Active Mobility Innovations for Green and safe city sOlutionS

Grant Agreement n°101104268

D2.1 – Co-creation Methodology

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Nature of the deliverable		
R	Document, report (excluding the periodic and final reports)	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
DATA	Data sets, microdata, etc.	
DMP	Data management plan	
ETHICS	Deliverables related to ethics issues	
SECURITY	Deliverables related to security issues	
OTHER	Software, technical diagram, algorithms, models, etc.	

Dissemination level		
PU	Public, fully open, e.g. web (Deliverables flagged as public will be automatically published in CORDIS project's page)	X

[1] Please use the name "LUT University" outside official, contractual communications

SEN	Sensitive, limited under the conditions of the Grant Agreement	
CI	Classified, EU RESTRICTED, CONFIDENTIAL or SECRET under the Commission Decision No2015/444	

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Project abstract

To reach carbon neutrality, cities must adopt new, more adapted energy models for urban mobility, relying on zero-emission and active mobility modes. The uptake of sustainable mobility solutions relies on their inclusivity, affordability and safety, as well as their consistency with users' needs. Through co-creation activities and innovative digital tools, the AMIGOS project will identify present and future mobility challenges for 5 cities (LLs) and 10 urban areas (SIAs). The digital tools include a Mobility Observation Box and an application for the collection of new mobility data, which will feed a big data platform for their analysis and digital twins to visualize mobility scenarios. They will allow urban stakeholders to identify mobility challenges and will serve as a basis for the co-development of adapted mobility solutions: towards reducing traffic, increasing public and active mobility modes, improving safety and co-habitation between different mobilities for the 5 cities, and towards increased safety for the 10 urban areas.

Therefore, key stakeholders such as public authorities and vulnerable users will be included in the definition of technological and policy solutions mobility solutions which will be implemented in the cities. Their environmental, safety, economic and social impacts will be assessed, in addition to their medium- and long-term impact and their replicability, in view of their implementation in 5 twin cities.

Executive summary

The AMIGOS project aims to identify and address the current and future mobility challenges faced by 5 cities (LLs) and 10 urban areas (SIAs). By working with key stakeholders, including public authorities and vulnerable users, the project will co-create inclusive, safe, affordable and sustainable urban mobility solutions. This will be achieved through a series of co-creation activities. As part of these efforts, AMIGOS will develop and test a co-creation methodology for designing sustainable urban mobility solutions. This document (Deliverable 2.1) outlines the co-creation methodology developed for this purpose.

The main objective of this deliverable is to describe the developed co-creation method for designing inclusive, safe, affordable and sustainable urban mobility solutions. It details how this methodology will be applied in two iterations through LLs and SIAs. Building on a stakeholder analysis conducted earlier in the project, this deliverable will inform subsequent project activities and integrate inclusive city models and digital twins into planning efforts.

The developed co-creation method uses art- and game-based techniques alongside digital twin-compatible comprehensive city models, that will be developed in WP3 and integrated into the co-creation framework. These art- and game-based methods allow participants from different backgrounds to express and model their lived and desired mobilities. The comprehensive city models will enhance the visualization and evaluation of urban mobility toolboxes containing solutions that cities are willing and able to implement.

A research design process called PADRE is used to develop the co-creation process. This research design process emphasizes close interaction between stakeholders and researchers. It provides a mutual space for reflection, learning and action at each stage of an ADR cycle. It also positions public stakeholders, such as community representatives of vulnerable groups, as key participants in each step of the design process, from conception to testing and evaluation of urban mobility solutions.

The co-creation process is developed in a tabletop board-game-like style and consists mainly of a co-design canvas (a large paper worksheet where activities take place) and a guide to the co-creation process. The canvas is designed to facilitate collaborative ideation and decision-making among participants in co-creation workshops to improve urban mobility solutions. Its main objectives are to engage citizens from diverse backgrounds in identifying their lived mobility and expressing their desired mobility through structured brainstorming and collaboration.

Prior to the first iteration of workshops in the partner cities, LUT will provide comprehensive training to city representatives on the co-creation process. This training will enable the partner cities to run the co-creation workshops effectively. LUT will monitor the workshops remotely to ensure that everything runs smoothly.

Based on the co-creation activities and technological solutions, a thorough analysis will be carried out. Various measures, including safety, accessibility, availability, sustainability and coexistence between different mobility modes, will be implemented in the 5 LLs and 10 SIAs. These actions aim to improve both perceived and actual safety for all road users, especially vulnerable ones.

Glossary

Table 1 List of abbreviations and definitions

Abbreviation	Definition
ADR	Action Design Research
AMIGOS	Active Mobility Innovations for Green and safe city Solutions
LL	Living Lab
LUT	Lappeenranta-Lahti University of Technology
PADRE	Participatory Action Design Research
PAR	Participatory Action Research
PD	Participatory Design
SIA	Safety Improvement Area
WP	Work Package

1. Introduction

AMIGOS is an Innovation action (IA) that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101104268. This deliverable presents the co-creation methodology developed for the AMIGOS project, detailing a structured approach to engaging stakeholders in the design and implementation of sustainable urban mobility solutions. The deliverable preparation is part of WP1, Task 1.4 activities. The method itself guides WP2 T2.1 activities and indirectly contributes to several WP2 activities, from T2.2 to T2.4.

The presented methodology integrates art- and game-based techniques with digital twin-compatible city models to facilitate creative expression and effective collaboration among participants. The co-creation design process is guided by the PADRE (Participatory Action Design Research) framework that enables iterative development and continuous improvement based on stakeholder feedback. Additionally, the deliverable outlines the theoretical grounding, design process, and practical applications of the co-creation canvas. The canvas provides structured guidelines for facilitators to conduct workshops, discover participant needs and wishes, and co-ideate solutions.

The methodology will be further revised throughout the living lab activities and a living document has been set up as an open science artefact at https://osf.io/e6rqv/ , where further customizations for the needs of the each of the city partners will be published.

1.1. Deliverable objectives and structure

The main objective of this deliverable is to describe the developed co-creation method for designing inclusive, safe, affordable and sustainable urban mobility solutions. It details how this methodology will be applied in two iterations through LLs and SIAs. Building on a stakeholder analysis conducted earlier in the project, this deliverable will inform subsequent project activities and integrate inclusive city models and digital twins into planning efforts.

The deliverable provides a basis for working with stakeholders in this project and provides co-creative practices that will be further customized for each of the city needs. The first version of the co-creation methodology establishes shared, generic guidelines and presents the canvas.

Chapter 1 describes the project public abstract, executive summary of this deliverable, used abbreviations and the deliverable introduction. It presents the AMIGOS project, explains the rationale of this deliverable and structure of the document.

Chapter 2 outlines the project requirements for developing a co-creation method. It emphasizes the need for active stakeholder involvement to identify needs in urban mobility infrastructure, such as bike paths and public spaces, and to gather feedback for regulatory enhancements to increase safety and accessibility for vulnerable groups. The co-creation process is structured around a participatory action research design (PADRE), incorporating gameful and art-based methods to facilitate collaboration and creativity among participants.

Chapter 3 of the document focuses on the theoretical grounding of the co-creation canvas, integrating concepts from co-creation, gameful, and art-based methods. Co-creation, as defined by Sanders and Stappers, emphasizes the active involvement of all stakeholders throughout the design process to ensure outcomes meet their needs. This participatory approach shifts the role of designers to facilitators of the creative process, integrating user insights from pre-design to post-design stages. The chapter also discusses gameful methods, which incorporate

elements of play into non-game contexts to enhance engagement, creativity, and participation. Art-based methods, defined as diverse practices including various forms of artistic expression, are used to lower barriers and foster dialogue among participants. Together, these approaches form the foundation for the Urban Mobility Co-Design Canvas, which is designed to facilitate collaborative ideation and decision-making in co-creation workshops.

Chapter 4 focuses on how the co-creation workshops interact with other project deliverables and tasks. These workshops are key components within the broader project framework and utilize the stakeholder engagement strategies and city models developed in previous tasks. The chapter details this interconnectedness and explains the links with project elements and the co-creation methodology.

Chapter 5 presents the design process for developing the co-creation methodology for AMIGOS project. This process uses an iterative development approach, which includes the creation and refinement of prototypes based on user feedback gathered through playtests. The chapter furthermore details the timeline of activities, such as initial prototype development, design improvements, tests, and partner training needs. Additionally, it discusses the training of partners to facilitate the co-creation workshops effectively, ensuring consistency and engagement across different cities. The canvas, a key component of the methodology, is designed to be a living document, evolving based on continuous feedback from stakeholders to address local needs and improve the co-creation process. Lastly, the chapter discusses the needs to customize the canvas for the needs of the each of the city partners.

Chapter 6 introduces the canvas, a collaborative tool designed to enhance urban mobility solutions through co-creation workshops. The chapter provides an overview of the canvas, detailing its structure and intended workflow. The canvas aims to facilitate playful, creative discussions among diverse participants, engaging them in brainstorming, mapping, and sketching activities to collectively identify and prioritize urban mobility challenges and generate innovative solutions. The process is supported by a guidebook for facilitators and utilizes various materials such as post-it notes, stickers, cards, and timers as part of activities.

2. Points of departure: project requirement for the co-creation methodology

Selected functional design requirements for the co-creation method are summarized as follows.

- « Co-creation activities with stakeholders will help pinpoint the necessary improvements of existing infrastructures (ex. bike paths/lanes, bicycle streets, public spaces, etc.), but also provide feedback to decision-makers regarding regulatory developments to enhance safety and extend as possible the accessibility for different/vulnerable social groups. «
- « The co-creation events will be arranged minimally twice and are structured around two themes. In the first set of events, the urban mobility wishes are identified, and possible solutions framed. Moreover, these events inform the structure and support participants need to participate to the second set of workshops. «
- « The co-creation activities will use art- and game-based methods, as well as digital-twin compatible comprehensive city models. «
- « In the first workshops, art-based and game-based methods (state of the art in co-creation) will be used to imagine people's wished mobilities. »
- « In the second set of events, possible interventions are deployed and simulated on the city models. «

- « LUT will train city representatives to animate the co-creation workshops in T2.1. LUT will provide them with templates (workshop sheets) and techniques to include all the stakeholder's views in the final recommendations. »
- «LUT will develop the methodology for the co-creation activities in T2.1, combining participatory design with action design research. «

To fulfill these requirements, we have implemented a participatory action research design process (PADRE)[2] that has resulted in Urban Mobility Co-Design Canvas which merges gameful and art-based methods into an urban technology design process. The canvas enables structuring activities in such a manner that even inexperienced facilitators can follow activities in a similar manner across cities. The visual design of the canvas allows participant to see the game structure, take a more active part by interacting with the canvas structure, and contribute their ideas visually through drawing arts-based methods.

Furthermore, the co-creation canvas will be further customized for the needs of the each of participating city organizations. The methodology is flexible in its structure and will be implemented in part or fully, depending on the type and length of design process that each Living Lab or Safety Improvement are needs.

3. Theoretical grounding of the canvas

The canvas is based on three strands of research: Gameful and playful design[3] [4], co-design[5], and the design of civic and urban technology[6].

3.1. Co-creation

Co-design, as defined by Sanders and Stappers [5], is an approach that actively involves all stakeholders (e.g., users, designers, and others) in the design process to ensure the result meets their needs and is usable. It emphasizes collaboration and collective creativity from the earliest stages of the design process, allowing for a diverse range of perspectives and expertise to inform the development of solutions. Co-design seeks to democratize the design process, moving away from traditional designer-centric methodologies to more participatory methods where users are seen as experts in their own experiences and integral to the design team.

Sanders and Stappers[5] highlight that co-design is not just about involving users at specific points but integrating their insights throughout the entire design lifecycle. This approach helps in creating more relevant, innovative,

[2] Haj-Bolouri, A., Bernhardsson, L., & Rossi, M. (2016). PADRE: A method for participatory action design research. In Tackling Society's Grand Challenges with Design Science: 11th International Conference, DESRIST 2016, St. John's, NL, Canada, May 23-25, 2016, Proceedings 11 (pp. 19-36). Springer International Publishing.

[3] Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of human-computer studies*, *74*, 14-31.

[4] Lucero, A., Karapanos, E., Arrasvuori, J., & Korhonen, H. (2014). Playful or gameful? Creating delightful user experiences. interactions, 21(3), 34-39.

[5] Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-design*, *4*(1), 5-18.

[6] Lember, V. (2018). The increasing role of digital technologies in co-production and co-creation. In Co-production and co-creation (pp. 115-127). Routledge.

and user-friendly outcomes. The role of the designer shifts from being a sole creator to a facilitator of the creative process, enabling and empowering users to contribute meaningfully to the design.

