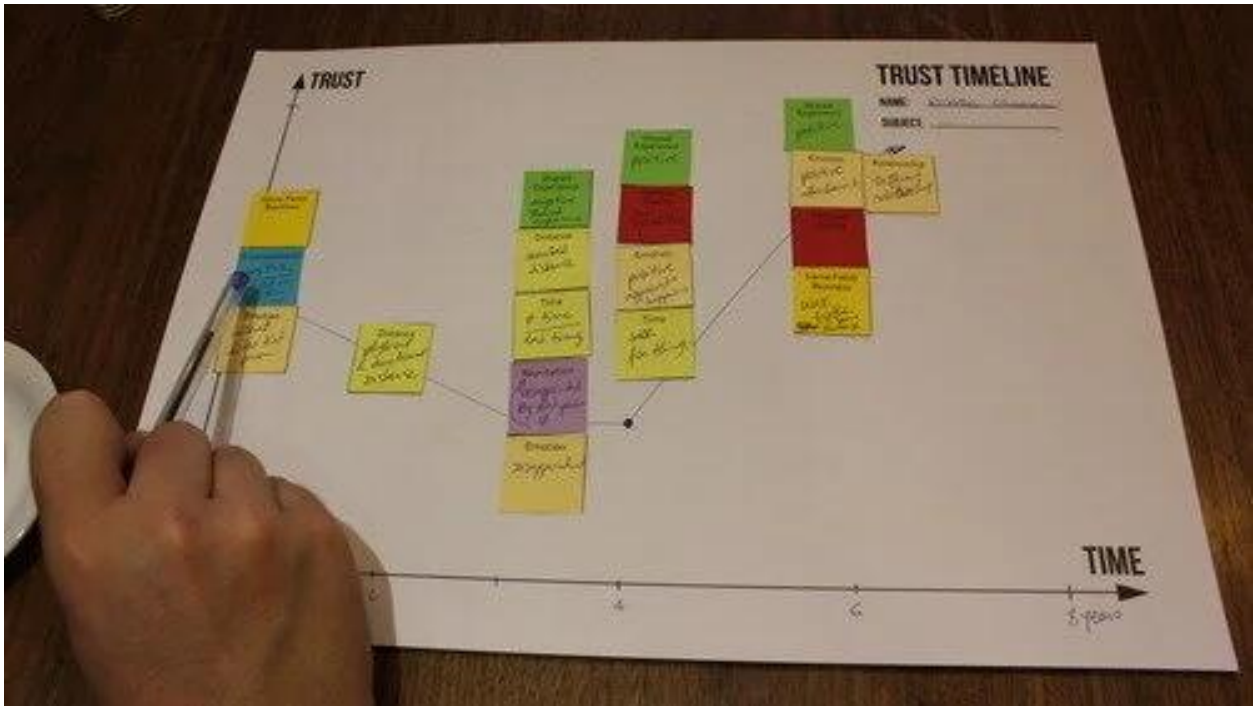

Figure 3 Mapping broken trust
Source: https://www.tatianatoutikian.com/trust-timeline

[24] Kolar et al., 2017

[25] Kappmeier et al., 2021

Steps:

1**. Introduce the purpose gently -** Explain that the activity is not about blaming individuals but about *understanding the shared journey of trust* within the CO. Emphasise that trust is dynamic — it is built, sometimes shaken, and sometimes broken — and that acknowledging these shifts is the first step in repair.

2. **Individual reflection (gentle entry)** - Provide participants with sticky notes or cards. Invite them to recall *significant moments* in the CO process (positive or difficult). Ask them to write these moments down in *neutral terms* (what happened, not why). Afterwards, introduce colour coding: Green = trust built; Yellow = trust shaken; Red = trust broken. Make it optional for participants to assign a colour if they feel comfortable.

3. **Collective mapping** - Collect the notes and place them along a large visual timeline (on a wall, flipchart, or digital board). Cluster similar moments together to make patterns visible. Ensure anonymity if participants prefer, by having facilitators post the notes.

4. **Guided reflection session** - Facilitators lead a dialogue around the emerging timeline: What patterns do we see? Where did trust strengthen, and where did it fracture? Were there missed opportunities for repair? What do these moments reveal about underlying dynamics, such as communication gaps, power imbalances, or lack of follow-through?

5. **Harvesting insights** - Encourage the group to identify: *Resilience factors* (what helped rebuild or maintain trust despite challenges). *Repair opportunities* (moments where action could have helped but were missed). *Shared commitments* for moving forward (how participants want to prevent repetition).

6. **Closing with care** - Since recalling broken trust can surface vulnerability, facilitators should close with an affirming round: each participant shares *one thing they commit to contribute* toward strengthening trust in the CO going forward.

Additional resources:

The **Action Participatory Science Toolkit Against Pollution** (Action Project, 2022) provides a range of tools to support Citizen Science and Citizen Observatories, including guidelines for open and impactful communication and dissemination

The **Impact Journey Approach (MICS, 2022)** provides a methodology for co-evaluation, which is inclusive of a range of stakeholders and aims to promote understanding of CO aims and impacts

Wehn and Almomani (2019), as part of the Ground Truth 2.0 project, developed a framework on incentives and barriers influencing how stakeholders share, harmonise, and use data in policy-making.

Wehn et al. (2015) present a conceptual framework for governance analysis within COs, useful to understand the role and authority of citizens and to track governance changes resulting from COs..

The ***WeSenseIt Incentives and Barriers framework*** outlines factors that either facilitate or hinder citizen engagement in weather observatories, helping to design strategies for ICT-enabled participation.

The organigraph tool developed by **(Durrant et al., 2022)** can be used to understand stakeholder power dynamics, and to identify stakeholder groups that are underrepresented and less connected to the decision-making process.

The **Ground Truth 2.0 co-design approach** (Wehn & Pfeiffer, 2019) offers a framework that ensures participant involvement in the design of COs, ensuring that CO processes are designed by all and allows for joint learning

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How can we ensure that the views and interests of all stakeholders are taken into account?

Why is it relevant?

As a CO, your aim is to engage and involve the broader public in the knowledge co-production. Therefore, it is crucial for you to ensure that the views and interests of all participants are considered in decision-making processes. By incorporating diverse perspectives, your CO can generate a more comprehensive and representative understanding of the issues at hand, while also promoting inclusivity, transparency, and democratic decision-making, fostering ownership and empowerment among participants. Additionally, different people bring unique knowledge, expertise, and experiences that can contribute to more robust and innovative solutions. By valuing and integrating the viewpoints of all individuals involved, you can enhance the relevance, credibility, and effectiveness of the CO, ultimately leading to better-informed decisions and positive societal outcomes.

How can this be done?

Meaningful inclusion requires more than simply inviting participation; it demands careful attention to how diverse perspectives and interests are recognised and integrated. **Joint problem-framing** anchors the process by ensuring that issues are co-defined rather than imposed, taking everyone's views into account from the outset. This prevents tokenism and lays the groundwork for shared accountability. **Consensus-seeking** activities provide structured spaces for participants to negotiate differences and identify common ground, aligning with analytic–**deliberative inclusion** approaches that strengthen ownership of outcomes. Power mapping further supports this by making visible which interests and perspectives are prioritised, exposing asymmetries that can otherwise undermine legitimacy. Finally, it is essential to identify and include missing or marginalised voices; methods for this are detailed in the Leave-No-One-Behind Toolkit (LNOB) Toolkit.

Existing (adapted) approaches	Featured tools
A. Joint framing	Joint problem identification sessions using Stakeholder Salience Mapping
B. Seeking Consensus	Consensus-building workshops using 1-2-4 All activity
C. Deliberate inclusion	Power Mapping using Chapati Diagrams

A. Joint framing

Joint framing emphasises the co-definition of problems, goals, and priorities at the outset of a CO. This early-stage collaboration generates shared language, clarifies expectations, and reduces the risk of tokenistic participation. It also builds ownership, as participants see their concerns reflected in the project's agenda. Co-framing processes thus anchor inclusivity in the design of the observatory, rather than as an add-on[26].

One way to facilitate joint framing is through **Stakeholder Salience Mapping.** In this activity, participants collaboratively identify all relevant stakeholder groups and then assess them along three dimensions: power (their ability to influence decisions), legitimacy (the appropriateness of their involvement), and urgency (the immediacy of their claims). Plotting stakeholders against these dimensions creates a shared visual map of who is most visible, who may be overlooked, and where tensions or gaps in representation exist[27]. In a CO, this process opens explicit discussion on how different voices are weighed, helping to rebalance attention toward marginalised groups and ensure that their views are not overshadowed by more powerful actors.

Steps:

1. **Brainstorm stakeholder groups -** Begin with an open list of all groups, organisations, and individuals who are (or could be) affected by the issue. Encourage participants to think beyond the usual suspects, including marginalised or less-visible actors.

2. **Introduce the salience criteria** - Explain the three dimensions:

[26] Nogueira, Bjørkan, & Dale, 2021

[27] Mitchell, Agle, & Wood, 1997

a. *Power*: ability to influence the outcome.

b. *Legitimacy*: appropriateness of involvement (socially or morally recognised).

c. *Urgency*: immediacy and criticality of the claim.

3. **Assess each stakeholder -** In small groups or plenary, discuss and rate each stakeholder against the three criteria (using cards, sticky notes, or a digital board).

4. **Plot stakeholders on a salience map -** Place stakeholders visually in a grid/diagram, showing which groups score high/low on power, legitimacy, and urgency.

5. **Reflect collectively -** Facilitate a discussion: Who dominates? Who is missing or undervalued? What tensions arise? Highlight where inclusion efforts need to be strengthened.

6. **Design actions for balance -** Agree on practical steps, e.g. targeted outreach to under-represented groups, rotating facilitation, or quota-setting in follow-up activities.

The results can guide you and your fellow participants in designing follow-up measures, such as targeted outreach to missing groups, dedicated dialogue sessions for less powerful voices, or rotating facilitation methods to ensure balanced input. In this way, joint framing supported by salience mapping ensures that the views and interests of all participants are not only acknowledged but meaningfully integrated into decision-making processes.

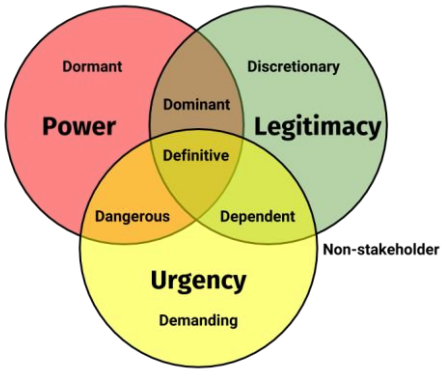

Figure 4 Diagram to map and assess stakeholders[28]

[28]Source: https://www.deepfriedbrainproject.com/2017/09/salience-model-for-stakeholder-classification.html

Use this diagram to map and assess stakeholders by their power, legitimacy, and urgency, helping you identify which voices are most salient and where inclusion efforts may be needed.

B. Seeking consensus

Consensus-seeking focuses on building common ground among participants who may hold divergent perspectives and interests. The aim is not necessarily to achieve unanimous agreement, but to create mutual understanding and workable compromises. Deliberative approaches, such as consensus conferences provide structured forums where evidence, values, and trade-offs are discussed openly. These processes foster transparency and shared ownership of outcomes, making decisions more robust and acceptable.

The 1-2-4-All activity can facilitate a nuanced conversation about the different opinions that exist on a variety of different issues/topics. Rather than needing a binary yes/no or agree/disagree response from participants, this activity offers space for a spectrum of opinions and CO participants can see the layers of agreement that already exist; this creates space for compromise even when complete consensus is not possible.