In a later article about co-design tools, Sanders and Stappers[7] place co-design tools on a research trajectory that spans from pre-design research to post-design evaluation. This trajectory proposes how each tool fits best into different stages of the design process. Probes are used early on to gather deep, qualitative insights into users' lives and contexts, serving as inspirational and exploratory devices. Generative toolkits come into play in the middle stages, enabling users to creatively express their ideas and needs, thereby facilitating the generation of design concepts. Prototypes are employed in the later stages to create tangible representations of these concepts, allowing for testing, evaluation, and iterative refinement.

In a later avenue of research, Madden et al. have connected co-design tools to being compatible with participatory action research[8]. They found that common co-design tools such as probes and prototypes can be used in participatory action and design research.

A framework that combines the design of technological artefacts and action research has been presented by Haj-Bolouri et al.[2]. The framework, named PADRE, provides a structured methodology for integrating Participatory Action Research (PAR) and Design Research (DR) to facilitate collaborative, iterative and outcome-oriented design processes. The framework begins with the Planning phase, which involves identifying the research problem, engaging stakeholders, and establishing the research context. This phase emphasizes co-defining objectives and expectations with all participants to ensure a shared understanding and commitment. The Acting phase follows, wherein interventions are implemented in the field based on the co-designed plans. Stakeholders actively participate in creating and testing design artifacts, ensuring that interventions are grounded in real-world contexts and responsive to users' needs.

3.2. Gameful and art-based methods

In this Section, we detail earlier work on gameful and art-based methods.

3.2.1. Gameful methods

Gameful and playful methods encompass a range of approaches that involve the application of elements of play or games to non-game contexts (Deterding, 2016). These methods have been applied in various contexts,

[7] Sanders, E. B. N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. CoDesign, 10(1), 5-14.

[8] Madden, D., Cadet-James, Y., Atkinson, I., & Watkin Lui, F. (2014). Probes and prototypes: a participatory action research approach to codesign. CoDesign, 10(1), 31-45.

including education[9], smart city design[10], civic participation[11], and co-design[12]. They are characterized by their ability to enhance engagement, creativity, and enjoyment, and are often used to improve user experience and learning outcomes. They have been shown to increase participation in user research as well[13]. Key design aspects of these methods include theming, storification, scripting, ruling, and framing, role-play, and the integration of these aspects into unified experiences[14].

Gameful and playful methods have been previously examined, Ghanbari et al.[15] investigated the impact of online serious games on the quality of requirements elicitation in distributed software projects. The results of their empirical study indicate that the utilization of online serious games can be expected to increase the quantity of user requirements. While the proposed approach enables less-experienced individuals to identify and provide a higher number of requirements, it also hinders developers from imposing their preferred features on customers.

Further advancement in this field is seen in Snijders et al's[16] proposal of a gamified online platform for requirements elicitation and refinement, which engages a crowd of stakeholders including users, developers, and analysts. Marcelino-Jesus et al.[17] proposed utilizing serious games to support requirements engineering acquisition and validation, leading to the discovery of both new and existing requirements. The results indicate that serious games aid in validating the requirements engineering process, technical and business scenarios, and

[9] Pavlidis, G. P., & Markantonatou, S. (2018). Playful education and innovative gamified learning approaches. In *Handbook of Research on Educational Design and Cloud Computing in Modern Classroom Settings* (pp. 321-341). IGI Global.

[10] Wolff, A., Kortuem, G., & Cavero, J. (2015, July). Urban data games: Creating smart citizens for smart cities. In *2015 IEEE 15th International Conference on Advanced Learning Technologies* (pp. 164-165). IEEE.

[11] Hassan, L., & Hamari, J. (2020). Gameful civic engagement: A review of the literature on gamification of e-participation. *Government Information Quarterly*, *37*(3), 101461.

[12] Vaajakallio, K., & Mattelmäki, T. (2014). Design games in codesign: as a tool, a mindset and a structure. *CoDesign*, *10*(1), 63-77.

[13] Bernhaupt, R., Weiss, A., Obrist, M., & Tscheligi, M. (2007). Playful probing: Making probing more fun. In *Human-Computer Interaction–INTERACT 2007: 11th IFIP TC 13 International Conference, Rio de Janeiro, Brazil, September 10-14, 2007, Proceedings, Part I 11* (pp. 606-619). Springer Berlin Heidelberg.

[14] Deterding, S. (2016). Make-Believe in Gameful and Playful Design. In P. Turner & J. T. Harviainen (Eds.), Digital Make-Believe (pp. 101–124). Springer International Publishing.

[15] Ghanbari, H., Similä, J. and Markkula, J., 2015. Utilizing online serious games to facilitate distributed requirements elicitation. Journal of Systems and Software, 109, pp.32-49.

[16] Snijders, R., Dalpiaz, F., Brinkkemper, S., Hosseini, M., Ali, R. and Ozum, A., 2015, August. REfine: A gamified platform for participatory requirements engineering. In 2015 IEEE 1st International Workshop on Crowd-Based Requirements Engineering (CrowdRE) (pp. 1-6). IEEE.

[17] Marcelino-Jesus, E., Sarraipa, J., Agostinho, C. and Jardim-Goncalves, R., 2016. The use of serious games in requirements engineering. In Enterprise Interoperability VII: Enterprise Interoperability in the Digitized and Networked Factory of the Future (pp. 263-274). Springer International Publishing.

serve as effective tools for dissemination purposes. Complementing this, Requirements Bazaar[18] offers a browser-based social software platform for Social Requirements Engineering (SRE), providing another path for collaborative requirement gathering and refinement.

3.2.2. Art-based methods

Art can be broadly defined as a human action, creation and ways of expression, including for example dance, music, literature, theater, film, sculpture and paintings manifesting various way in different cultures and times[19]. In its use, we follow the practices and recommendations of the Guidebook on Using Arts-based Methods in Science Communication[20]. The guidebook defines art-based approaches "as a wide spectrum of practice"[21] where on the one point of spectrum there is an instrumental use of art and on the other point of spectrum art is having absolute value without any need to serve or benefit anything else than itself. Coemans & Hannes[22] define arts-based methods in community-based inquiry as: "The use of artistically inspired methods by researchers and participants in a collaborative research environment where members of the community are actively involved either in creating art in the search for meaning or in providing a critical, situated response to artistically inspired formats of research dissemination from others."

The methods developed in the Guidebook and followed in this Deliverable, "are designed to help to build up dialogue and lower barriers to make-sense, articulate and share experiences as well as imagine possibilities and future scenarios. It is a knowledge source to find out local knowledge to citizens themselves as well as local civic organizations."

4. Connections to other deliverables

The co-creation workshops, informed by this methodology and several other WP1 Tasks, work as a lynchpin of several parallel efforts that occur in WP2. The co-creation workshops benefit from the stakeholder engagement strategy and recruitment in T1.2, city model creation in T1.4, and training materials. The interconnectivity of these activities is visualized in Figure 1.

[18] Renzel, D., Behrendt, M., Klamma, R. and Jarke, M., 2013, July. Requirements bazaar: Social requirements engineering for community-driven innovation. In 2013 21st IEEE International Requirements Engineering Conference (RE) (pp. 326-327). IEEE.

[19] Fleming, J. and Honour, H. (2009) A World History of Art. Revised seventh edition. Laurence King Publishing Ltd.

[20] Pässilä, A., Knutas, A., Wolff, A. (eds) (2023). Using Arts-based Methods in Science Communication. LUT Scientific and Expertise Publications / Oppimateriaalit – Lecture Notes, 26.

[21] Owens, A. (2019). Thinking about arts-based methods: an introduction. In Benmerqui, R., Owens, A., and Pässilä, A. (eds.) Beyond Text – Art-based methods for research, assessment, and evaluation. https://beyondtext.weebly.com/

[22] Coemans, S., Hannes, K. (2017) Researchers under the spell of the arts: Two decades of using arts-based methods in community-based inquiry with vulnerable populations. Educational Research Review 22: 34-49.

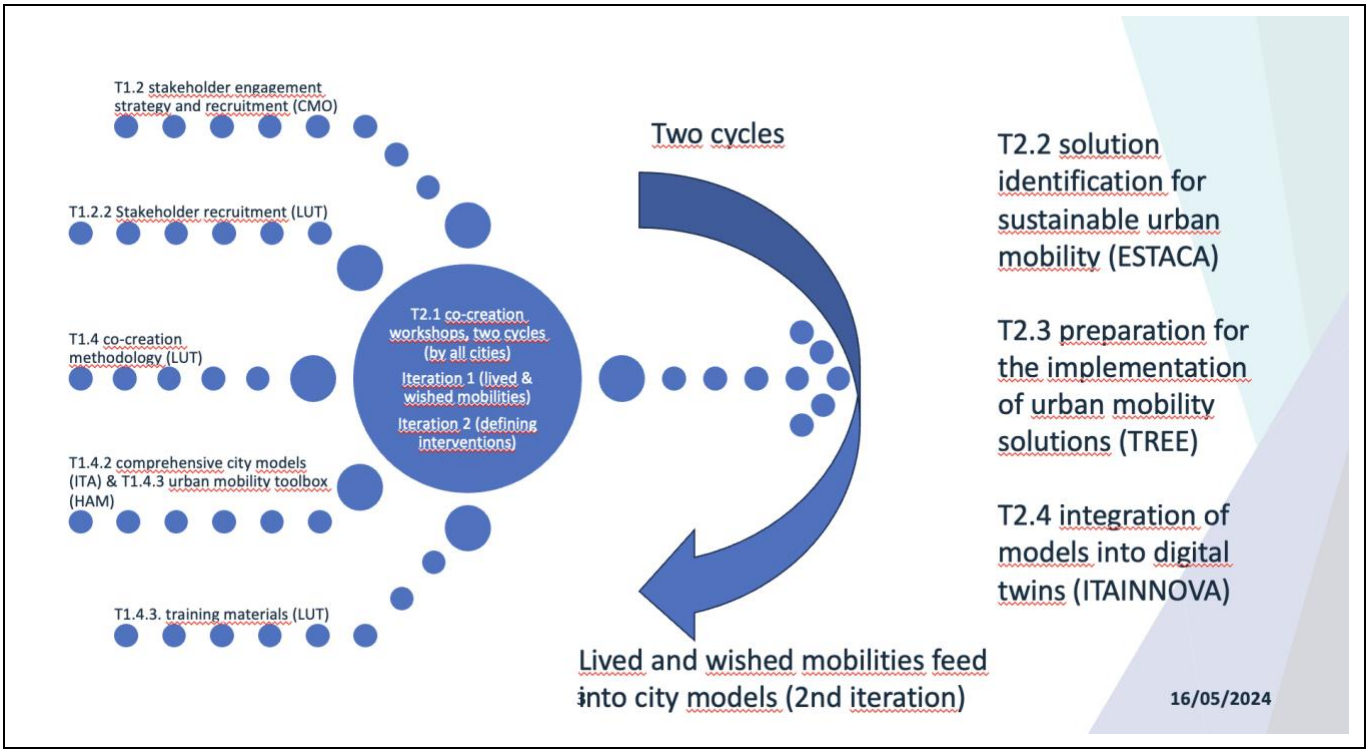

Figure 1 Connections to other tasks

5. Design process

The co-creation method resembles a tabletop board game and includes a co-design canvas[5] (a large paper worksheet where activities are conducted) and a guidebook to direct the co-creation process. The canvas is specifically designed to facilitate collaborative ideation and decision-making among participants in co-creation workshops.

In the creation of this method or artefact, we have used an iterative action design research approach, called PADRE. PADRE is an extension of ADR method[23] and is inspired by the principles driving from PAR[24] and PD[25]. It advocates for close interaction between stakeholders and researchers by providing them a reciprocal space for reflection, learning, and action throughout each stage of an ADR cycle. The rationale for adopting this approach is that it encourages close collaboration between stakeholders, such as community members or end-users, and researchers by providing a forum for reflection, learning and action at each stage of the ADR cycle, as shown in Figure 2.

[23] Sein, Maung K., et al. ”Action design research.” MIS quarterly (2011): 37-56.

[24] Swantz, Marja Liisa. ”Participatory action research as practice.” The Sage handbook of action research: Participative inquiry and practice (2008): 31-48.

[25] Spinuzzi, Clay. ”The methodology of participatory design.” Technical communication 52.2 (2005): 163-174.