Steps:

1. **Pose the framing question** - Present a clear, open-ended question relevant to the issue (e.g., “What criteria should guide the prioritisation of monitoring activities in our CO?”).
2. **Individual reflection** - Each participant notes their initial thoughts independently, ensuring all voices are captured from the start.
3. **Pair discussion** - Participants share their reflections in pairs, finding commonalities and differences.
4. **Group of four** - Pairs join with another pair to compare perspectives, synthesise emerging agreements, and note areas of divergence.
5. **Whole-group sharing (All)** - Small groups share their key points with the plenary. Facilitators cluster responses to show overlapping concerns, layers of agreement, and remaining tensions.

6. **Synthesis and compromise** - Facilitators highlight shared ground and invite discussion on workable compromises. Points of disagreement are acknowledged but reframed as resources for further dialogue rather than obstacles.

Participants see how their individual perspectives connect to wider patterns of agreement. The method makes visible where consensus already exists, and where compromise can be built, while ensuring that no single voice dominates the process. This layered approach fosters legitimacy, inclusivity, and collective ownership of decisions.

C. Deliberate inclusion

Deliberate inclusion involves intentionally bringing forward perspectives and viewpoints that are often overlooked or given less priority. This requires moving beyond open invitations to participation and instead actively seeking out underrepresented positions, whether they are marginalised by socio-economic barriers, cultural norms, or entrenched power dynamics. In the context of a CO, this might include groups such as residents from low-income areas, young people, the elderly, informal community groups, or others whose perspectives are often less visible compared to institutional or more powerful actors. Mapping whose perspectives dominate and whose are absent helps identify these gaps. In doing so, diverse perspectives can meaningfully inform decision-making. Such practices not only broaden the range of knowledge considered but also strengthen the legitimacy of the CO by showing that all viewpoints are valued in shaping outcomes[29].

One inclusive mapping method is the Chapati Diagrams Activity, which is a participatory tool for visually mapping stakeholder relationships and power dynamics. The process validates the opinions of all participants and encourages negotiation and compromise, ensuring no group or individual is ignored in discussions and decision-making. Using this tool can act as a check for your CO to ensure that not one group or individual is dominating discussions and can help call people in to give more attention to certain groups/individuals.

[29] Burgess et al., 2007; Cornwall, 2008; Reed et al., 2009

Steps:

1. **Frame the activity** - Begin with a short input on *understanding power* — explain that circles will represent people or groups, and their *size* shows perceived power. Clarify that the aim is not to criticise but to surface perceptions of influence and voice within the system.

2. **Form small groups** - Divide participants into groups of 4 -6. Provide each group with paper, scissors, and markers.

3. **Create the chapatis (circles)** - Each group cuts circles of different sizes from paper. Each circle is labelled with the name of a stakeholder (individual, group, or institution). Larger circles = more perceived power; smaller circles = less perceived power.

4. **Arrange the circles** - Groups place the circles on a large sheet (or floor/board). Proximity to the centre (the issue or CO) indicates closeness of involvement; distance shows exclusion or weak connection. Overlaps can be used to indicate collaboration or shared influence.

5. **Debrief in small groups** - Groups discuss what the arrangement reveals: Who dominates? Who is marginalised or missing? How do overlaps reflect alliances?

6. **Whole-group reflection** - Each group shares their chapati diagram with everyone. Facilitators invite discussion on differences between groups' perceptions.

7. **Careful processing** - Acknowledge that some participants may feel exposed if they are represented as having "too much" or "too little" power. Allow time to unpack these feelings, clarify intentions, and frame the outcome as collective learning, not judgement.

8. **Identify follow-up actions** - Use the insights to design deliberate inclusion strategies, e.g. giving more space to quieter actors, targeted outreach to missing groups, or mechanisms to rebalance influence in the CO.

The chapati diagrams make perceptions of power visible in a tangible, embodied way. By cutting, sizing, and positioning circles, participants externalise difficult dynamics, opening space for negotiation and empathy. With careful facilitation, the exercise validates experiences of marginalisation and creates a practical basis for more inclusive engagement in your CO.

Additional resources

The **D-CENT Toolbox (D-CENT, unknown)** provides a range of tools that can be used to lower the barrier to participant engagement in decision making, including open-source software for citizen notifications, collaborative policy making and electronic voting.

The **Inclusive Civic Engagement Toolkit for Governments (Inclusion International, 2015)** seeks to address the various barriers faced by marginalised and underrepresented groups in exercising their right to participate in civic engagement and political processes.

The **Community Engagement Good Practice Guide (The Policy Project, 2020)** provides guidelines for adopting effective community engagement practices, including the involvement of a broad range of stakeholders in decision-making processes

The **organigraph tool (Durrant et al., 2022)** can be used to understand stakeholder power dynamics, and to identify stakeholder groups that are underrepresented and less connected to the decision-making process.

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How can we manage decision making within our citizen observatory in the face of uncertainty and complexity?

Why is it relevant?

In contexts of uncertainty, change, and complexity, decision making within your CO becomes more challenging as there are multiple unknowns, rapidly changing circumstances, and intricate interconnections between various factors. This often creates hesitation, fragmented responses, or reliance on narrow expertise in decision-making processes. By gaining insights into effective decision-making strategies, you can navigate these complexities and make informed choices that address emerging issues and maximise the impact of your CO. This understanding allows for adaptive and flexible decision making, enabling your CO to respond promptly to new information, adapt strategies, and engage stakeholders in a way that is responsive to evolving needs and dynamics. Additionally, managing decision making under uncertainty and complexity requires careful risk assessment, integration of diverse knowledge sources, and the ability to balance short-term actions with long-term goals, ultimately leading to more resilient and sustainable outcomes within your CO.

How can this be done?

Addressing this challenge requires practices that both structure and legitimise decision-making while leaving room for adaptation. One way is through **adaptive management**, operationalised by an iterative Plan–Do–Check–Act cycles, which allow participants to incorporate new information, monitor outcomes, and adjust strategies accordingly. A second approach is **polycentric decision-making**, supported by multi-level negotiation platforms that create parallel arenas for deliberation and coordination across scales, ensuring that no single perspective dominates and that interdependencies is explicitly addressed. Finally, **deliberative resilience** can be fostered through structured deliberation methods such as Multi-Criteria Decision Analysis (MCDA), which help participants systematically weigh diverse values and uncertainties, making disagreements transparent and productive rather than paralysing[30]. Together, these tools operationalise decision-making as an iterative, inclusive, and adaptive process that can hold complexity rather than collapse under it.

[30] Stirling, 2008

Existing (adapted) approaches	Featured tools
A. Adaptive management	Flexible and iterative approach to decision-making within the CO using **Plan–Do–Check–Act** (PDCA cycle) **-** also known as the Deming or Shewhart cycle
B. Polycentric negotiation	Create multiple parallel spaces where different actors can advance solutions, which can later be aligned using **Scenario building workshops**
C. Deliberative resilience	Accepting that disagreement itself can be productive, and focus on building the capacity to stay engaged despite unresolved differences using **Multi-Criteria Decision Analysis (MCDA).**

A. Adaptive management

Adopting an adaptive management approach can greatly support decision making within your CO, particularly when operating under conditions of high uncertainty and complexity. Adaptive management approaches emphasise flexible and iterative processes that allow for continuous monitoring, evaluation of outcomes, and adjustment of strategies based on new information and changing circumstances[31]. This approach enables your CO to respond to uncertainties and complexities effectively, ensuring that decisions remain relevant and impactful.

Key to adaptive management is the development of a comprehensive monitoring strategy. Data on environmental conditions and CO activities (for example, sensor measurements, observations, or reported events) should be regularly collected, monitored, and reviewed, allowing for monitoring protocols and action plans to be adjusted if required. This iterative process enables your CO to adapt its strategies based on emerging patterns, challenges, and opportunities, ensuring that decision making remains evidence-based and responsive to the dynamic nature of the observed system[32].

A variety of tools have been identified for the implementation of adaptive management[33]. However, commonly all approaches share four concrete, iterative steps: **Plan, Do, Monitor,**

[31] Williams & Brown., 2018

[32] Levin et al., 2013

[33] Norton, 2018

Learn[34]. This cyclical approach to adaptive management incorporates a learning cycle, highlighting the importance of using lessons learned from previous stages to inform the next.

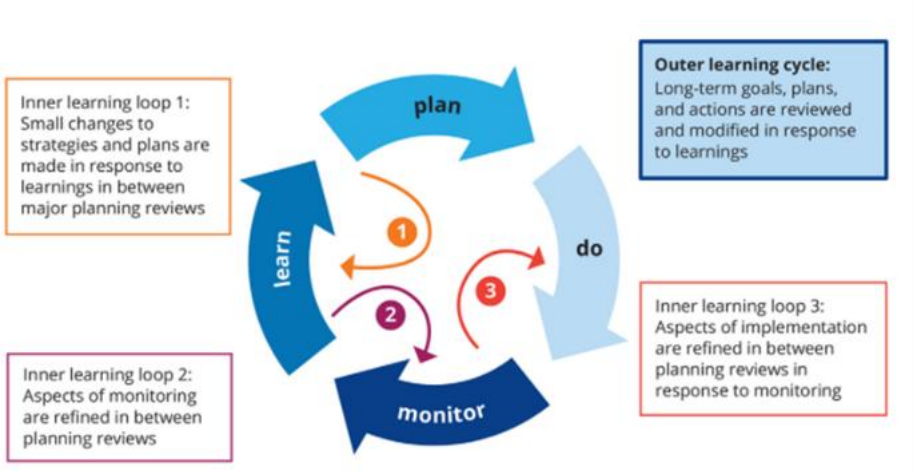

Figure 5 Plan, Do, Monitor, Learn Adaptive Management approach (Webb et al., 2017)

This tool taps into these iterative learning principles is a six-step activity, that aims to promote creativity when dealing with uncertainty, risk and change[35]. This tool provides a structured process to simultaneously implement and evaluate actions, and to modify or refine future activities as needed.

Steps:

1. **Problem Assessment –** Problems (with decision making in your CO in contexts of uncertainty, change, and complexity) can be identified in a variety of ways. One approach is to use facilitated workshops, in which participants define the scope of the issue. Participants can integrate existing knowledge about the system or issue and explore potential outcomes of different actions. To evaluate which actions are most likely to achieve management objectives, explicit forecasts are generated. This process also helps identify crucial gaps in understanding that hinder outcome prediction.
2. **Design –** Creating a plan and monitoring program that offer reliable feedback on the effectiveness of chosen actions. Ideally, the plan should address the identified gaps in

[34] Webb et al., 2017

[35] Nyberg, 1999

understanding from Step 1. Proposed plans or designs should be assessed based on factors such as costs, risks, informativeness, and their ability to meet management objectives.

3. **Implementation –** Implementing the plan
4. **Monitoring** – Focusing on tracking indicators to determine the efficacy of actions in meeting management objectives. It also involves testing the hypothesized relationships that formed the basis for the initial forecasts.
5. **Evaluation** – Comparing actual outcomes to the earlier forecasts, and the reasons behind any disparities are analysed and interpreted.
6. **Adjustment** – Modifying practices, objectives, and the forecast models based on new insights gained. The understanding acquired in each of these six steps may lead to a re-evaluation of the problem, generation of new questions, and exploration of alternative options, forming an ongoing cycle of improvement.

Such tools have considerable overlap with co-evaluation tools, such as the MICS Impact Journey Approach[36]. This outlines a methodology for citizen science or CO projects to incorporate a wide range of stakeholders in iterative problem identification, and impact assessment. This tool is comprised of three steps.

Steps:

1. **Context analysis** – During this stage, stakeholders can reflect on the context in which the initiative is being established and identify pathways of change, desired outcomes and impacts. Relevant stakeholders are identified, and political, environmental, social, and economic contexts are evaluated.
2. **Development and validation of an impact journey map** – Relevant domains of change, expected impacts, and expected outcomes are drafted in this stage. Based on this, strategies for achieving desired changes are formulated, and cause and effect relationships are identified. Key impacts are then operational by the stakeholders.

[36] Wehn, Gharesifard & Somerwill, 2021

Developing an impact monitoring strategy/continuing co-evaluation – Indicators and methods for measuring indicators are identified, and an overall plan for monitoring and evaluation of citizen science impact is created. If required, context analysis is conducted again at regular intervals to ascertain if the strategy is still appropriate.

The Plan–Do–Check–Act (PDCA) cycle, (also called the Deming Cycle) is a classic iterative management method for continuous learning and improvement. It's often used in adaptive management, governance, and citizen science because it provides a simple, yet structured way to deal with uncertainty.

Steps:

1. **Plan:** identify a problem, set objectives, and design an intervention or action plan.
2. **Do:** implement the plan on a small scale or pilot basis.
3. **Check:** monitor and evaluate the outcomes against the objectives, looking for successes, failures, and unintended effects.
4. **Act:** adjust the plan, scale up what works, and revise or abandon what does not, before beginning the cycle again.

This cyclical process ensures that decision-making isn't static but is continually updated in light of new evidence and experiences. In governance contexts, it helps stakeholders experiment safely, learn collectively, and adapt strategies over time rather than locking into rigid solutions.

B. Polycentric negotiation

Polycentric negotiation refers to the practice of creating multiple, overlapping spaces for discussion where authority and decision-making are shared. Instead of relying on a single authority, negotiations unfold across levels (community, municipal, regional) and between sectors (civil society, government, academia). This approach draws from polycentric governance theory, which highlights that complex problems are better addressed through interconnected centres of

decision-making that can adapt, experiment, and learn from one another[37]. In your CO, polycentric negotiation helps prevent dominance by a single person/group and provides space for all voices to enter discussions. It creates opportunities for alignment across scales while respecting contextual diversity, making agreements more robust and legitimate.

One practical tool to support this approach is **scenario-building workshops**. These workshops allow each group to map out possible future pathways and outcomes in a structured way. The results from different groups can then be compared, aligned, and synthesised to build a shared direction across the CO.

Steps:

1. **Identify critical drivers and uncertainties** shaping their system (e.g. water scarcity, budget constraints, institutional mandates).
2. **Develop multiple plausible scenarios** by combining these drivers into contrasting but realistic trajectories.
3. **Map sector-specific responses** to each scenario, enabling participants from different governance levels to stress-test their strategies against those of others.
4. **Compare and align pathways across groups**, highlighting interdependencies, synergies, and potential conflicts.
5. **Agree on robust strategies** that can hold across multiple futures, ensuring flexibility and resilience.

This tool is widely used in environmental governance. For example, the U.S. National Park Service facilitated scenario workshops in Acadia National Park, where communities, scientists, and managers co-developed climate futures and aligned them into adaptive management plans. These workshops bring representatives from each decision-making space together to co-develop and compare future scenarios. As explained by SessionLab, scenario planning involves guiding groups through the process of identifying key uncertainties, crafting alternative storylines, and

[37] Ostrom, 2010

stress-testing assumptions – creating future-ready, resilient strategies rather than predicting a single outcome.

C. Deliberative resilience

Deliberative resilience involves fostering the capacity of participatory processes to withstand disagreement, tension, and uncertainty without collapsing. Rather than aiming for quick consensus, deliberative resilience emphasises the value of open discussion as part of problem-solving. It encourages stakeholders to keep engaging even when discussions are difficult, thereby normalising conflict as part of democratic practice. In COs, this means designing spaces where participants can confront trade-offs, revisit assumptions, and adapt solutions over time. By cultivating resilience in deliberation, your CO can move beyond fragile agreements and instead develop adaptive pathways that can evolve as new information, values, and uncertainties emerge.

The ability to navigate disagreement constructively can be strengthened through Multi-Criteria Decision Analysis (MCDA). MCDA provides a structured process for identifying, comparing, and weighing different perspectives and options. By turning conflicting viewpoints into systematically assessed criteria, MCDA ensures that differences are not dismissed or suppressed but recognised as legitimate inputs for decision-making. Through conducting an MCDA participants learn to acknowledge and respect different viewpoints and accept that difference is inevitable and can be constructive. Through the analysis participants will give structure to the different opinions and options that exist and develop a system for considering these and moving forward with a dynamic framework to help manage decisions.

Steps:

1. **Define the decision context -** Clarify the problem, objectives, and scope of the decision.
2. **Identify stakeholders and perspectives -** Ensure relevant actors are involved; gather their values and concerns.
3. **Generate alternatives/options -** List the possible courses of action or solutions to be assessed.
4. **Develop decision criteria -** Identify the dimensions along which options will be evaluated (e.g., cost, equity, environmental impact).

5. **Weight the criteria** - Determine the relative importance of each criterion, often through stakeholder input.
6. **Score the alternatives** - Assess how well each option performs against each criterion.
7. **Aggregate the results** - Combine scores and weights to compare alternatives transparently.
8. **Conduct sensitivity analysis** - Test how robust the results are to changes in weights, scores, or assumptions.
9. **Facilitate reflection and decision-making** - Use the results to support discussion, highlight trade-offs, and build legitimacy for the chosen way forward.

How can we manage and meaningfully resolve conflicts between stakeholders in our CO?

Why is it relevant?

Learning how to effectively manage and resolve conflicts between participants in your CO is crucial for ensuring the success and sustainability of these initiatives. Conflict is a natural occurrence when diverse individuals and groups come together, each with their own interests, perspectives, and expectations. By understanding conflict management strategies, you can help your CO address disagreements in a constructive manner and:

- prevent conflicts from escalating and hindering progress,
- promote transparency, trust, and mutual respect among stakeholders,
- enhance the overall credibility and legitimacy of your CO, by demonstrating a commitment to fair and inclusive decision-making processes.

How can this be done?

Conflict is an inevitable part of collaborative governance, but it need not derail cooperation; when addressed constructively, it can clarify differences and strengthen relationships. This can be done through a graduated set of practices that match the intensity of the conflict: direct negotiation empowers parties to co-create solutions[38]; mediation introduces a neutral facilitator to balance

[38] Fisher & Ury, 2011

power asymmetries and guide dialogue[39]; and arbitration provides rule-based decisions that ensure legitimacy when consensus cannot be reached[40]. Embedding such practices in the CO creates structured ways of turning potentially destructive conflict into constructive engagement.

Existing (adapted) approaches	Featured tools
A. Facilitated and rule-based resolution	Negotiation
	Mediation
	Arbitration

A. Facilitated and rule-based resolution:

Conflicts that cannot be resolved through direct discussion may require the involvement of neutral facilitators or mediators to guide dialogue and balance power asymmetries, or more formal arbitration processes to ensure fair and binding outcomes. Such approaches provide structure, legitimacy, and impartiality, helping participants to de-escalate disputes and reach sustainable agreements[41].

Negotiation

Negotiation is a widely used and cost-effective method of resolving disputes in the construction industry, allowing the involved parties to maintain control over the resolution process. To achieve a successful negotiated settlement in a conflict, four key characteristics should be met: fairness, efficiency, wisdom, and stability[42]. Fairness ensures that all parties have an equal opportunity to present their perspectives and interests. Efficiency focuses on reaching a resolution in a timely and cost-effective manner. Wisdom involves making informed decisions based on sound judgment and expertise. Stability aims to establish a durable and long-lasting resolution that minimises the likelihood of further conflicts arising. By incorporating these characteristics into the negotiation process, a positive outcome can be achieved for all parties involved.

Negotiations are often divided into two types: cooperative and competitive. Cooperative negotiation, also known as win/win negotiation, involves a different approach compared to

[39] Moore, 2014

[40] Moura & Teixeira, 2009

[41] Moore, 2014

[42] Moura & Teixera, 2009

competitive negotiation. Each approach has fundamental elements that should be taken into consideration:

Table 2 Approaches for different negotiation types (Fisher and Ury, 1991)

Cooperative Negotiations:	**Competitive Negotiations**
1. Separate people from the problem: View the other person as someone with whom you can solve a problem, not the opponent. Don't personalize the situation. 2. Focus on interests, not positions: The underlying interests are what truly matter for effective problem-solving. Concentrate on understanding the reasons behind a demand and seek solutions that address these interests. 3. Generate options for mutual gains: Explore ways of expanding the benefits for all parties involved. Seek creative solutions that enhance mutual benefits. 4. Use objective criteria: Rely on mutually accepted and objective criteria to evaluate the outcomes of the negotiations, promoting fairness and legitimacy. 5. Consider the best alternative to a negotiated agreement: By considering the alternatives, you can better understand the value of finding a mutually acceptable agreement and avoid potential drawbacks.	1. Refrain from launching personal attacks and instead adopt an impartial perspective. 2. Actively listen to and acknowledge the opposing viewpoint, striving to find areas of agreement. 3. Focus the discussion on finding solutions that meet the interests of both sides. 4. Utilise the other party's ideas as a foundation to facilitate their agreement. 5. Present proposals in a way that makes it challenging for the other party to refuse.

These elements for the different approaches to negotiations are accompanied by a list of thirteen principles for a negotiator:

1. Establish commonly accepted facts.
2. Separate people from problems.
3. Base your position on principles, even if your opponent tries to make it personal.
4. Emphasise equality principles.
5. Ask questions instead of making statements.

6. Explore the principles of the other side.
7. Listen, rephrase, and clarify your points.
8. Take time to consider the problem and prepare your response; avoid making immediate decisions.
9. Present your reasons before proposing.
10. Present your proposition as a fair solution.
11. Share your perspectives on the consequences of reaching an agreement or not.
12. Give the other side an opportunity to influence the outcome of the negotiation process.
13. Conclude the negotiation in a conciliatory manner, even if you do not fully feel it.

Mediation

Mediation is a conflict resolution process in which a neutral third party, known as a mediator, assists individuals involved in a conflict to negotiate and reach a mutually acceptable agreement[43]. There are strong ties between negotiation and mediation, and the two approaches are often used in conjunction[44], particularly when those involved in the dispute are not familiar with common patterns of behaviour in conflicts or be aware of the various options for resolving their differences[45].

In order to structure and implement mediation processes, a six-step process is often used.

Steps:

1. **Introductory Remarks:** The mediator facilitates introductions, creates a non-threatening environment, and establishes their neutrality, while outlining the participants' roles and briefly addressing the main issue.
2. **Statement of the Problem by the Parties:** Each party is given an opportunity to present their story, allowing them to frame the issues and providing the mediator with emotional information.

[43] Moore, 2014

[44] Currie et al., 2017

[45] Bollen & Euwema, 2013

3. **Information Gathering:** The mediator employs open-ended questions, active listening, and summarising to delve into the emotional undercurrents and build rapport between the parties.
4. **Problem Identification:** The mediator strives to find common goals and identify the issues that can be settled or prioritised for resolution.
5. **Bargaining and Generating Options/Reaching an Agreement**: Through various methods like caucus sessions or proposals, the mediator facilitates option generation, negotiation, and the exploration of potential solutions leading to a final agreement that resolves the conflict.
6. **Reaching an agreement**: Private sessions with each party separately are conducted to accelerate negotiations, allowing for confidential discussions, brainstorming, and the surfacing of underlying fears to find common ground and possible solutions.

Arbitration

Arbitration is a way to solve disagreements in a formal and controlled manner. Instead of going to court, those involved in the dispute agree to have a private person or a group of people called arbitrators decide on the outcome of the conflict. These arbitrators are qualified, impartial and chosen by both parties involved or by a mutual agreement.

Here is a four-steps approach to the arbitration process[46]:

Steps:

1. The parties agree to settle any current or future disputes through arbitration. This is called the arbitration agreement.
2. The conflicting parties choose an arbitrator or a group of arbitrators together.
3. The arbitration procedure begins when one of the parties takes the initiative to address the dispute.