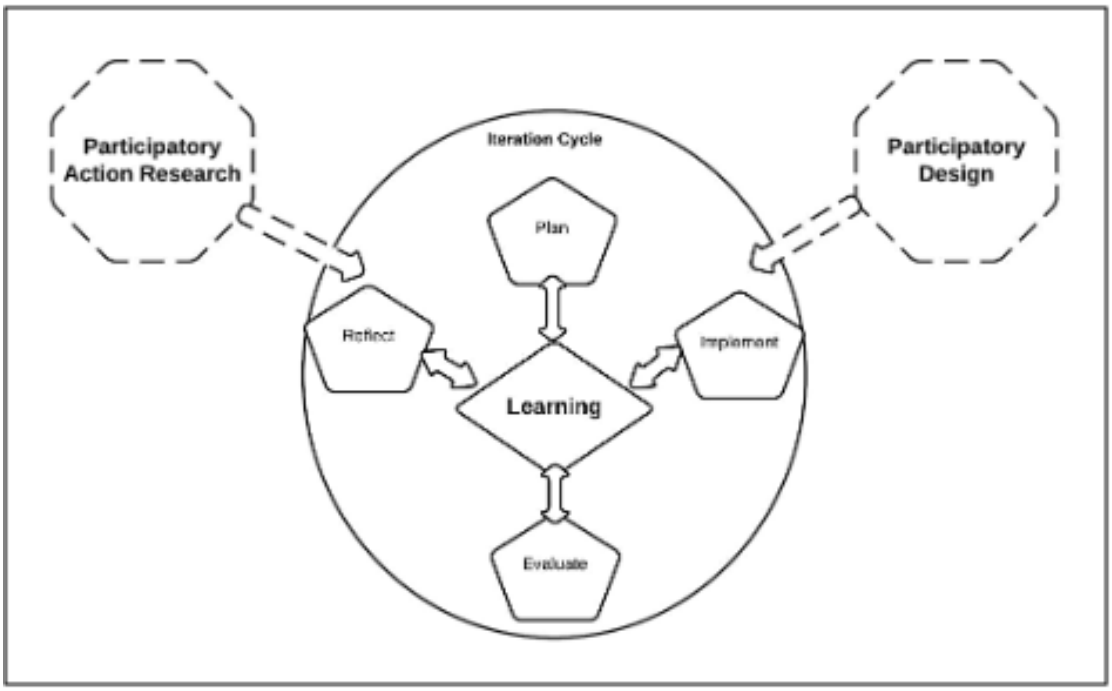

Figure 2 Structure of PADRE[2]

In the planning phase, an analysis of requirements, a literature study and a review of existing tabletop games (canvas-based games) for best practices are conducted, and the learnings are documented textually. Based on the documented reflection and learning from the planning stage, in the implementation phase, we engaged in the implementation of an early artefact prototype that addresses the formulated needs and requirements. In the third phase, initial playtests and usability testing are conducted. During this phase, the artefact is introduced to the participants, fostering dialogue among them. The outcomes of the evaluation of the implemented prototype are documented and addressed further through collective reflections between the researchers and the participants involved. The reflection is conducted through a survey questionnaire. Following this initial iteration, several further iterations are performed with different groups of participants, one play and usability test is conducted at the PONG labs at the University of Milan[26] on 17th and 29th of May, with a group of students. Another separate workshop is conducted at the Lappeenranta-Lahti University of Technology (LUT)[27] on the 6th of May 2024, with a group of junior researchers.

These iterations were followed by further virtual and face-to-face testing. To gather feedback from the AMIGOS project partners, a series of virtual playtests were conducted with cities and technical partners involved in the project. During the AMIGOS partner's general assembly in Oslo on 15-16 May 2024, a face-to-face test was conducted with the project partners via a co-creation workshop. The workshop was video recorded with the consent of the partners to capture their evaluations and a questionnaire was distributed to the participants to obtain their feedback on the co-creation process.

[26] https://pong.di.unimi.it

[27] https://www.lut.fi/en

5.1. Iterative development

This section provides a high-level summary of the development iterations of the co-creation methodology. Each iteration focused on specific objective and produced measurable outcomes. Table 2 provides the iterations.

Table 2 Development iterations of the co-creation methodology

Iteration	Date	Objective	Outcome
1	February - March 2024	Initial prototype development	Basic functionality implemented
2	Early April 2024	User interface enhancements	Improved user interface design
3	April – May 2024	User feedback integration	Adjustments based on feedback

In the initial development iteration, the objective was to create an early prototype to test the initial concept and design of the co-creation methodology. During this phase, the basic tabletop game (canvas) was developed, and initial internal play and usability tests were conducted with participants. This allowed for the identification of design flaws and areas needing improvement. While positive feedback was received on core features, it was evident that the interface needed to be more intuitive. Based on this feedback, an interface redesign was planned for the next iteration.

In the second iteration, the objective was to enhance the interface, or the canvas layout based on the feedback received to improve the user experience and usability. The user interface was redesigned with a more intuitive layout, considering the future co-creators who would use it. This included increasing font sizes, enhancing color combinations, and eliminating repetitive activities on the canvas. Following these improvements, usability tests were conducted both virtually with AMIGOS partners and in face-to-face workshops. The redesigned interface received positive feedback, and the usability tests indicated increased user satisfaction. However, users suggested additional customization options and further improvements to the canvas layout.

In the third development iteration, the aim was to integrate the user feedback and conduct a larger face-to-face co-creation workshop with AMIGOS partners. The requested changes were implemented, and the co-creation canvas was refined. A face-to-face co-creation workshop was conducted during the AMIGOS partners' general assembly in Oslo between 15 and 16 May 2024. A diverse range of feedback was received, encompassing both positive and negative comments. These were captured digitally through video recordings and questionnaire surveys. For the next iteration, it was planned to incorporate the newly requested modifications and conduct additional play and usability tests before rolling out the co-creation canvas to cities for use by stakeholders.

Overall, the prototype has undergone significant development, with enhancements to the user interface of the co-creation canvas. Further development iterations are planned.

5.2. Timeline of activities and training of partners

As illustrated in Figure 3, the following activities are scheduled: further development iterations of the co-creation canvas and its accompanying guidebook. These iterations will build on insights and lessons learned from previous development iterations. As previously discussed, the PADRE framework will be employed for the design and development process of the co-creation process. These iterations will be complemented by bilateral meetings

with cities and other project partners, during which city-specific needs will be identified and refined, and elements from other WPs will be integrated into the co-creation methodology. Additionally, city representatives will be invited to participate in co-creation process training sessions.

The subsequent step is stakeholder recruitment. During this phase, we will actively engage in contacting and inviting stakeholders to participate in co-creation workshops. This endeavor will utilize the stakeholder engagement and recruitment strategies developed in previous WP1. Following the recruitment of stakeholders, a pilot co-creation workshop will be conducted in the city of Lappeenranta, Finland. Finally, a series of co-creation workshops will be arranged and conducted across the AMIGOS partner cities. Best practices and positive feedback from the pilot workshop will be replicated throughout the sequence of workshops to ensure consistency and effectiveness.

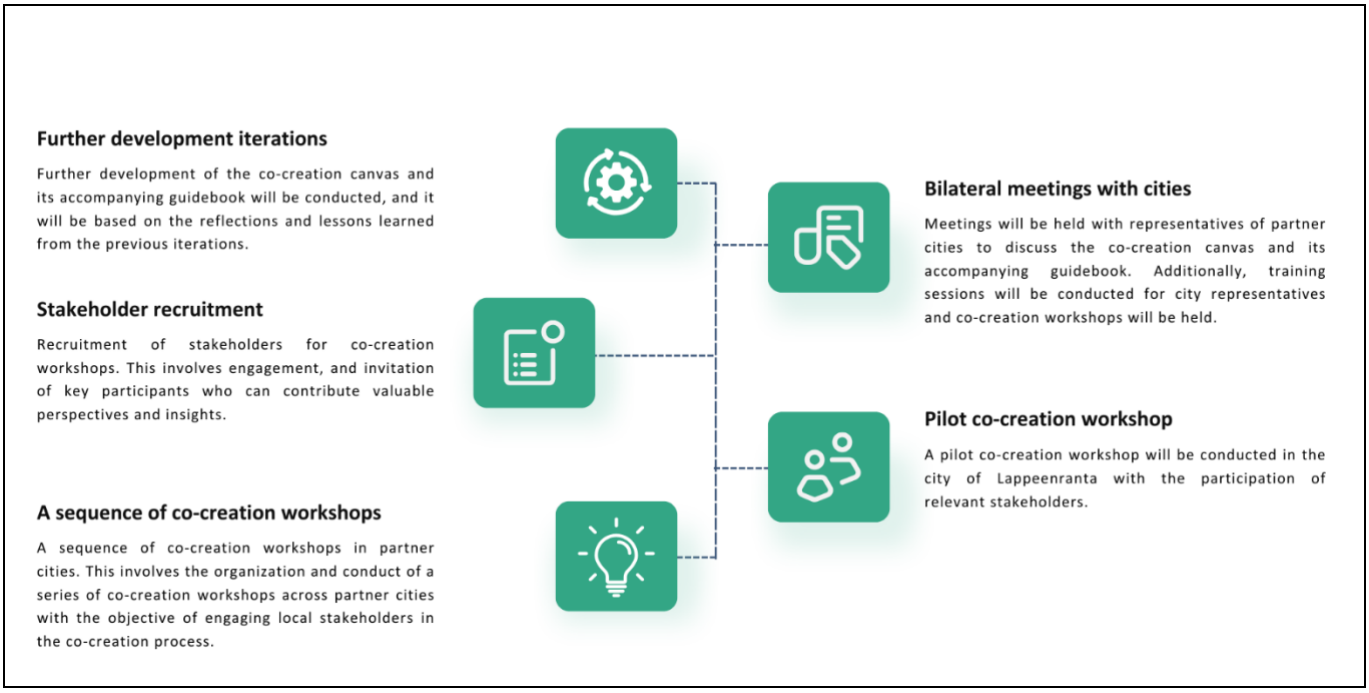

Figure 3 Further activities in the co-creation process and its implementation

The figure below (Figure 4) illustrates the timeline for executing the aforementioned activities. This timeline provides a tentative schedule outlining each remaining phase of the development and implementation of the co-creation process, from further development iterations of the co-creation canvas and guidebook to the stakeholder recruitment and subsequent workshops.

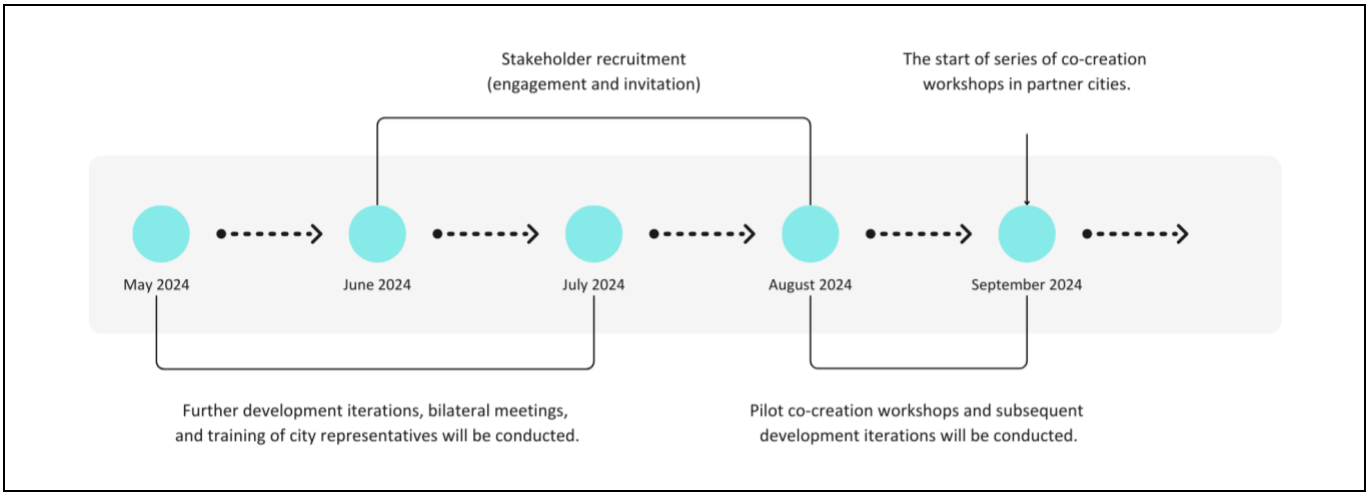

Figure 4 Timeline of further activities in the development of the co-creation process and its implementation

5.3. Feedback, future work, and canvas as living document

The canvas will remain a living as part of research and adaptation during the implementation of co-creation workshops, based on the feedback of living labs, safety improvement areas, and all the stakeholders at cities. As stakeholders are engaged, their needs are better discovered and the methodology further adapted, following the principles of "methods as documented" vs "methods in action,"[28] and method adaptation[29]. Improvements discovered during the "method in action" phase will be then translated into improvement documentation for further co-creation practice.

Open Science Framework project page was set up to facilitate development and canvas hosting at https://osf.io/e6rqv/ . OSF.io was selected for the living document stage, since it has social components such as wikis and can facilitate the cooperation of several project workers, while still supporting FAIR principles. Final open science repository for the outcomes is still Zenodo.

Further work that is foreseen as part of WP2 is:

- Translations for each of the living lab cities' local languages
- Feedback for usability and revised documentation, based on the playtest in the 2024 May general assembly and feedback from facilitators
    - Support for challenge framing for cities and facilitators
    - Improvements to the "thinking hats" section of the canvas
    - Other changes to the flow and documentation of canvas to address misunderstandings
- Providing presupplied materials ("playbooks") for living labs and safety improvements areas, based on the fact sheets and problem framing created in WP1

[28] Dittrich, Y. (2016). What does it mean to use a method? Towards a practice theory for software engineering. *Information and Software Technology*, *70*, 220-231.

[29] Dingsøyr, T., Moe, N. B., Fægri, T. E., & Seim, E. A. (2018). Exploring software development at the very large-scale: a revelatory case study and research agenda for agile method adaptation. *Empirical Software Engineering*, *23*, 490-520.

- Adaptation to state of local AMIGOS interventions

6. Introducing the urban mobility tabletop canvas

6.1. Overview

The urban mobility tabletop canvas comprises a co-design[5] canvas (a large paper worksheet where activities take place) and a guidebook to guide the co-creation process. The canvas is designed to facilitate collaborative ideation and decision-making among participants in co-creation workshops, with the aim of enhancing smart city urban mobility solutions. Its primary objectives include engaging citizens from diverse backgrounds in the identification of key challenges or unfulfilled needs within urban mobility and generating innovative ideas and solutions through structured brainstorming and collaboration.

The canvas comprises a series of activities, which should last approximately two hours, including breaks. The optimal group size is between three and five participants. The aim of the canvas is to facilitate a playful discussion among participants, enabling them to clarify their vision collectively, create a shared understanding of their goals and plan their next moves. It offers a way to engage all participants in project discussions and ensure that all contribute equally to the co-creation process. All activities included in the co-creation process require participants to engage in brainstorming, group reflection, mapping, writing, sketching, and other forms of creative expression. The process requires the utilization of several materials, including pens or pencils, Post-it notes, stickers, timers, and blank papers. Additionally, a facilitator must be present to orchestrate the process. The separate guidebook is prepared to help facilitators run the co-creation process smoothly.

Once the co-creation process has concluded, the canvas will be utilized by service provides as a requirements specification document, as participants have inputted information onto the canvas throughout the co-creation session. The service providers in this context are those responsible for urban mobility solutions.

6.2. Workflow

The collaborative design process consists of 4 interrelated phases and 8 activities. These activities are grouped into the four phases. The first phase is a preparatory phase consisting of one activity (introduction by the facilitator). In the second phase, which includes activities to identify challenges or unmet needs related to urban mobility, participants report unmet needs as open requirements. This phase involves negotiation and prioritization of requirements among participants. The third phase is the ideation phase, where participants brainstorm or ideate on how to address their unmet needs. This is followed by refinement and negotiation. The fourth stage is framing a solution. This helps to identify participants' perceptions of their future mobility. Figure 5 depicts the phases in a co-creation process.

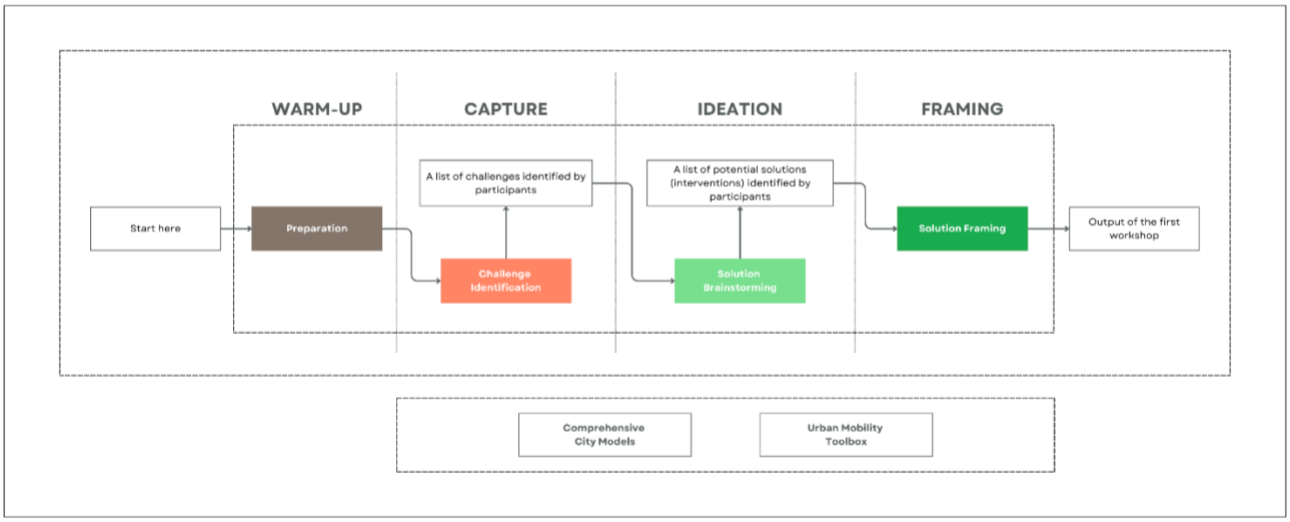

Figure 5 Phases in the proposed co-creation event

6.3. The co-creation canvas

The co-creation canvas enables stakeholders to identify and prioritize their unfulfilled urban mobility needs. The requirement elicitation or challenge identification page (Figure 6) serves as the main sheet to list and prioritize participants' urban mobility challenges. Requirement prioritization is introduced as a solution to eliminate some of the requirements based on judgment in terms of priority, value and rank made by participants[30]. It is based on the Eisenhower Method[31] of arranging requirements by urgency and importance in a 2x2 matrix. This method is normally used for business purposes to prevent wasting time from implementing low priority tasks[30].

[30] Rusli, Siti NurSyafiqah Binti, Rohani Binti Abu Bakar, and Siti Suhaila Binti Abdul Hamid. "An Improvement of Interactive Priorization Technique for Requirements Interdependency in Prioritization Process." 2023 IEEE 8th International Conference On Software Engineering and Computer Systems (ICSECS). IEEE, 2023.

[31] Jyothi, N. S., and A. Parkavi. "A study on task management system."2016 International Conference on Research Advances in Integrated Navigation Systems (RAINS). IEEE, 2016.

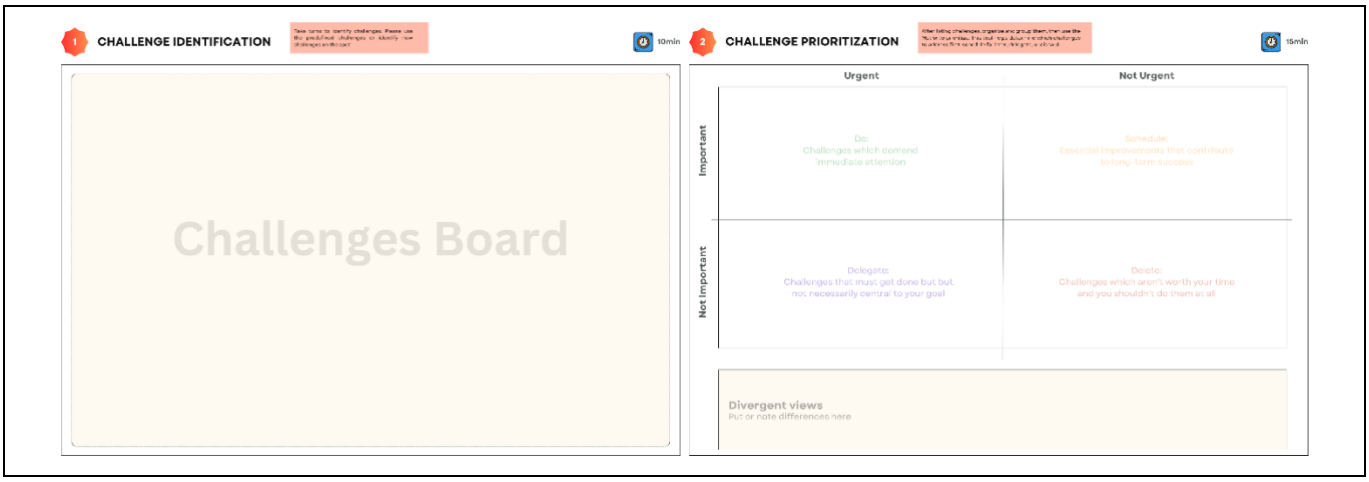

Figure 6 Challenge identification and prioritization in the co-creation canvas

Following the prioritization of challenges or requirements, challenge framing (Figure 7) is employed to contextualize a challenge(s) and identify stakeholders. These stakeholders are individuals and organizations that are directly involved in or impacted by the mobility challenge, including residents, vulnerable road users, businesses, governments, knowledge institutions, and non-profit organizations.

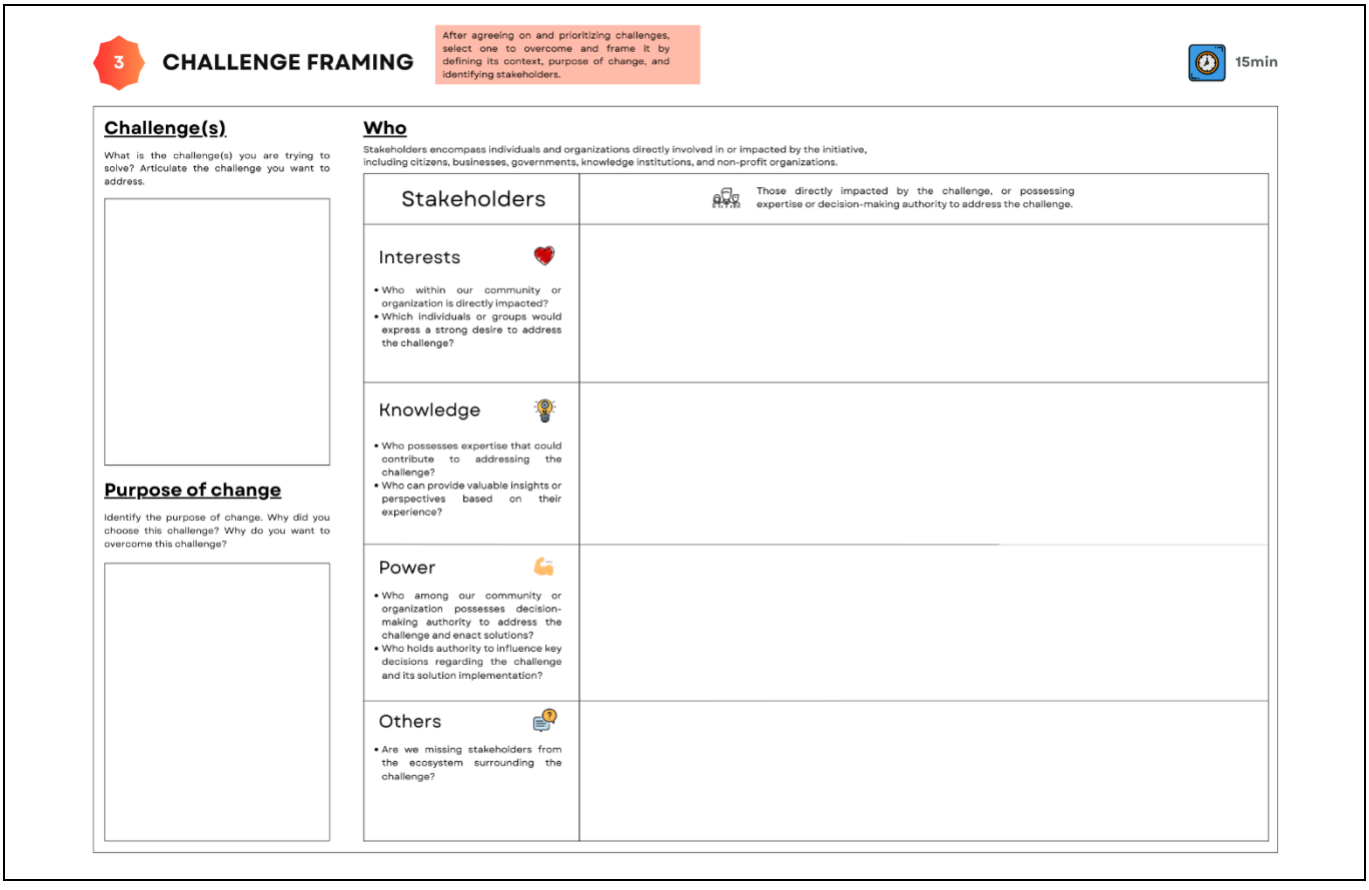

Figure 7 Challenge framing in the co-creation canvas

In the ideation sheet (Figure 8), participants utilize art-based methods[32], such as bricolage[33] or collaborative sketching to unlock their creativity and brainstorm solutions. The objective of this sheet's activities is to encourage participants to engage in a creative process of envisioning their future mobility. In addition to the art-based methods, Edward de Bono's Six Thinking Hats technique[34] is employed to encourage participants to explore multiple perspectives in a systematic manner, thereby facilitating more comprehensive analysis, innovative solutions, and balanced decision-making.