[46] (Moura and Teixera, 2009)

4. The final stage is the award and enforcement of the arbitrator's decision. This decision is typically considered binding and cannot be changed, except in specific circumstances mentioned previously.

Additional resources

The **Community Engagement Good Practice Guide (The Policy Project, 2020)** provides guidelines for adopting effective community engagement practices, including the management of conflict situations amongst stakeholders.

The **WeObserve Cookbook (WeObserve Consortium, 2021)** provides comprehensive support for CO practitioners, including specific pages on stakeholder management

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How can we identify the root causes of problems with stakeholder interactions in our citizen observatory and develop more effective and sustainable solutions?

Why is it relevant?

The interactions between participants serve as the backbone of effective COs, enabling the engagement and collaboration of diverse individuals, groups, and organisations to address pressing socio-environmental challenges. By investigating the root causes behind problems

arising in these interactions, you can gain valuable insights into the fundamental systemic barriers that impede fruitful collaboration and engagement. Such comprehension empowers participants to address these core issues directly, rather than merely treating the surface-level symptoms. You can develop strategies and approaches that foster enhanced participant interactions, facilitating the formation of robust partnerships, fostering trust, and establishing an inclusive and empowering environment. This, in turn, unlocks the full potential of participants and paves the way for more impactful and sustainable outcomes.

How can it be done?

Symptoms of participant tensions - such as recurring disputes or lack of follow-through, often mask deeper systemic problems that remain unaddressed. **Collective reflexivity** enables you and fellow participants to probe these underlying causes by critically examining your own assumptions and by recognising the interdependencies that shape interactions. This can be done through causal loop diagrams and problem-tree analysis, which make visible the feedback and systemic drivers that reproduce tensions. Regular reflection spaces, including reflexive monitoring in action, institutionalise learning cycles that continually question and adapt underlying practices. By embedding systemic thinking into everyday governance, your CO can move beyond treating symptoms to addressing root causes, thereby generating solutions that are both adaptive and sustainable.

Existing (adapted) approaches	Featured tools
A. Collective reflexivity	Problem tree methods, Force-field analysis
	Causal loop diagrams
	5 WHYS

A. Collective reflexivity

Identifying the root causes of problems in participant interactions requires moving beyond immediate symptoms, such as disagreements in meetings or resistance to decisions, and probing the deeper structures that generate these tensions. Collective reflexivity provides a way for participants to critically examine their assumptions, values, and practices, as well as the institutional and cultural contexts that shape them. Importantly, it draws on systemic thinking, encouraging participants to map interdependencies between actors, institutions, and socio-ecological dynamics that reproduce conflicts or exclusions. By reflecting together, participants are

supported to confront uncomfortable questions, recognise underlying power imbalances, and expand their worldviews beyond entrenched positions. This practice helps uncover systemic drivers, such as knowledge hierarchies, historical mistrust, or procedural rigidity, that might otherwise remain hidden.

Reflexivity is not a one-off exercise but a continuous process of learning, questioning, and adaptation embedded throughout the CO. In this sense, it fosters a culture of openness and responsiveness, where failures and tensions are treated as opportunities for collective learning rather than setbacks. Research in sustainability and governance shows that such reflexive processes, grounded in systemic perspectives, are key to developing solutions that are not only more effective in addressing immediate challenges but also more sustainable because they tackle underlying causes and reconfigure relationships between interconnected elements of the system[47].

There are many ways to practice collective reflexivity and since it is an ongoing and cyclical process, it is best to try out different methods at different times to see what works best for your CO.

A problem tree analysis uses the visual aid of a tree with its roots to identify the underlying cause of a problem as well as the impacts of that problem. This exercise encourages your CO to go beyond the surface issue and frustration and can help transform the situation.

Steps:

1. Draw a large tree with trunk, roots, and branches on a board or flipchart.
2. Place the **main problem** in the trunk.
3. Ask participants: *What causes this problem?* Write each cause on a card and place it among the roots.
4. Ask: *What effects does this problem have?* Write each effect and place it on the branches.
5. Discuss connections: link specific roots to branches.

[47] Voß & Kemp, 2006

6. Reflect collectively: *Which root causes are most fundamental? Which effects are most damaging?*

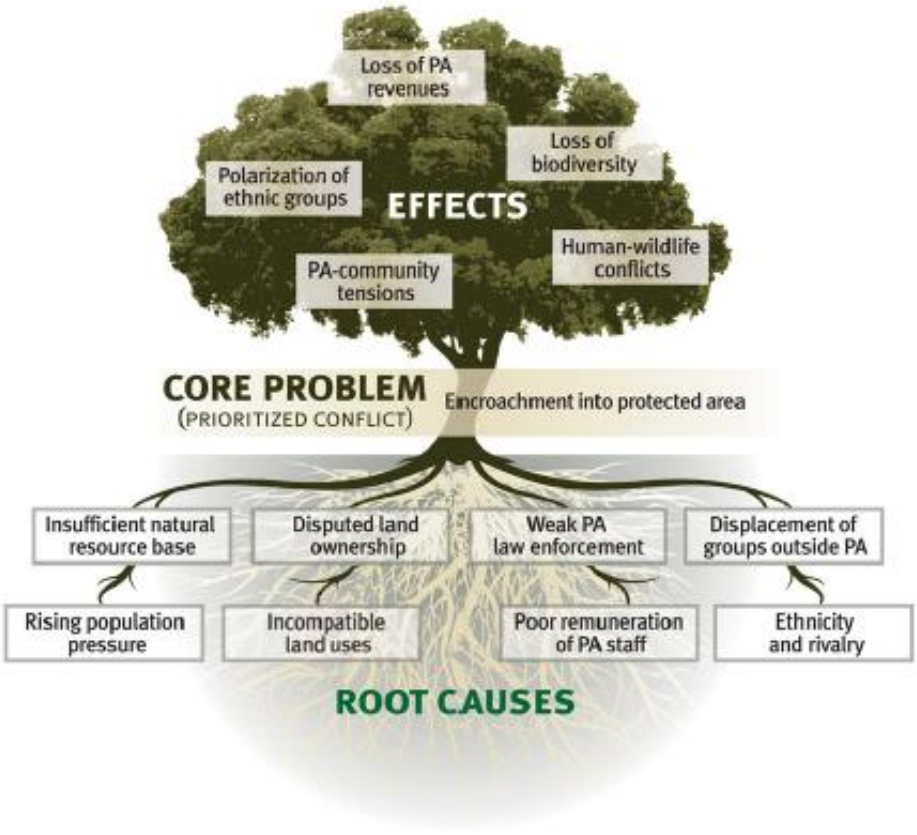

Figure 6 Problem tree analysis
Source: www.iisd.org/csconservation/conflict_tree.aspx

Another method for identifying the root cause of an issue is an activity called the 5 WHYS. This activity is simple but yields insightful results. It is specifically designed to trigger deep reflection on one topic so as to move past the initial assumptions that exist and identify the real source of the issue so that solutions can target that root problem.

Steps:

1. Write the problem clearly at the top of a page or board.
2. Ask: *Why is this happening?* Record the first answer.

3. Ask: *Why?* of that answer.
4. Repeat the process up to five times (or until participants agree they've reached the root cause).
5. Review the chain of answers together and highlight the most fundamental cause(s).

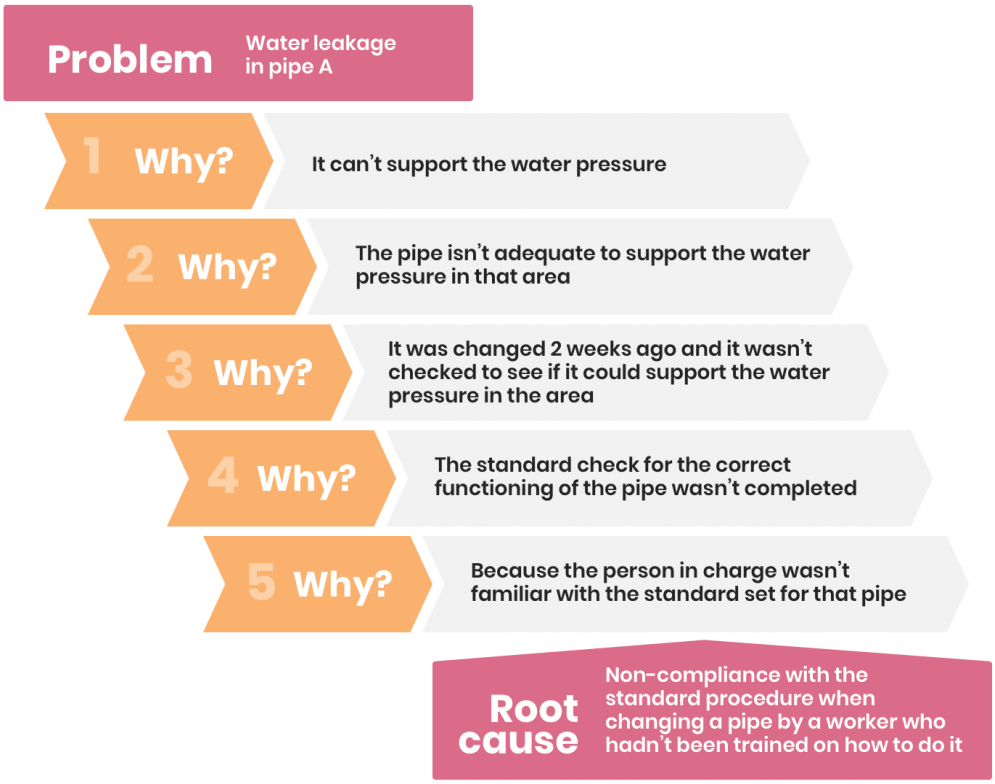

Figure 7 5 WHYS
Source: https://www.mlean.com/fr/blog/what-are-the-5-whys/

Another useful tool is a force-field analysis, which is a common tool for change-management. By collaboratively identifying the driving and restraining forces at play in your initiative/CO strategies for increasing the drivers and reducing the restrainers can be built, helping to create sustainable solutions to ongoing problems.

Steps:

1. **Draw the framework -** Take a large sheet or whiteboard. Draw a vertical line down the middle. Write the objective or desired change at the top of the page.

2. **List the driving forces -** On the left-hand side, write down all the factors that support or push towards the change. Use short phrases or keywords.

3. **List the restraining forces -** On the right-hand side, write down the factors that hold back or resist the change. Encourage participants to include practical barriers, cultural resistance, or resource gaps.

4. **Assess strength of forces -** Next to each factor, draw an arrow pointing towards the centre line. The length or thickness of the arrow should reflect the strength of the force (weak, medium, strong).

5. **Compare the balance -** Step back and look at both sides. Ask: Which drivers are strongest? Which restrainers are most critical?

6. **Plan strategies**

    a. Discuss how to: Increase the influence of key driving forces. Reduce, remove, or adapt the restraining forces.

    b. Note specific actions, responsible actors, and timelines.

7. **Revisit and adapt -** Return to the force-field chart at intervals. Update it as conditions change or new forces appear.

Causal-loop diagrams can also be used to foster reflection and root problem identification, leading toward sustainable solutions. This type of diagram specifically helps identify feedback loops in a system illuminating what reinforces organizational behaviours. Once these dynamics are identified, it becomes possible to transform the situation for lasting change.

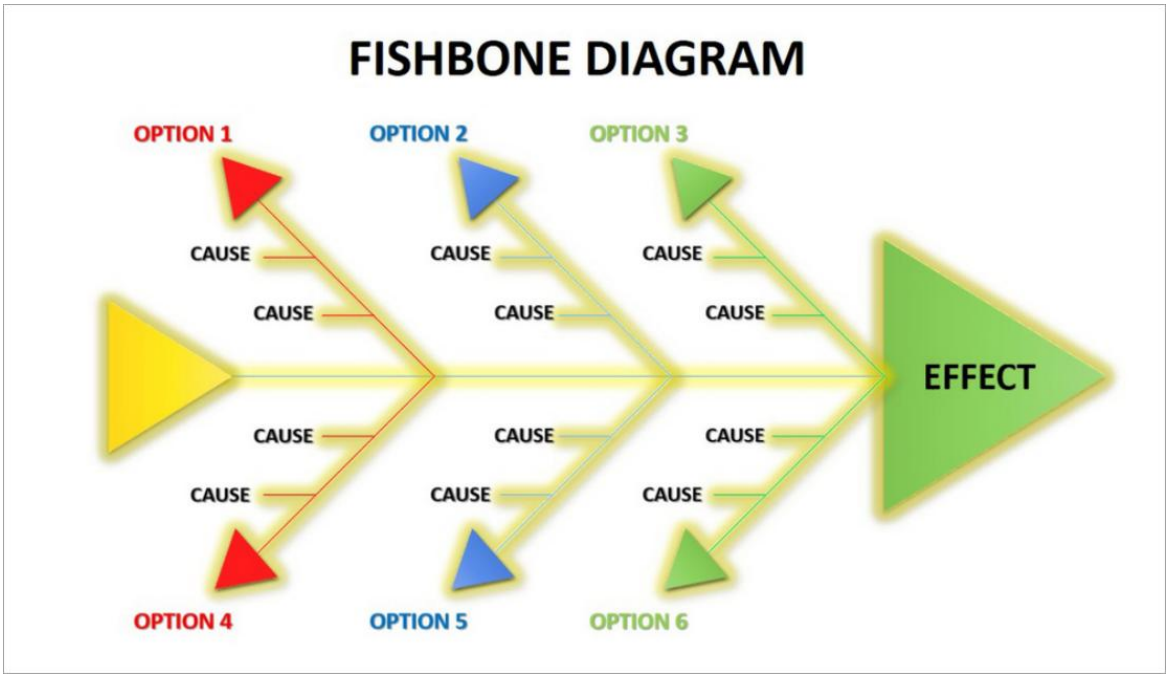

Figure 8 Fishbone Diagram

The Fishbone Diagram helps groups visually map out all possible causes of a problem (not just the obvious ones), so they can identify root causes and plan solutions more effectively.

Source: https://unichrone.com/blog/quality-management/fishbone-root-cause-analysis/

How can we ensure uptake of CO-generated data?

Why is it relevant?

If you want to ensure uptake of CO-generated data, you need to demonstrate its quality, reliability, and relevance. By doing so, you help participants see the value of their contributions, give policymakers confidence to base decisions on the data, and enable researchers to incorporate it into scientific analysis. Showing both robustness and potential impact is key to building the trust needed for wider use.

How can it be done?

You can build or strengthen trust in CO-generated data by combining scientific rigour with practices that make the data socially meaningful. This means ensuring data quality, while also recognising citizen contributions, communicating uncertainties openly, and presenting results in

accessible formats such as visualisations or dashboards. By doing so, you help stakeholders see the data as both credible and relevant, which increases its legitimacy and use in decision-making.

Existing (adapted) approaches	Featured tools
Building legitimacy and credibility in data through communication and recognition	Feedback and recognition mechanisms - Showcasing small wins / celebratory events
	Data storytelling and visualisation platforms to make results relatable using CSTIA
	Boundary objects such as Dashboards that can be understood and used across stakeholder groups.

A. Building legitimacy and credibility in data through communication and recognition

Data uptake depends not only on technical quality but also on whether it is perceived as legitimate and aligned with the needs and values of stakeholders. Recognition of citizen contributions, transparent communication of uncertainties, and accessible presentation formats help to build trust in CO-generated data and strengthen its social legitimacy[48]. By valuing contributors and making data relatable, you encourage stakeholders to see your CO's outputs as credible and worth integrating into decision processes.

One way is by ensuring that participants see their efforts acknowledged and celebrated, since recognition strengthens legitimacy and sustains engagement. This can be done ***by feedback and recognition mechanisms*** that go beyond technical validation and create moments of visibility and pride for participants. *Showcasing small wins* in newsletters or social media posts highlights how individual contributions add up to broader outcomes, reinforcing the sense of collective achievement. *Organising celebratory events* - such as community gatherings, award ceremonies, or exhibitions of citizen-collected data, provides opportunities for recognition in public settings and builds social capital among participants. Recognition can also be embedded into platforms themselves, for instance by *naming contributors on dashboards* or issuing certificates of participation. An example of this is in flood-risk observatories such as WeSenseIt, citizens were shown in real time how their rainfall observations updated official flood maps, and community events were used to celebrate their role in improving preparedness. Research on participatory governance underscores that such recognition is not merely symbolic: it enhances perceived

[48] Tsang et al., 2009

fairness, strengthens trust, and signals that citizens' efforts are valued and consequential[49]. In this way, celebration becomes both a motivational tool and a means of consolidating the legitimacy of CO-generated data.

A second way is by making data accessible and relatable across audiences. This can be done by using ***data storytelling*** and visualisation platforms such as participatory GIS, story maps, and the Citizen Science Impact Story Telling Approach (CSISTA). CSISTA incorporates testimonials and provides a structured process for practitioners to generate and communicate impact stories of citizen science initiatives[50]. Using the CSISTA Impact Inquiry Instrument, leaders collect qualitative data on realised and potential policy and decision-making impacts, thereby gaining insight into the initiative's influence. Practitioners then define their storytelling goals, select the appropriate storytelling instrument (Impact Brief or Impact Narrative), and craft concise or narrative stories that effectively convey policy impacts to broader audiences. In this way, CSISTA not only enhances accessibility but also explicitly links citizen-generated data to societal and governance outcomes. Storytelling and impact assessment tools have been shown to improve both understanding and uptake by bridging technical information with shared cultural meanings and decision-making needs.

Finally, uptake also relies on data being credible and usable across institutional and community boundaries. This can be done ***by creating boundary objects such as dashboards or joint monitoring reports,*** which translate complex, heterogeneous datasets into accessible and actionable formats. Dashboards function as shared 'translation devices' that allow different stakeholder groups to engage with the same information from their own perspectives. For policymakers, dashboards provide aggregated indicators and visual summaries that can be quickly integrated into decision processes[51]; for community members, they offer transparent access to raw data, interactive maps, or time series that validate local experiences. When co-designed with users, dashboards serve not only as technical artefacts but also as platforms for negotiation, enabling iterative discussion around what data means and how it should be acted upon. In this way, they embody the credibility–legitimacy–salience framework, ensuring that data is scientifically robust, socially trusted, and directly relevant to governance.

[49] Fung, 2006

[50] Wehn et al., 2021

[51] Kitchin, Lauriault,& McArdle; 2015

A practical example comes from flood risk citizen observatories in Europe, where dashboards provided real-time rainfall and water-level data collected by citizens and sensors. Policymakers used aggregated flood-risk indicators for emergency planning, while residents accessed localised alerts and maps to take precautionary action. Similarly, in air-quality observatories such as Luftdaten (now Sensor.Community), dashboards displaying community-collected particulate matter (PM2.5 and PM10) have been used by both local governments and neighbourhood groups to press for clean-air interventions. These cases show how dashboards, when participatory in design, enable citizen-generated data to travel across boundaries, becoming trusted inputs in both community action and institutional decision-making.

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4. CONCLUSIONS

This deliverable has presented a detailed description of the process followed for the creation of the second and final version of the CitiObs CO participation toolkit. This toolkit is connected and cross-references the Leave No-One Behind toolkit (produced as part of WP1 T1.1) and the Citizen-Led Action toolkit (WP1 T1.4), both of which provide guidance complementary to that from the CO participation in multi-level governance toolkit.

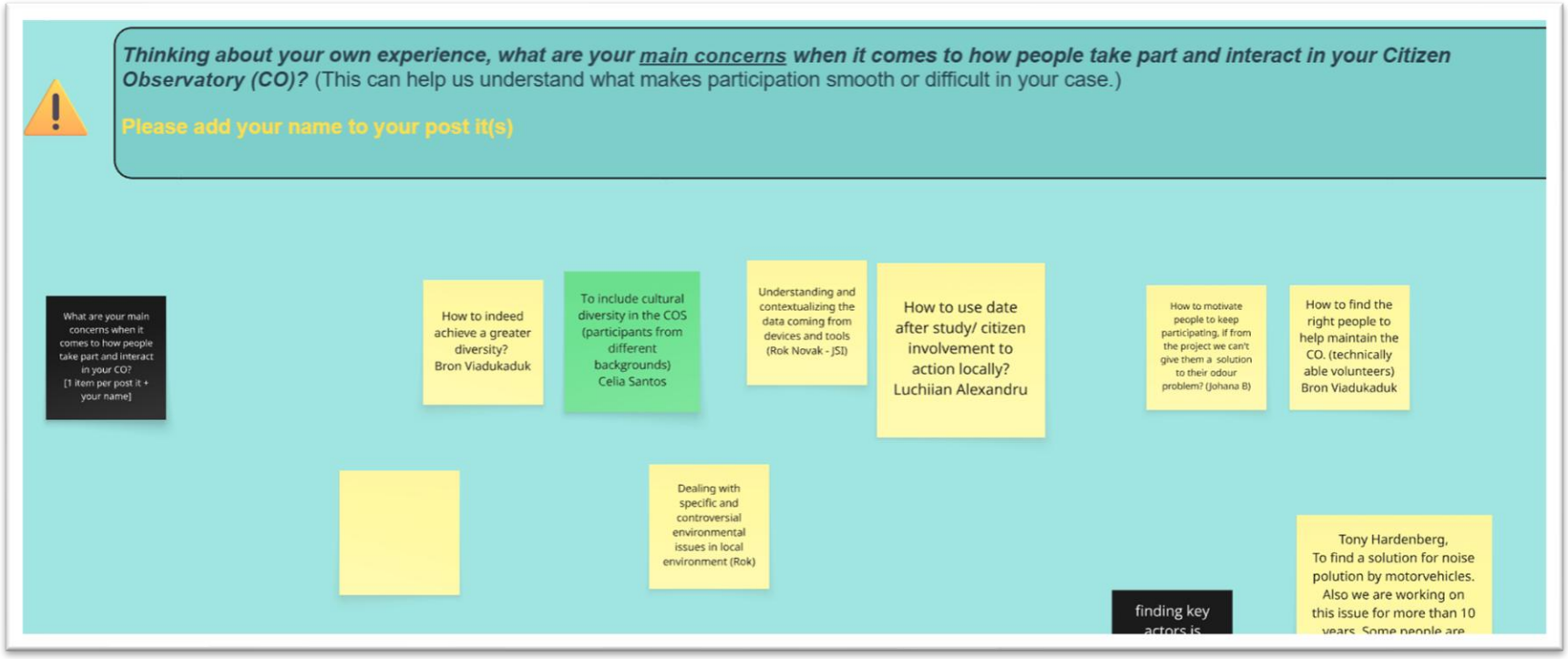
All of these toolkits feed into the work of WP3 and their activities with the five Frontrunner cases and 30 Implementer cases. In the final stage of the project, the WP1 toolkits will be used by the CitiObs mentoring teams in their mutual learning with all CitiObs cases (Frontrunner, Alliance and Fellow cases).This process will allow for the collection of illustrative case studies from the cases, which (with their permission) will be featured in the online version of the toolkit, integrated in the CitiObs Cookbook on the CitiObs Knowledge Platform, to illustrate the use of specific tools, highlight key challenges, and make the toolkit more engaging for users.