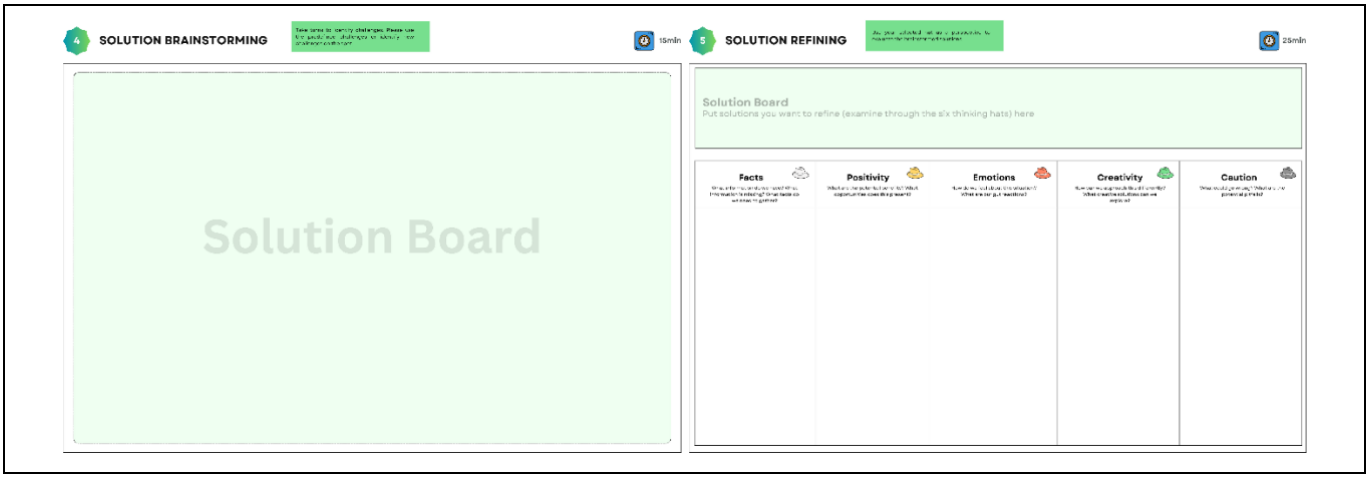

Figure 8 Ideation (solution brainstorming) in the co-creation canvas

The solution framing activity (Figure 9) follows the solution brainstorming and refining activities. This activity enables participants to engage in discussion and select a solution from the array of potential solutions generated during the brainstorming and design thinking phases. The question "You have produced a fantastic solution, but what is necessary to put it into action?" is then posed to the participants. To answer this question, the resource assessment exercise needs to be conducted. This step helps the participants to grasp the feasibility of the proposed solution. Consequently, it is recommended that participants conduct a resource assessment to ascertain the viability of the proposed solution.

[32] P̈assil̈a, Anne, Antti Knutas, and Annika Wolff. "Using Arts-based Methods in Science Communication." (2023).

[33] https://censemaking.com/2023/06/05/the-bricolage-of-innovation-and-a-kit-of-parts/.

[34] Carl III, Walter John. "Six Thinking Hats: Argumentativeness and Response to Thinking Model." (1996).

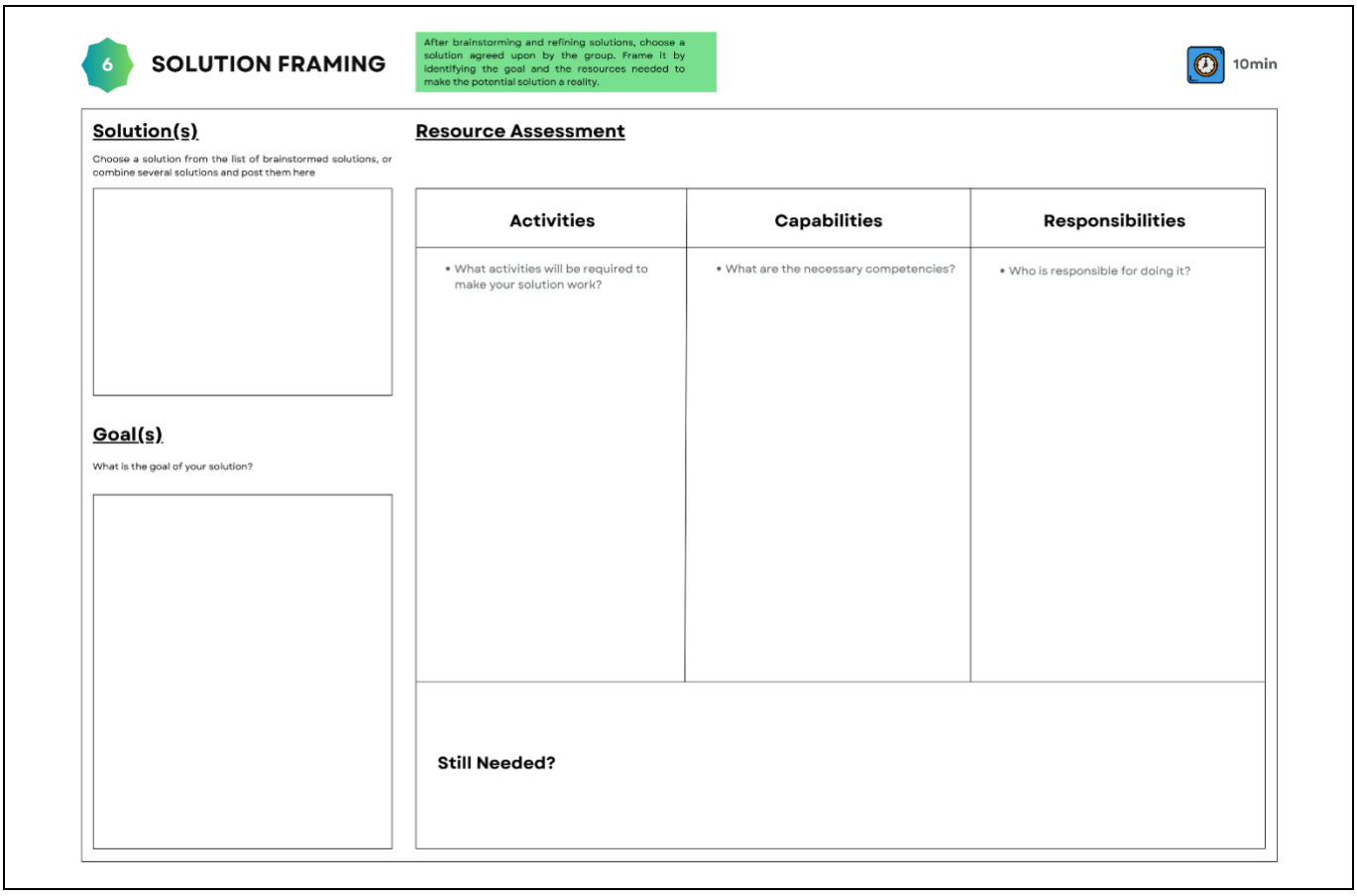

Figure 9 Solution(s) framing in the co-creation canvas

Finally, to conclude the workshop on a truly enriching note, we believe that it is highly beneficial to share the insights and discussions with the other participant groups. This practice not only captures the essence of collaborative learning, but also fosters a sense of community and shared understanding among all participants. By presenting the discussions, ideas and conclusions reached during the workshop, each group can gain new perspectives, learn from different viewpoints and further refine their own requirement and understanding. The collective sharing of knowledge not only enhances the overall learning experience but also ensures that the knowledge gained is widely disseminated throughout the workshop cohort, thereby maximizing its impact and relevance for all involved.

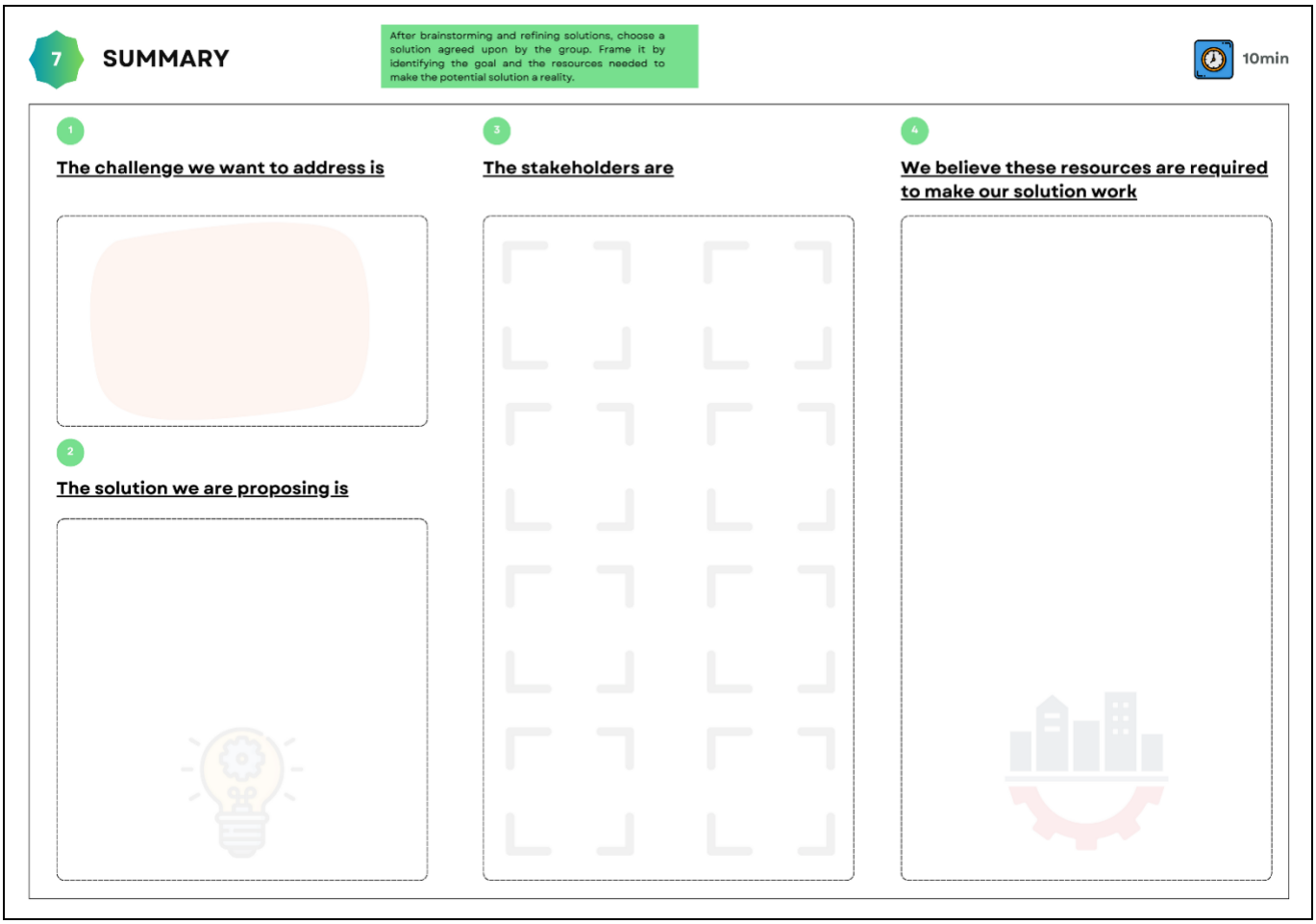

Figure 10 Summary in the co-creation canvas

Figure 10 presents a summary of the identified challenges, stakeholders, proposed solutions, and the resource assessment conducted in a co-creation workshop.

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Annex(es)

The guidebook for the canvas and the canvas are included as annexes in the subsequent pages.

UMCoDC

The Urban Mobility Co-Design Canvas

Workbook

UMCoDC

The Urban Mobility Co-Design Canvas

This workbook is a description and step-by-step guide to the collaborative tabletop game designed to address urban mobility challenges

Workbook

Preface

Welcome to using UMCoDC, your gateway to collaborative design for urban mobility solution. This workbook is an integral part of a co-design methodology (a tabletop game) developed by LUT (Lappeenranta-Lahti University of Technology) within the AMIGOS (Active Mobility Innovations for Green and Safe City Solutions) project. Funded by the European Union's Horizon Europe programme, the AMIGOS project aims to foster the co-creation, testing, evaluation and scaling of inclusive, safe, resilient and sustainable urban mobility solutions in European cities and beyond.

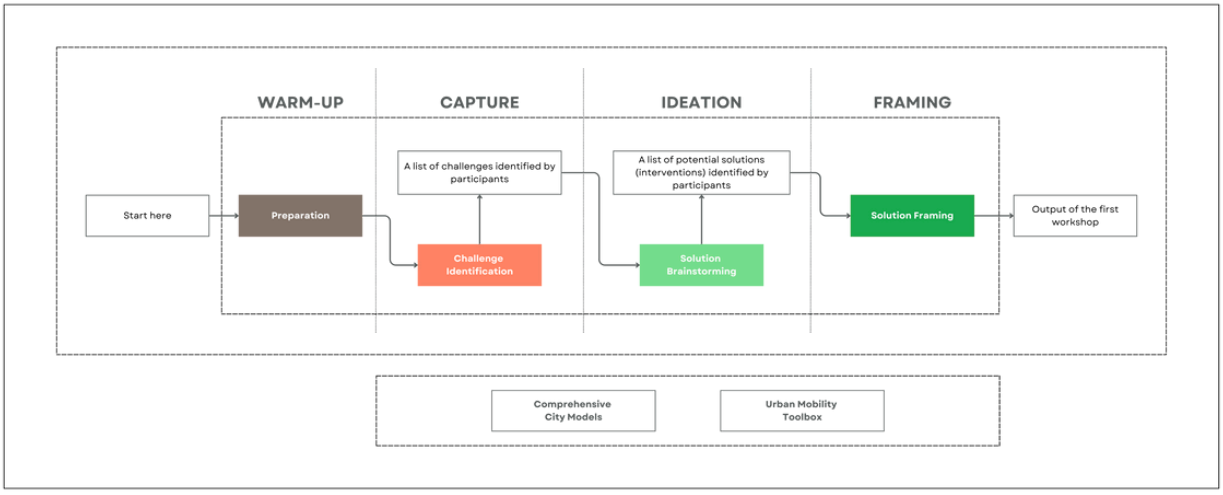
The objective of the tabletop game is to collaboratively design and test solutions to urban mobility challenges, considering the needs and preferences of diverse stakeholders while striving to improv the safety and quality of life of residents, especially vulnerable groups.

This workbook is a description and step-by-step guide to the collaborative tabletop game. Participants take on the roles of residents, vulnerable road users, community members, urban planners, policy makers and other stakeholders as they work together to improve current mobility challenges.

OVERVIEW

Stages

The collaborative design process consists of 4 phases and 8 activities. These activities are grouped into the four phases. The first phase is a preparatory phase consisting of one activity (introduction by the facilitator). In the second phase, which includes activities to identify challenges or unmet needs related to urban mobility, participants report unmet needs as open requirements. The third phase is the ideation phase, where participants brainstorm or ideate on how to address their unmet needs. This is followed by refinement and negotiation. The fourth stage is framing a solution. This helps to identify participants' perceptions of their future mobility.



OVERVIEW

The Process

Warm-Up

Introduction of the participants, the UMCoDC, goal and outcome of the co-creation workshop.

10 min

Capture

Challenge identification, prioritization and framing

35 min

Ideate

Solution brainstorming, design thinking, and refining

45 min

Frame

Solution framing and resource assessment

20 min

WARM-UP

Introduce Participants, the canvas, and the goal and expected outcome of the co-designing workshop.

Preparation

Instructions

1. Welcome the participants
2. Explain the canvas (check below; ‘About the canvas’)
3. Explain the event's goal (check below; ‘Goal’)
4. Explain the event’s expected outcome (check below; ‘Expected outcome’)

2 About the canvas

The Urban Mobility Co-design Canvas is a tool that enables citizens to collaboratively design and test solutions to urban mobility challenges, taking into account the needs and preferences of different stakeholders, while aiming to improve the safety and quality of life of residents, especially vulnerable road users.

3 Goal

The aim of this workshop is to foster collaboration among citizens, urban planners, designers, policy makers and other stakeholders. Through a co-design process, participants will identify their lived mobility challenges and co-design solutions, focusing on inclusive, safe, affordable and sustainable urban mobility.

4 Expected outcome

The expected outcome of this workshop is the proposal of a possible solution. Participants identify their current mobility and express their desired mobility using this tool.

CAPTURE

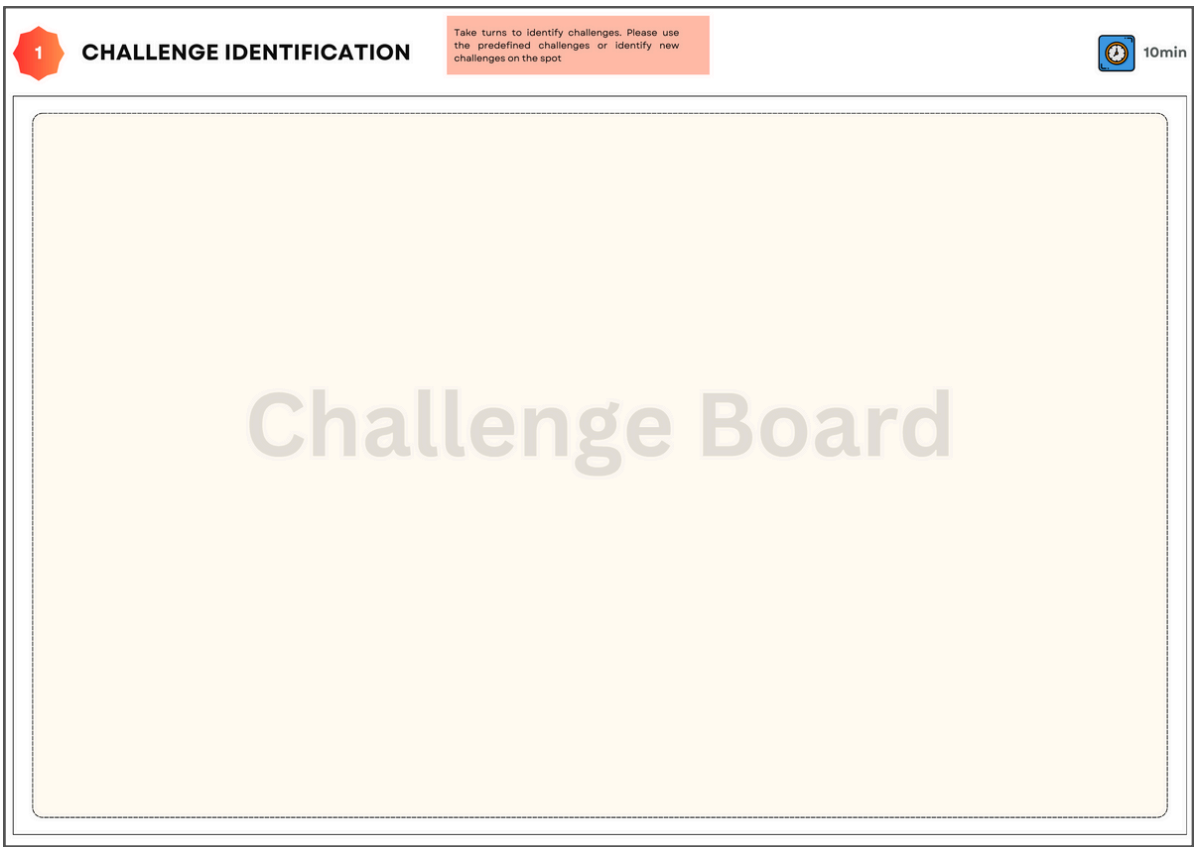
Challenge identification, prioritization and framing

Challenge Identification

Instructions

1. Ask the participants to take turns placing challenge cards on the canvas. Challenges can be written on sticky notes and placed on the challenge board.

Note: Make sure that the challenges are related to urban mobility challenges. Optionally, ask each participant why they think this challenge is important for urban mobility.

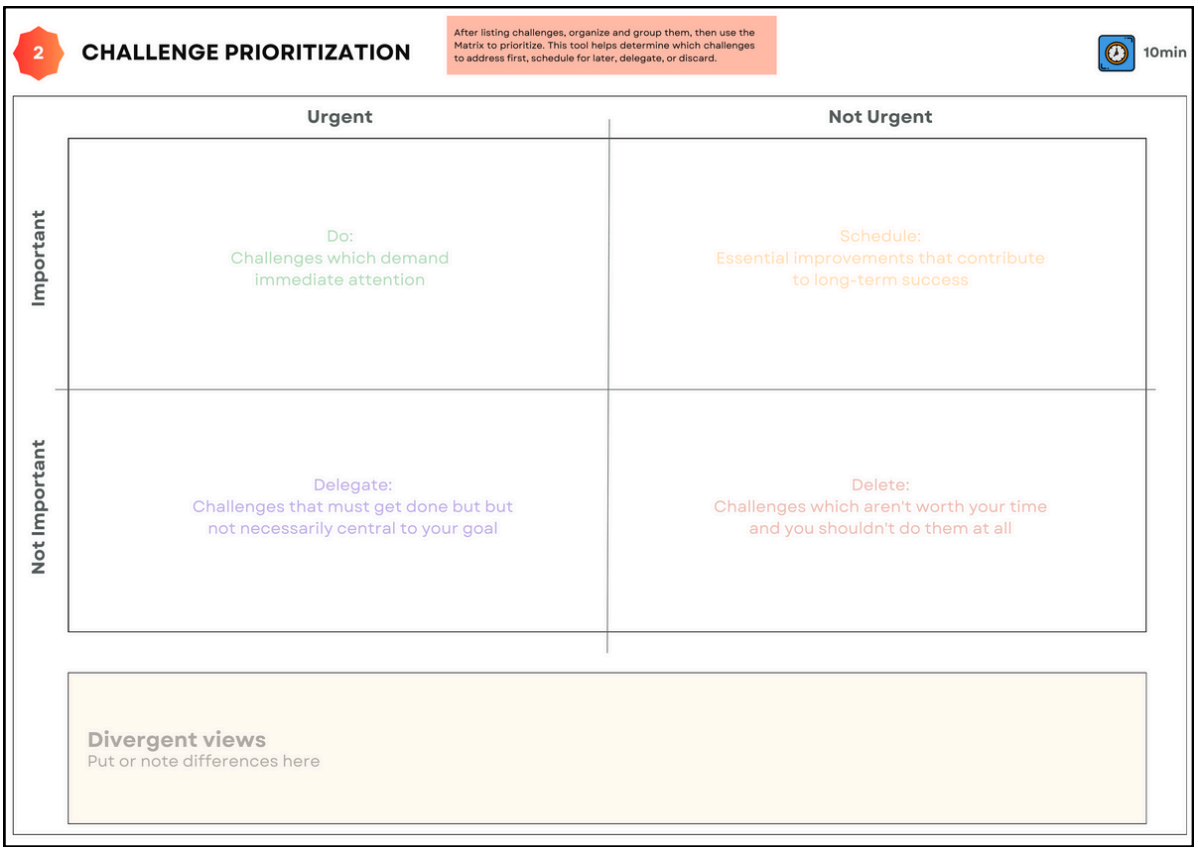


Challenge Prioritization

Instructions

1. Ask the participants to move their cards around, group similar challenges, or combine related issues.
2. Ask the participants to place their cards on the 2*2 matrix based on the challenge's urgency and importance.
    i. **Do**: ask the participants to move challenges which require immediate attention to prevent negative consequence
    ii. **Schedule**: ask the participants to move challenges that contribute to the long-term safety and sustainability of mobility in your city
    iii. **Delegate**: ask the participants to move challenges that can be delegated to others (i.e., government) or any urgent but low-priority tasks
    iv. **Delete**: ask the participants to move challenges, that you consider non-essential or insignificant to the workshop's overarching goal.

Note: Encourage participants to think about their most pressing daily challenges and identify interrelated challenges. Encourage them to place challenges with conflicting opinions in the box below the matrix.



Priority Matrix

The Eisenhower Matrix is also known as the Time Management Matrix, the Eisenhower Box and the Most Important Matrix. This tool helps participants to sort the challenges they have identified into four categories: the challenges they will do first, the challenges they will schedule for later, the challenges they will delegate and the challenges they will delete.

Important Challenges

- Impact: Important or critical challenges have a significant impact on the functioning and efficiency of urban mobility systems. They may cause severe disruptions, safety hazards, or economic losses if left unaddressed.
- Importance: Critical challenges are central to the core objectives and goals of urban mobility, such as ensuring accessibility, safety, and sustainability.

Urgent Challenges

- Timeframe: Urgent challenges require immediate attention and action due to their time-sensitive nature. Delaying action on these challenges could lead to escalating problems or missed opportunities.
- Impact: Urgent challenges may vary in impact but share the characteristic of needing immediate resolution to prevent further escalation or negative consequences.