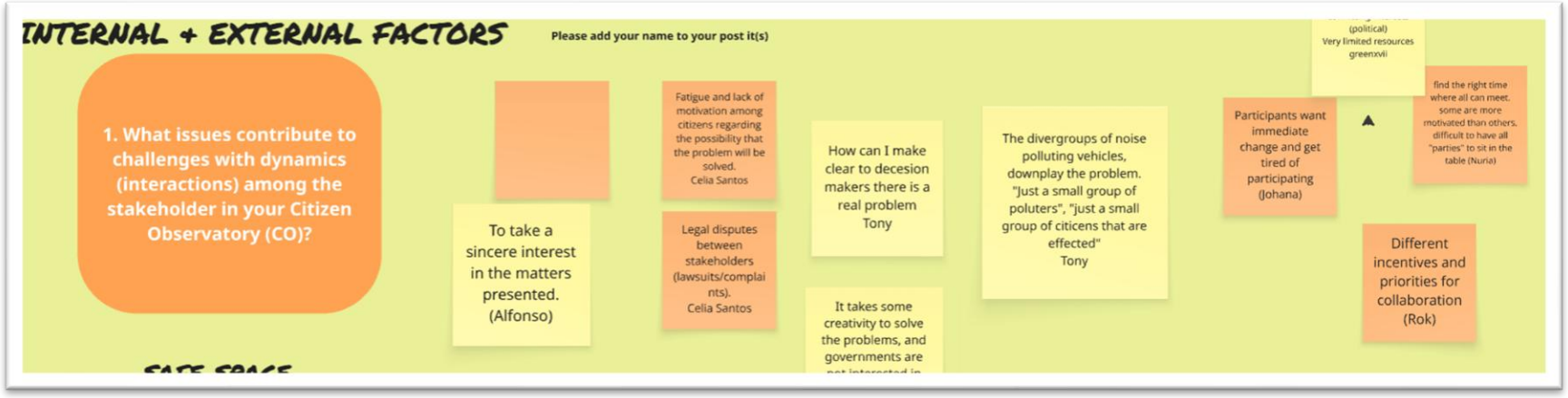
Moreover, in collaboration with T3.5 (evaluation of the demonstration activities), the application of specific tools will generate detailed insights into the required skills, resources and experience for their implementation. These will be included as pre-requisites and additional information in the online version of the toolkit, allowing future users beyond the project to gauge the extent to which they need to rely on external help to use specific approaches to address challenges with CO participation dynamics.

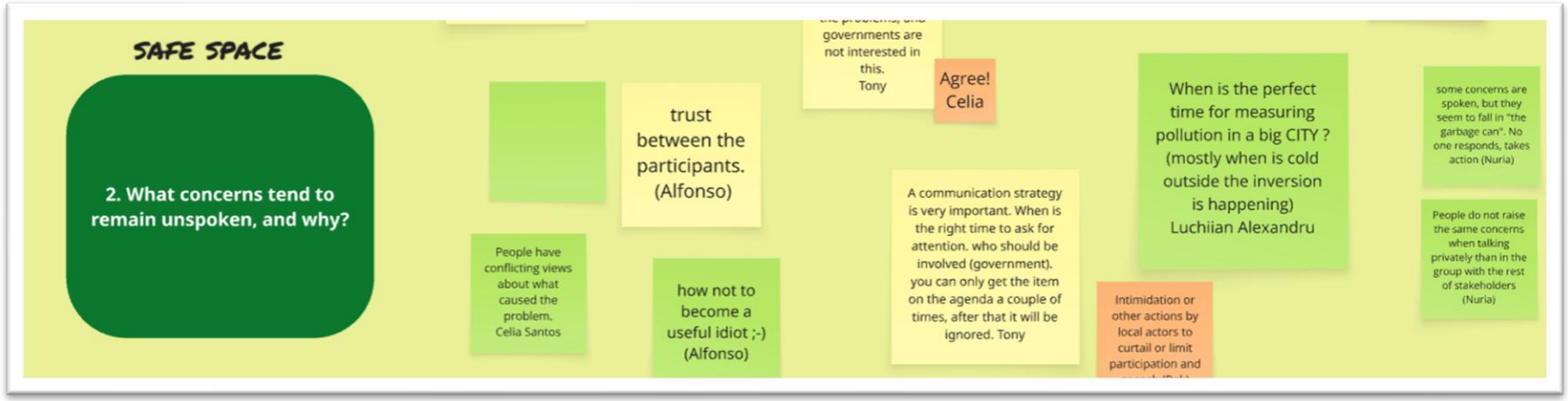
5. ANNEXES

5.1 Annex 1 Front Runner & Alliance Cases Workshop Miro Board

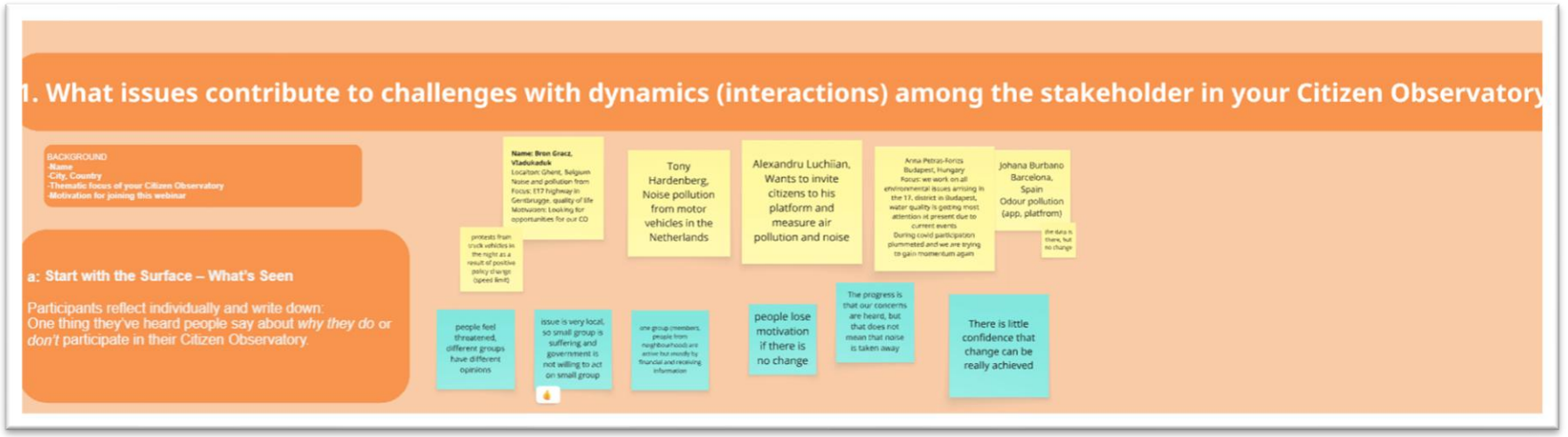
Introduction Frames:

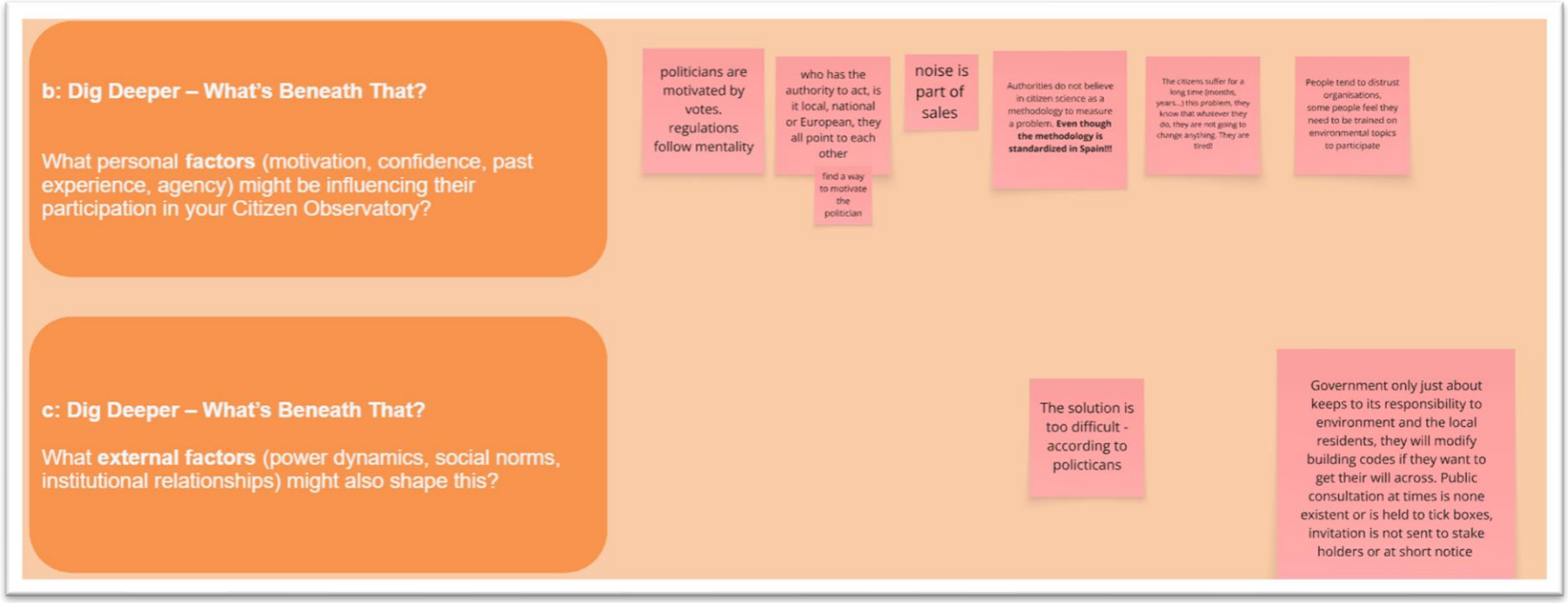



INTERNAL + EXTERNAL FACTORS
Please add your name to your post it(s)
1. What issues contribute to challenges with dynamics (interactions) among the stakeholder in your Citizen Observatory (CO)?
To take a sincere interest in the matters presented. (Alfonso)
Fatigue and lack of motivation among citizens regarding the possibility that the problem will be solved. Celia Santos
Legal disputes between stakeholders (lawsuits/complaints). Celia Santos
How can I make clear to decesion makers there is a real problem Tony
It takes some creativity to solve the problems, and governments are
The divergroups of noise polluting vehicles, downplay the problem. "Just a small group of poluters", "just a small group of citicens that are effected" Tony
(political)
Very limited resources greenxvii
Participants want immediate change and get tired of participating (Johana)
find the right time where all can meet. some are more motivated than others. difficult to have all "parties" to sit in the table (Nuria)
Different incentives and priorities for collaboration (Rok)


SAFE SPACE
2. What concerns tend to remain unspoken, and why?
trust between the participants. (Alfonso)
People have conflicting views about what caused the problem. Celia Santos
how not to become a useful idiot ;-) (Alfonso)
governments are not interested in this. Tony
Agree! Celia
A communication strategy is very important. When is the right time to ask for attention. who should be involved (government). you can only get the item on the agenda a couple of times, after that it will be ignored. Tony
When is the perfect time for measuring pollution in a big CITY ? (mostly when is cold outside the inversion is happening) Luchiian Alexandru
Intimidation or other actions by local actors to curtail or limit participation and
some concerns are spoken, but they seem to fall in "the garbage can". No one responds, takes action (Nuria)
People do not raise the same concerns when talking privately than in the group with the rest of stakeholders (Nuria)