Non Important Challenges

- Impact: Non-important challenges have a relatively lower impact on urban mobility compared to important challenges. While they may still affect the quality of transportation services, they are not as immediately severe or disruptive.
- Importance: Non-important challenges may be important for long-term planning and improvement but are not as urgent for immediate action.

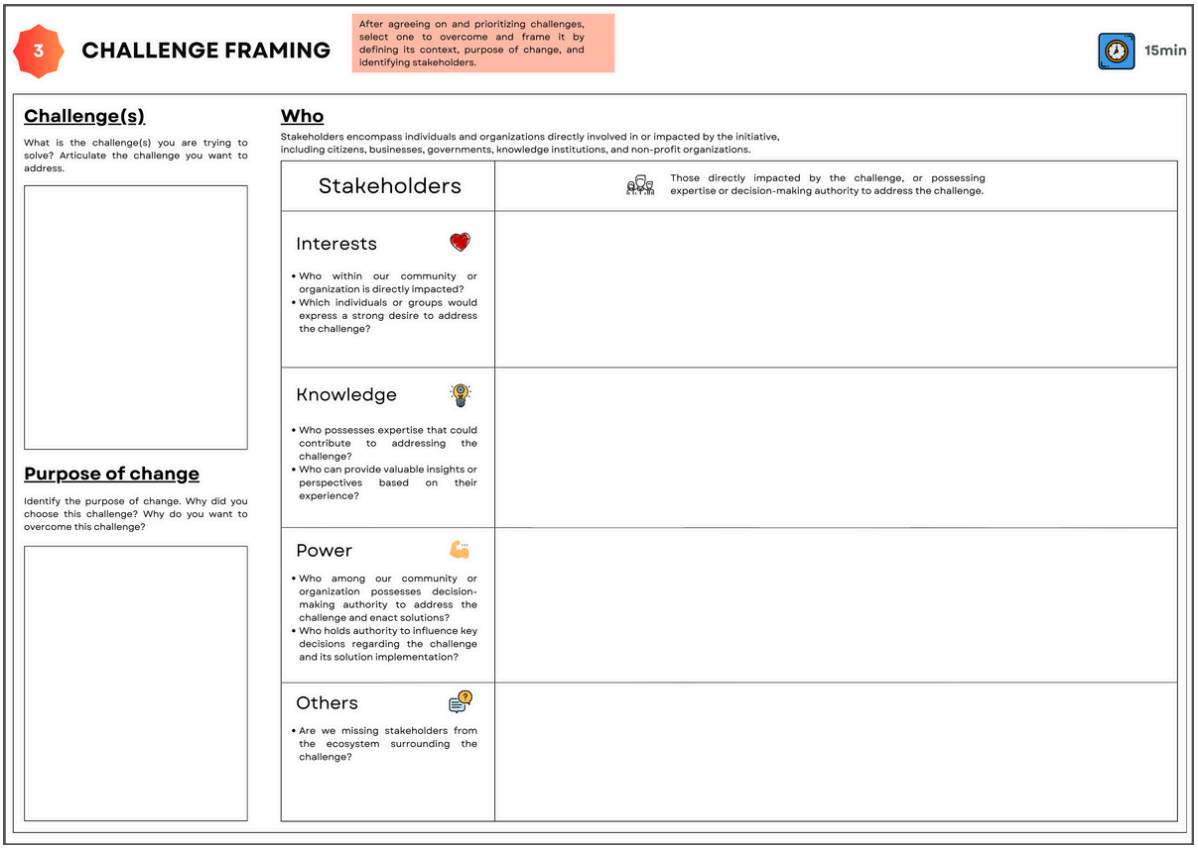
Non-Urgent Challenges

- Timeframe: Non-urgent challenges do not require immediate action and can be addressed over a longer timeframe without significant negative consequences.
- Impact: While non-urgent challenges may still be important for long-term planning and improvement, they do not pose immediate risks or disruptions to urban mobility.

Challenge Framing

Instructions

1. Ask the participants to pick a challenge from the prioritized challenges and move their card to the ‘Challenge’ box.
2. Ask the participants to define the purpose of change. The initial purpose of change relates to the current pressing mobility challenge.
3. Ask the participants to identify stakeholders. (Check page number 10, about stakeholders).



Stakeholders

Stakeholders encompass individuals and organizations directly involved in or impacted by the mobility challenge, including residents, vulnerable road users, businesses, governments, knowledge institutions, and non-profit organizations.

Interest

Who has which interests? individual and group stakeholders who could be interested or would be delighted if the challenge is solved. Which individuals or groups would express a strong desire to address the challenge?

Knowledge

Who has what knowledge or expertise in relation to the challenge? Individuals or groups who have expertise that could help address the challenge. Individuals or groups who can provide valuable insights or perspectives based on their experience.

Power

Who has the authority to influence key decisions regarding the challenge and its solution implementation? individuals or groups who have the decision-making authority to address the challenge and implement solutions.

Others

Who is not in the pre-defined categories, but could be identified as a stakeholder?

BREAK

10 minutes

IDEATE

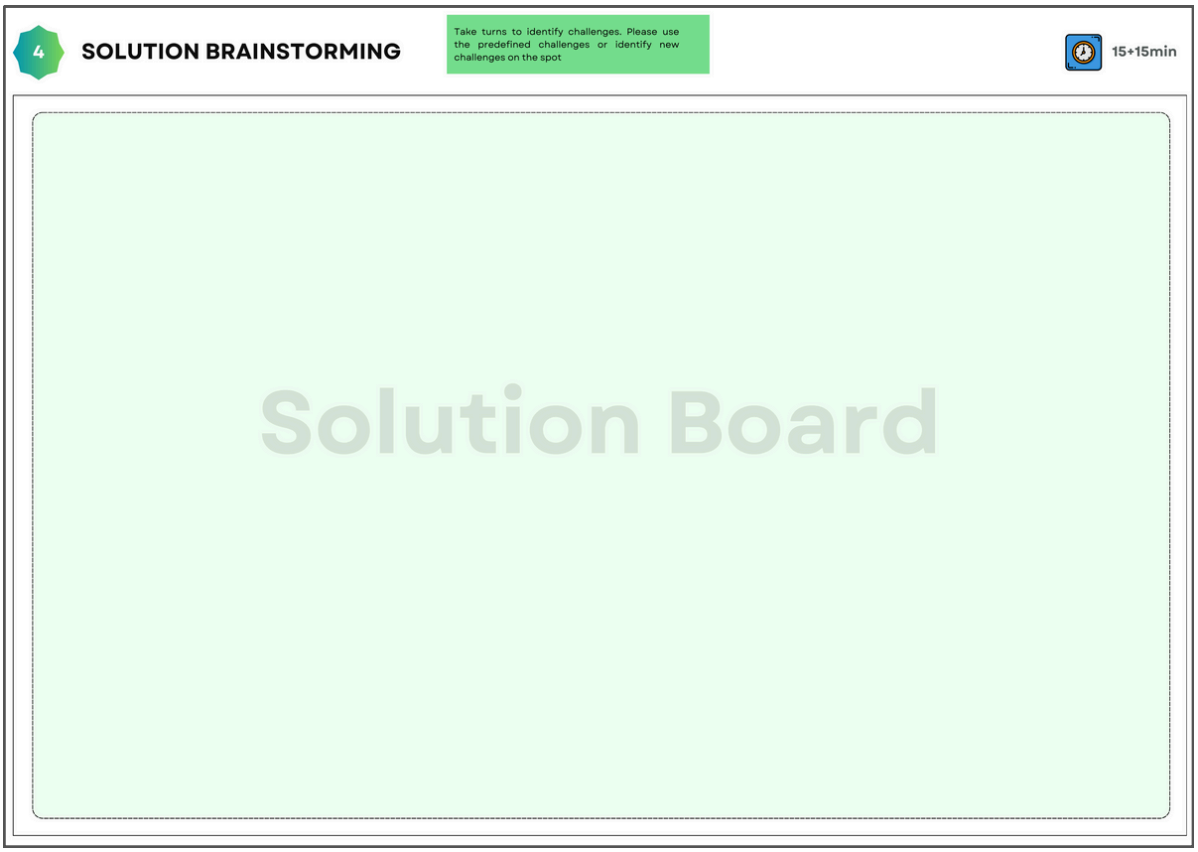
Brainstorm solutions, think systematically and holistically

Brainstorm

Instructions

1. Give the participants the separate brainstorming paper. These papers will be provided to the facilitator as part of the co-design tool.

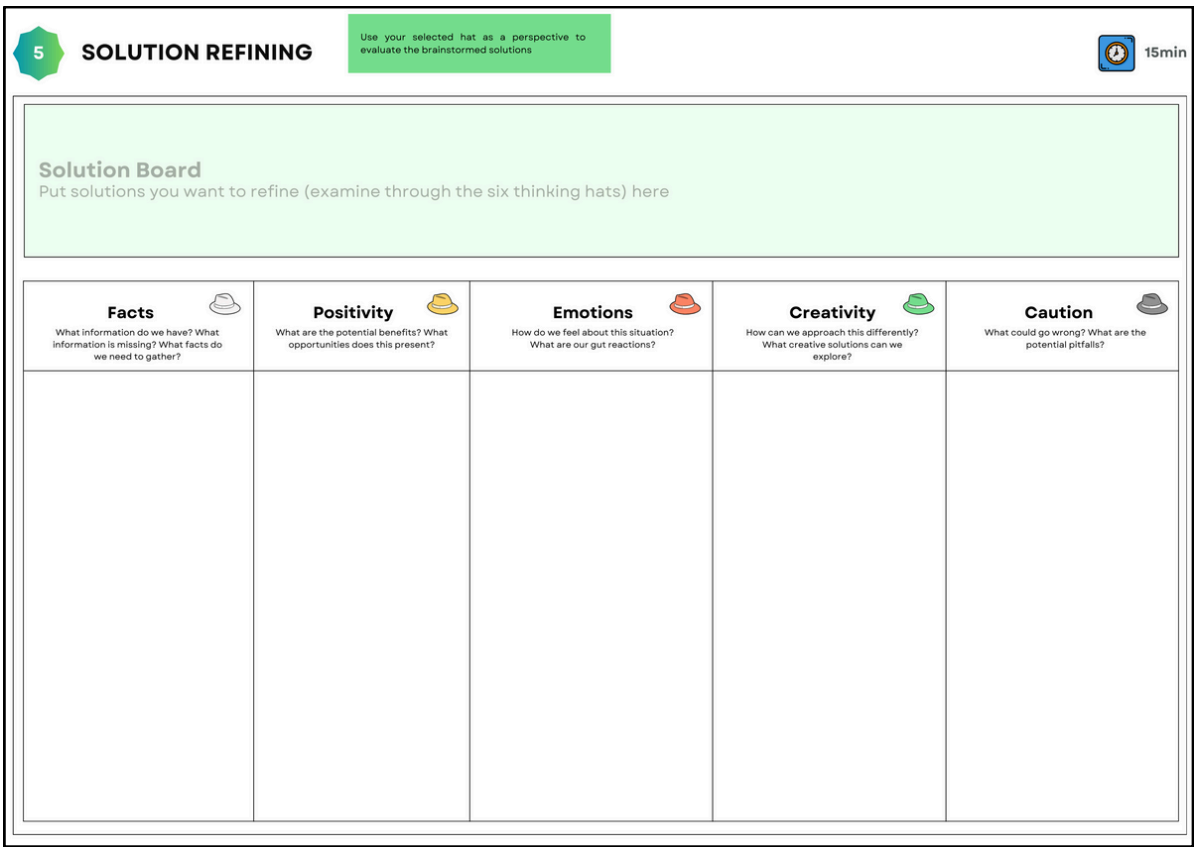
Note: Encourage participants to brainstorm without critique and to draw, sketch or write their ideas with pen and paper.



Refine

Instructions

1. Ask participants to choose one or more solutions to explore using the six thinking hats technique.
2. Ask participants to wear their imaginary hats to explore the solutions, they have brainstormed, in different dimensions. (The hats and questions are explained on page 15).



The Six Thinking Hats

"The Six Thinking Hats" is a method for group discussion and individual thinking. Each thinking role is identified with a colored symbolic “thinking hat.” By mentally wearing and switching “hats,” the participants can easily focus or redirect thoughts, the conversation, or the meeting.

White Hat

The White Hat calls for information known or needed.

- What information do we have about the problem we're solving?
- What data supports our understanding of the user's needs or preferences?

Green Hat

The Green Hat focuses on creativity; the possibilities, alternatives, and new ideas.

- How can we further refine and develop the creatively brainstormed solution?
- Are there any additional features or functionalities we can incorporate to make it even more innovative?

Yellow Hat

The Yellow Hat symbolizes brightness and optimism.