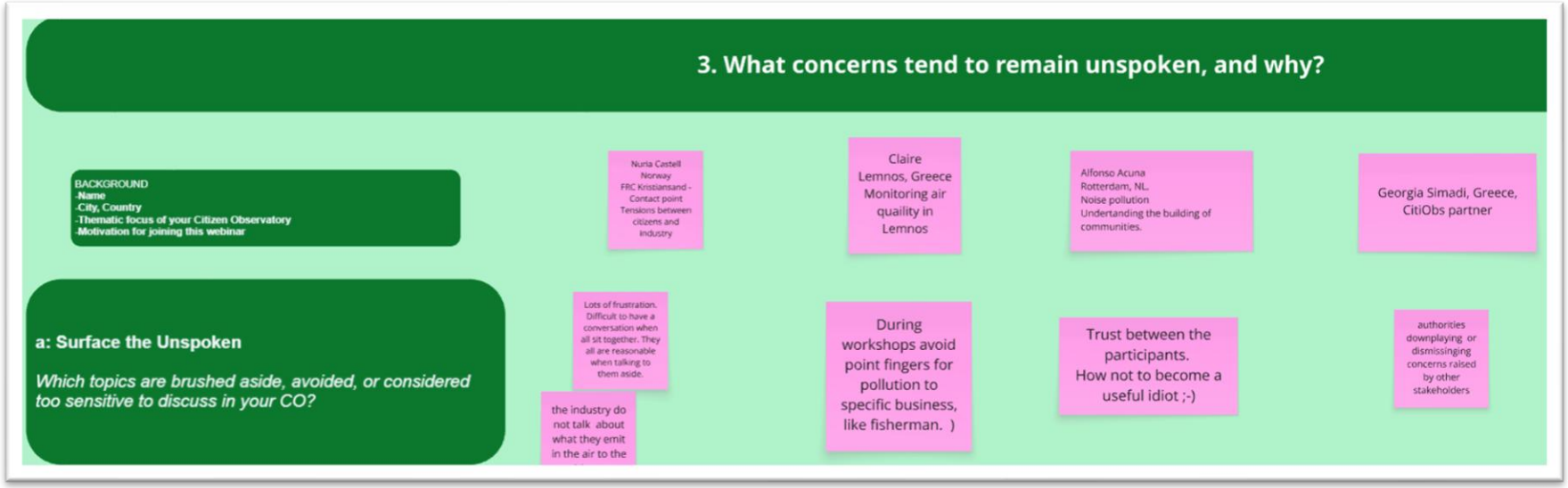
Topic 1, Group 1: Internal and External Factors




b: Dig Deeper – What's Beneath That?
What personal factors (motivation, confidence, past experience, agency) might be influencing their participation in your Citizen Observatory?
politicians are motivated by votes. regulations follow mentality
who has the authority to act, is it local, national or European, they all point to each other
find a way to motivate the politician
noise is part of sales
Authorities do not believe in citizen science as a methodology to measure a problem. Even though the methodology is standardized in Spain!!!
The citizens suffer for a long time (months, years...) this problem, they know that whatever they do, they are not going to change anything. They are tired!
People tend to distrust organisations, some people feel they need to be trained on environmental topics to participate
c: Dig Deeper – What's Beneath That?
What external factors (power dynamics, social norms, institutional relationships) might also shape this?
The solution is too difficult - according to policticans
Government only just about keeps to its responsibility to environment and the local residents, they will modify building codes if they want to get their will across. Public consultation at times is none existent or is held to tick boxes, invitation is not sent to stake holders or at short notice


Corresponding Tools -
to identify the root causes of problems with stakeholder interactions
Mediation through third party mediator
Force field Analysis
Mapping the Underlying story
A visual storytelling tool to trace a stakeholder group's engagement over time, identifying ke
incentives and barriers at each stage — revealing how broader systems and experiences
shape participation, trust, and conflict.
Summary Points
Surface-Level Reason (What is one common explanation given for low or uneven participation?)
Your response -
What Lies Beneath (What deeper personal (e.g. confidence, previous experience) and external (e.g. power structures, social expectations) factors might actually be influencing this?)
Your response -
What This Reveals (What did your group realise about the broader systems or conditions shaping participation?)
Your response -
Key Reflection
Complete the sentence: *To better understand participation in our CO, we need to pay more attention to...
Your response -
Examples of actions:
Need for funding to make a big statement
Trying to talk to stakeholders and make them listen
Go with a big group to politicians, and inform journalists

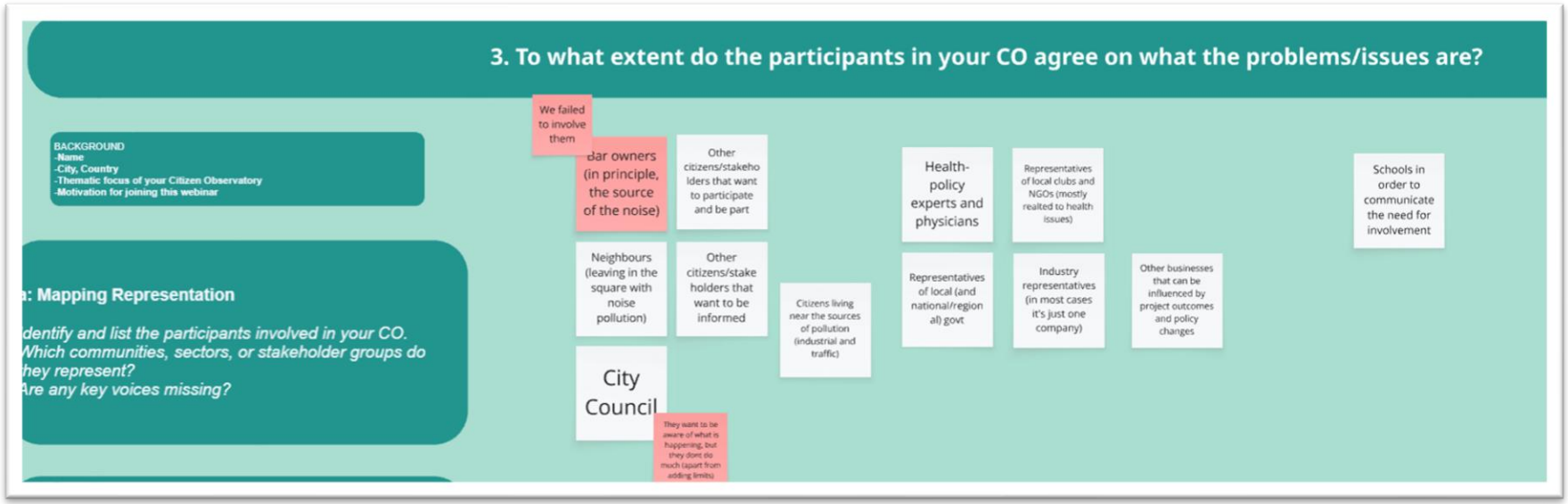
Topic 2, Group 2: Nurturing Safe-Enough Space

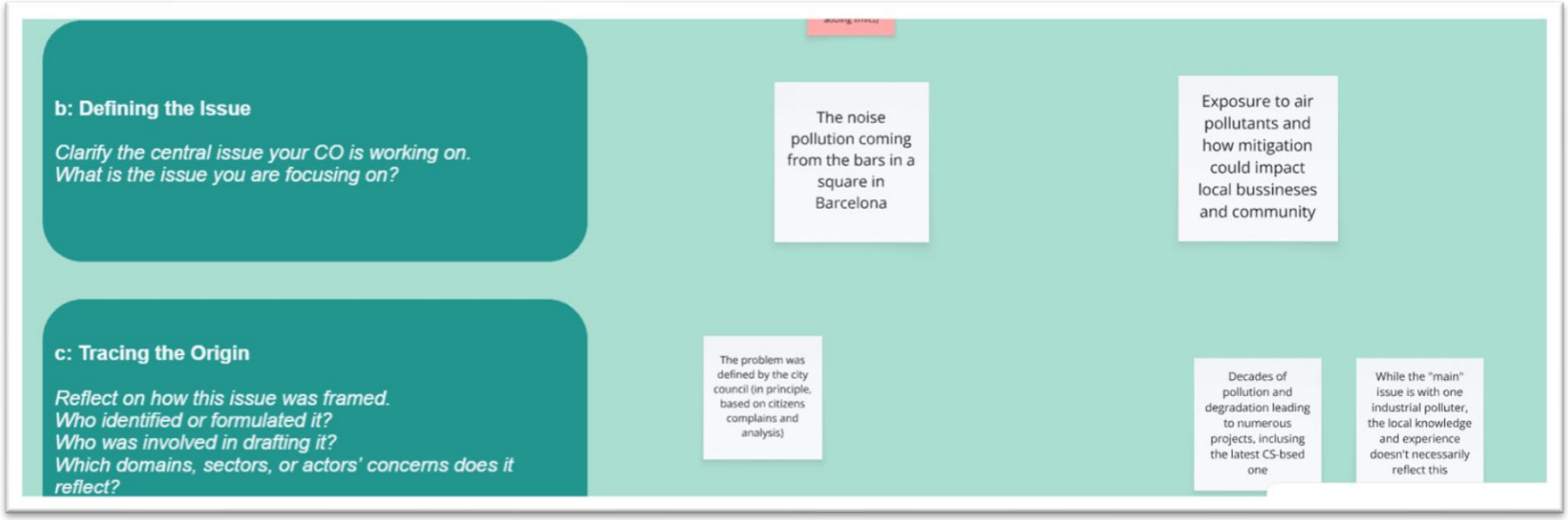


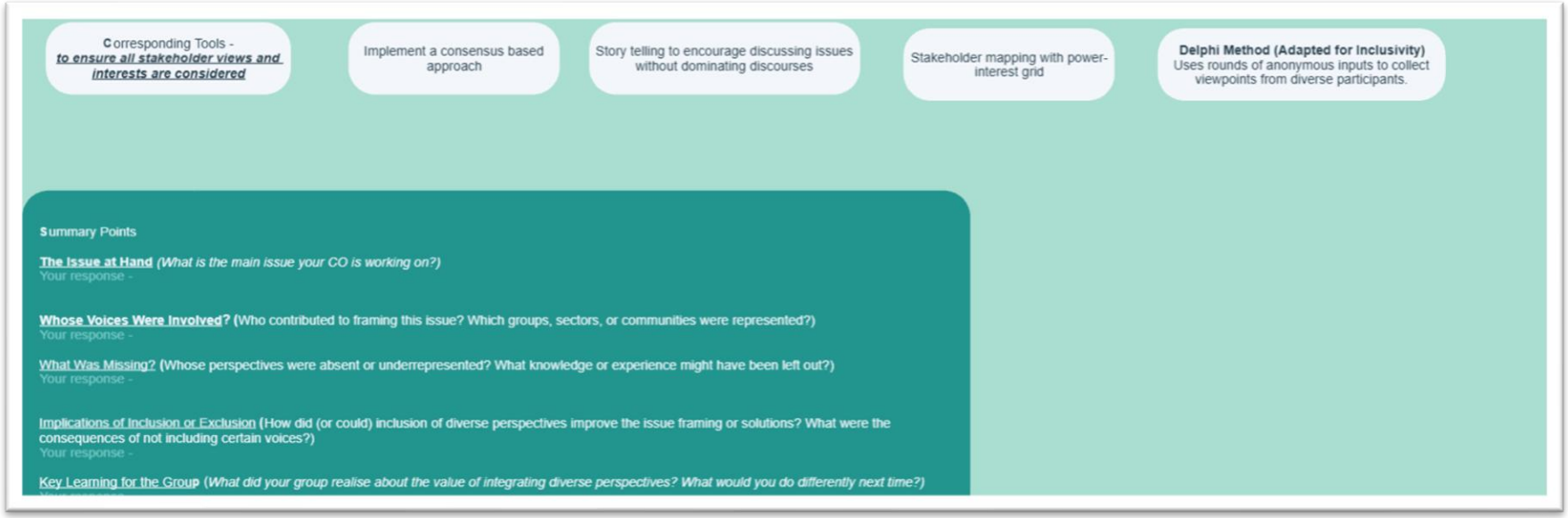

b: Reflection
Why do these topics remain unspoken?
What are people afraid might happen if these are brought up?
Who feels comfortable speaking — and who doesn't?
c: Reflect on the Space
What does this say about how 'safe' your space really is?
Are there informal norms, behaviours, or power imbalances that make it unsafe or unequal?
From an observer, I would say industry and authorities might feel afraid of opening the pandora box. No one want to relocate industry or housing.
Participants in our workshop have relatives who are farmers and fisherman and are part of the pollution problem. They get defensive when someone mentions they should change their practices.
When supported by solid data, the municipal administration's political agenda can be critically examined.
Political Agenda
Not create confrontation
Not belief in change
There are power imbalances. Citizens feel powerless. Industry keeps following all the regulations and operating.
Focus more on sollutions
Gain credibility and build trust by gathering reliable data and data analysis.


Corresponding Tools to build trust and cooperation
Roles clarification and understanding intentions
Creating routines through consistency - Regular updates, inclusive discussions, and accessible information contribute to building trust.
Broken Trust Timeline:
To create a shared narrative around past events that may have caused distrust — without blaming individuals.
(participants anonymously or collectively place moments where they felt trust was built, shaken, or broken in the CO process.)
Summary Points
The purpose of the CO (What is the environmental issue are you working on?) ...What is the purpose of your CO?
Air quality (Lemnos), Noise Pollution (Rotterdam), Urban Heat (Athens)
Reasons why the space felt unsafe?
A lot of frustration that makes conversation difficult, treating people differently or favorably, if they are relatives, friends etc or even getting defensive, trust issues because of the political agenda of the administration, authorities undermining the problem that the other stakeholders bring up, the idea that nothing will change
Reflection on how it could be made more safer?
Decrease power imbalances, maybe a tour for citizens to visit the industrial facilities, interaction and creativity, Gain credibility and build trust by gathering reliable data and data analysis, create transparency

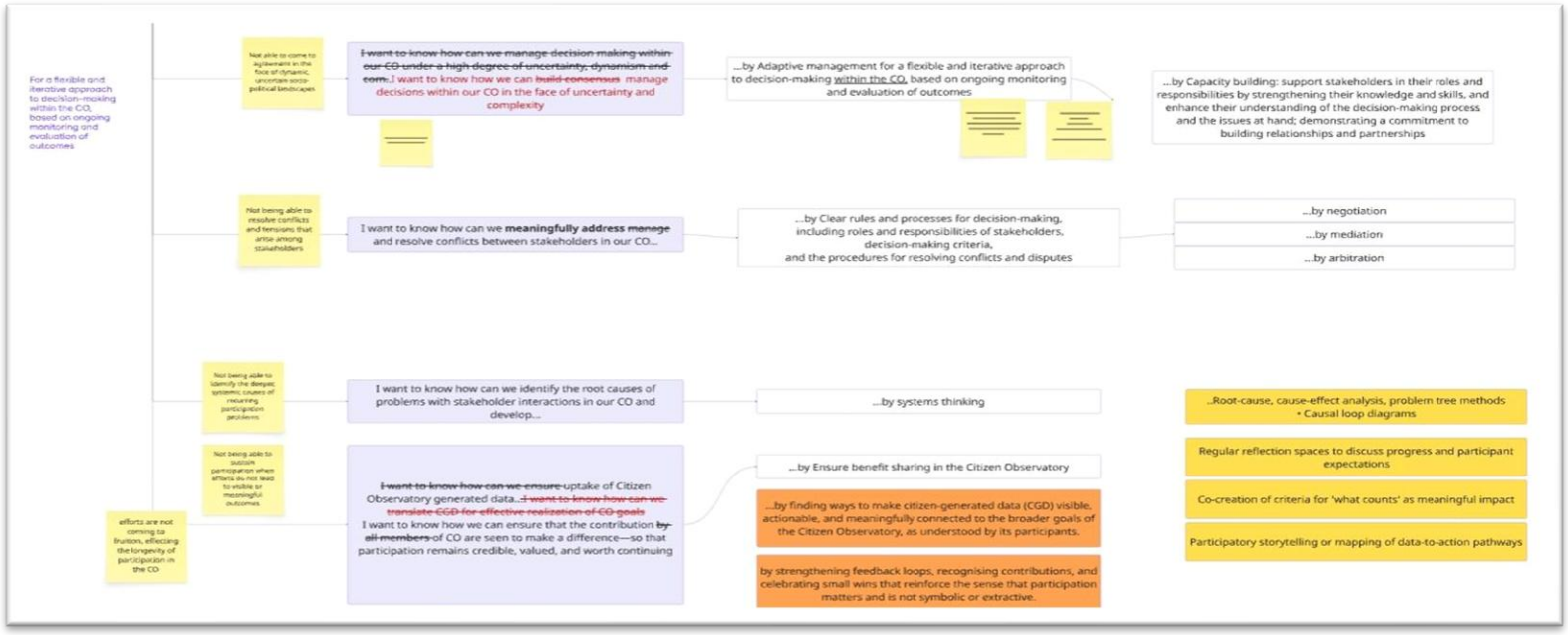
Topic 3, Group 3: Arriving at Common Grounds

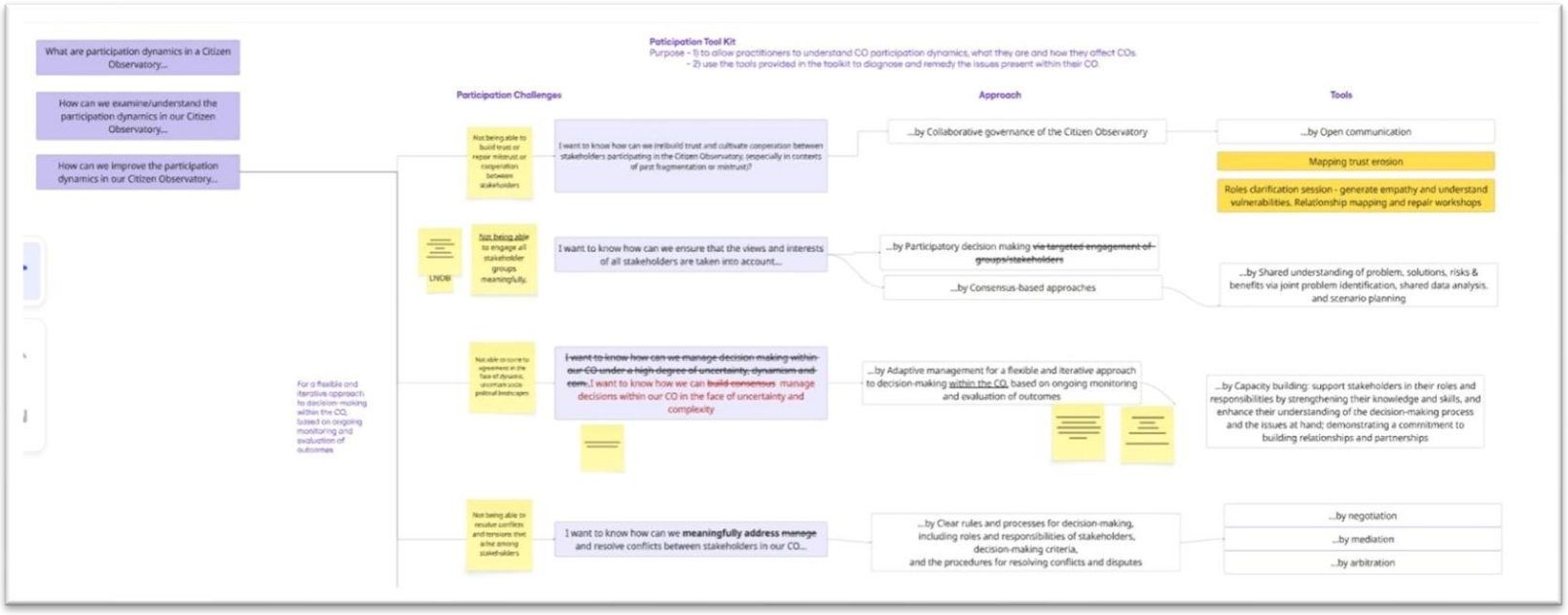



b: Defining the Issue
Clarify the central issue your CO is working on.
What is the issue you are focusing on?
The noise pollution coming from the bars in a square in Barcelona
Exposure to air pollutants and how mitigation could impact local bussineses and community
c: Tracing the Origin
Reflect on how this issue was framed.
Who identified or formulated it?
Who was involved in drafting it?
Which domains, sectors, or actors' concerns does it reflect?
The problem was defined by the city council (in principle, based on citizens complains and analysis)
Decades of pollution and degradation leading to numerous projects, inclusing the latest CS-bsed one
While the "main" issue is with one industrial polluter, the local knowledge and experience doesn't necessarily reflect this


Corresponding Tools -
to ensure all stakeholder views and interests are considered
Implement a consensus based approach
Story telling to encourage discussing issues without dominating discourses
Stakeholder mapping with power-interest grid
Delphi Method (Adapted for Inclusivity)
Uses rounds of anonymous inputs to collect viewpoints from diverse participants.
Summary Points
The Issue at Hand (What is the main issue your CO is working on?)
Your response -
Whose Voices Were Involved? (Who contributed to framing this issue? Which groups, sectors, or communities were represented?)
Your response -
What Was Missing? (Whose perspectives were absent or underrepresented? What knowledge or experience might have been left out?)
Your response -
Implications of Inclusion or Exclusion (How did (or could) inclusion of diverse perspectives improve the issue framing or solutions? What were the consequences of not including certain voices?)
Your response -
Key Learning for the Group (What did your group realise about the value of integrating diverse perspectives? What would you do differently next time?)

5.2 Annex 2 Internal revisions to participation toolkit Miro Board




What are participation dynamics in a Citizen Observatory...
How can we examine/understand the participation dynamics in our Citizen Observatory...
How can we improve the participation dynamics in our Citizen Observatory...
Paticipation Tool Kit
Purpose - 1) to allow practitioners to understand CO participation dynamics, what they are and how they affect COs.
- 2) use the tools provided in the toolkit to diagnose and remedy the issues present within their CO.
Participation Challenges
Approach
Tools
I want to know how can we (re)build trust and cultivate cooperation between stakeholders participating in the Citizen Observatory, (especially in contexts of past fragmentation or mistrust)?
...by Collaborative governance of the Citizen Observatory
...by Open communication
Mapping trust erosion
Roles clarification session - generate empathy and understand vulnerabilities. Relationship mapping and repair workshops
I want to know how can we ensure that the views and interests of all stakeholders are taken into account...
...by Participatory decision making via targeted engagement of groups/stakeholders
...by Consensus-based approaches
...by Shared understanding of problem, solutions, risks & benefits via joint problem identification, shared data analysis, and scenario planning
I want to know how can we manage decision-making within our CO under a high degree of uncertainty, dynamism and conf. I want to know how we can build consensus manage decisions within our CO in the face of uncertainty and complexity
...by Adaptive management for a flexible and iterative approach to decision-making within the CO, based on ongoing monitoring and evaluation of outcomes
...by Capacity building: support stakeholders in their roles and responsibilities by strengthening their knowledge and skills, and enhance their understanding of the decision-making process and the issues at hand; demonstrating a commitment to building relationships and partnerships
I want to know how can we meaningfully address manage and resolve conflicts between stakeholders in our CO...
...by Clear rules and processes for decision-making, including roles and responsibilities of stakeholders, decision-making criteria, and the procedures for resolving conflicts and disputes
...by negotiation
...by mediation
...by arbitration