- What are the strengths or advantages of each solution?
- How might these solutions positively impact the user experience?

Black Hat

Risks, difficulties, Problems.

- What are the potential drawbacks or risks associated with each solution?
- Where might these solutions fall short in addressing the user's needs?
- Are there any unintended consequences we need to consider (ripple effect)?

Red Hat

The Red Hat signifies feelings, hunches and intuition.

- How do we feel about each proposed solution?
- What are our initial gut reactions to these ideas?
- Which solutions resonate with us emotionally, and why?

Blue Hat

The Blue Hat is used to manage the thinking process. The facilitator wear this hat to manage the systematic thinking process.

BREAK

10 minutes

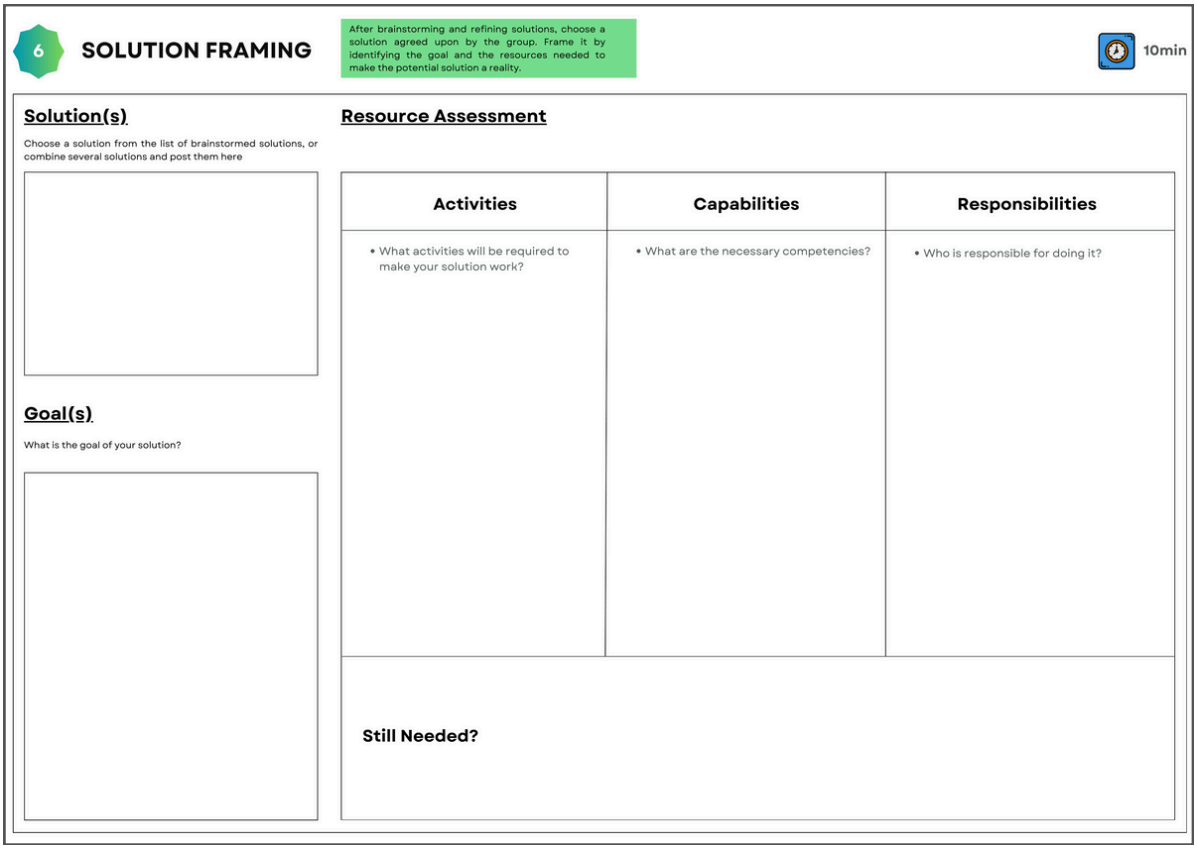
FRAME

Solution framing and resource assessment

Framing

Instructions

1. Ask participants to write their solution on a sticky note and place it in the solution box on the canvas.
2. Ask participants to identify the goal of their solution.
3. Ask participants to identify resources needed to make the potential solution a reality. (Check page 20)



Solution Framing

Solution framing enable participants to engage in discussion and select a solution from the array of potential solutions generated during the brainstorming and design thinking phases.

Solution/s

Ask participants to write their solution on a sticky note and place it in the solution box provided on the canvas. This solution will be the one chosen by participants as the best of the brainstormed solutions.

Goal/s

Ask participants to identify the goal of their solution. Ask them what they hope to achieve by overcoming the challenge with their solution.

Resource Assessment

You have produced a fantastic solution, but what is necessary to put it into action? This step helps the participants to grasp the feasibility of the proposed solution. Consequently, participants should conduct a resource assessment to gauge whether the solution is viable.

Activities

Activities are essential tasks required for the successful development of the solution. Participants are tasked with identifying activities they deem crucial for accomplishing the goal. These activities can be done by any of the stakeholders identified in the stakeholder identification activity.

Capabilities

Capabilities are the skills required to develop the solution. Capabilities relate to the stakeholders identified in the ‘Knowledge’ category.

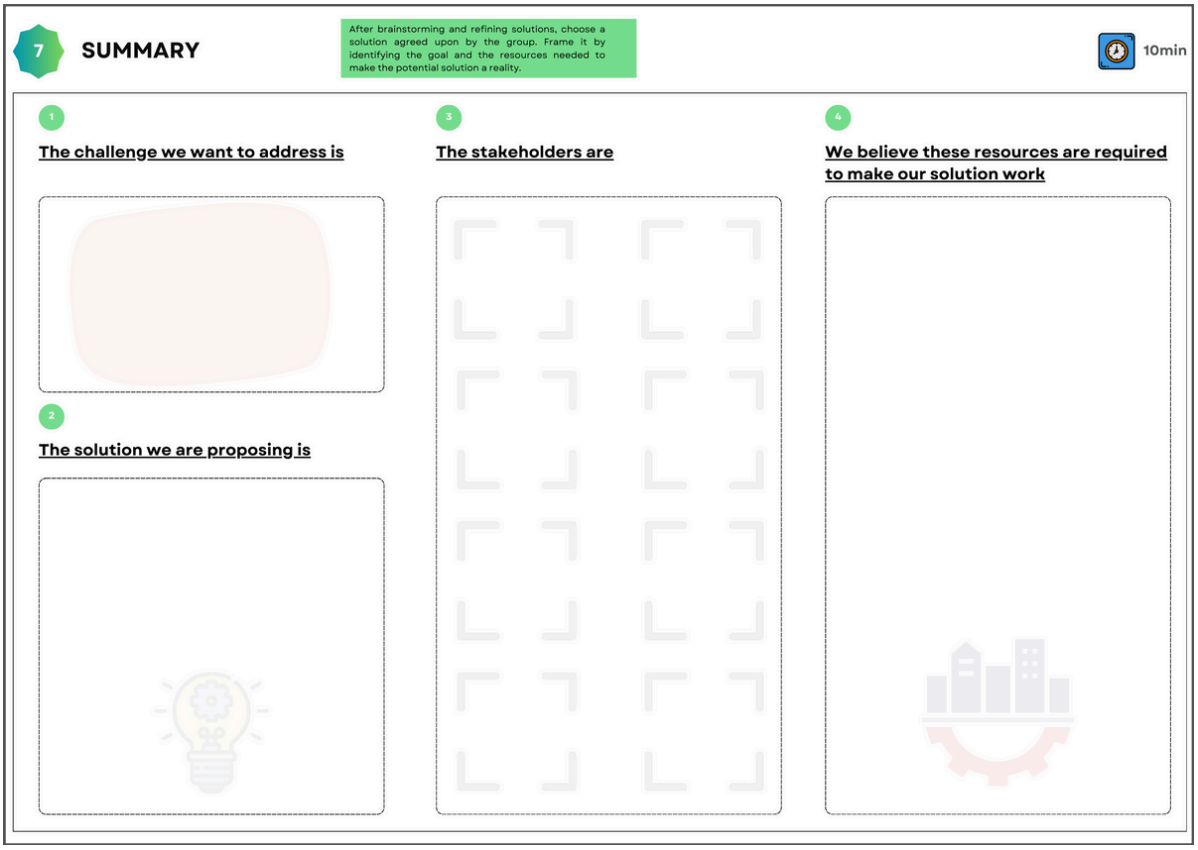
Responsibilities

Who is responsible for developing the proposed solution? This is related to the stakeholders identified in the ‘Power’ category.

Summary

Instructions

1. Ask participants to write the challenge on a sticky note and place it in the challenge box on the canvas.
2. Ask participants to write their solution on a sticky note and place it in the solution box on the canvas.
3. Ask participants to write the stakeholders on a sticky note and place it in the stakeholder box on the canvas.
4. Ask participants to write the resources needed on a sticky note and place it in the Resources box on the canvas.
5. Ask participants to present their summary to the other groups.



Summary

To conclude the workshop on a truly enriching note, it is highly beneficial to share the insights and discussions with the other participant groups. This practice not only captures the essence of collaborative learning, but also fosters a sense of community and shared understanding among all participants. By presenting the discussions, ideas and conclusions reached during the workshop, each group has the opportunity to gain new perspectives, learn from different viewpoints and further refine their own understanding. This collective sharing not only enhances the overall learning experience, but also ensures that the knowledge gained is widely disseminated throughout the workshop cohort, maximizing its impact and relevance for all involved.

THANK YOU

For using UMCoDC

Funded by the European Union

1

CHALLENGE IDENTIFICATION

Take turns to identify challenges. Please use the predefined challenges or identify new challenges on the spot

10min

Challenge Board

2

CHALLENGE PRIORITIZATION

After listing challenges, organize and group them, then use the Matrix to prioritize. This tool helps determine which challenges to address first, schedule for later, delegate, or discard.

10min

	Urgent	Not Urgent
Important	Do: Challenges which demand immediate attention	Schedule: Essential improvements that contribute to long-term success
Not Important	Delegate: Challenges that must get done but but not necessarily central to your goal	Delete: Challenges which aren't worth your time and you shouldn't do them at all

Divergent views

Put or note differences here

3 CHALLENGE FRAMING

After agreeing on and prioritizing challenges, select one to overcome and frame it by defining its context, purpose of change, and identifying stakeholders.

15min

Challenge(s)

What is the challenge(s) you are trying to solve? Articulate the challenge you want to address.

Purpose of change

Identify the purpose of change. Why did you choose this challenge? Why do you want to overcome this challenge?

Who

Stakeholders encompass individuals and organizations directly involved in or impacted by the initiative, including citizens, businesses, governments, knowledge institutions, and non-profit organizations.

Stakeholders	Those directly impacted by the challenge, or possessing expertise or decision-making authority to address the challenge.
Interests • Who within our community or organization is directly impacted? • Which individuals or groups would express a strong desire to address the challenge?	
Knowledge • Who possesses expertise that could contribute to addressing the challenge? • Who can provide valuable insights or perspectives based on their experience?	
Power • Who among our community or organization possesses decision-making authority to address the challenge and enact solutions? • Who holds authority to influence key decisions regarding the challenge and its solution implementation?	
Others • Are we missing stakeholders from the ecosystem surrounding the challenge?	

4 SOLUTION BRAINSTORMING

Take turns to identify challenges. Please use the predefined challenges or identify new challenges on the spot

15+15min

Solution Board

5

SOLUTION REFINING

Use your selected hat as a perspective to evaluate the brainstormed solutions

15min

Solution Board

Put solutions you want to refine (examine through the six thinking hats) here

Facts	Positivity	Emotions	Creativity	Caution
What information do we have? What information is missing? What facts do we need to gather?	What are the potential benefits? What opportunities does this present?	How do we feel about this situation? What are our gut reactions?	How can we approach this differently? What creative solutions can we explore?	What could go wrong? What are the potential pitfalls?

6 SOLUTION FRAMING

After brainstorming and refining solutions, choose a solution agreed upon by the group. Frame it by identifying the goal and the resources needed to make the potential solution a reality.

10min

Solution(s)

Choose a solution from the list of brainstormed solutions, or combine several solutions and post them here

Goal(s)

What is the goal of your solution?

Resource Assessment

Activities	Capabilities	Responsibilities
• What activities will be required to make your solution work?	• What are the necessary competencies?	• Who is responsible for doing it?

Still Needed?

7 SUMMARY

After brainstorming and refining solutions, choose a solution agreed upon by the group. Frame it by identifying the goal and the resources needed to make the potential solution a reality.

10min

1

The challenge we want to address is

2

The solution we are proposing is

3

The stakeholders are

4

We believe these resources are required to make our solution work