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Participatory approaches in shaping the mobility of the future: SINFONICA evaluation methodology

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Abstract

The SINFONICA project, funded under the Horizon Europe programme, developed and tested a participatory approach aimed at supporting the inclusive design and social validation of Cooperative, Connected, and Automated Mobility (CCAM) solutions. This paper presents the evaluation methodology adopted to assess the quality and effectiveness of the participatory process across three key phases: Design and Planning, Implementation, and Results and Impacts. The framework was applied in four European territories (Trikala, Hamburg, Noord-Brabant, and West Midlands), using both quantitative and qualitative methods. Evaluation results revealed that the approach was positively received for its inclusivity, coherence, and adaptability. Key outcomes include a stronger sense of ownership among participants, increased awareness of CCAM technologies, and improved collaboration among stakeholders. However, challenges emerged regarding the clarity of return mechanisms and the continuity of participant engagement. These findings underline the importance of process-oriented evaluations and provide actionable insights for scaling up participatory strategies in CCAM and other ITS-related initiatives. The SINFONICA evaluation framework offers a replicable model that can support public authorities and mobility stakeholders in designing equitable, human-centred mobility policies.

Keywords:

CCAM impact assessment: Societal implications

Introduction

Technological advancements in mobility, particularly CCAM solutions, are transforming how individuals and

communities interact with transport systems. However, the success of these innovations depends not only on their technical feasibility but also on their social acceptance and relevance to users' needs. Involving citizens and stakeholders in the process of designing recommendations for CCAM solutions is essential to ensure that these technologies address real-world challenges and improve the lives of all users, particularly those with mobility difficulties (Cargo & Mercer, 2008).

Vulnerable groups (or People with Mobility Challenges – PMC), such as elderly individuals, people with disabilities, and those living in rural areas, often face significant barriers to accessing transport services. Without their active involvement in shaping CCAM solutions, there is a risk that technological advancements will exacerbate existing inequalities rather than reduce them. Participatory approaches foster inclusivity by integrating the perspectives and lived experiences of these vulnerable groups, ensuring that new mobility systems respond to the needs of all societal segments and empower democratic decision-making processes (Auwerx et al., 2011). These processes also enhance trust and acceptance of new technologies, which is crucial for their successful deployment (Jagosh et al., 2012).

In recent Horizon Europe projects, participatory strategies have been increasingly recognized as key to designing inclusive and sustainable transport systems. Co-creation and co-design processes allow citizens, communities, and stakeholders to collaboratively address pressing mobility issues. Notable examples include projects such as MUV – Mobility Urban Values (2017–2020) and SUM – Seamless Shared Urban Mobility (2023–2026), which emphasize early and continuous stakeholder engagement to inform mobility planning. The MUV project, under the guiding principle “Building With, Not For”, implemented participatory methodologies to involve citizens in the development of urban mobility solutions. Through tools such as wearable apps, environmental monitoring, and data analysis, MUV facilitated collaborative problem-solving and behavioural change aimed at improving urban living conditions. The ongoing SUM project builds on similar principles but on a broader scale, integrating shared mobility with public transport across 15 European cities by 2026 (and 30 by 2030). By employing co-creation techniques and user-driven innovation across nine Living Labs, SUM seeks to deliver scalable and inclusive urban mobility services, including new infrastructure and shared mobility models.

Compared with these initiatives, the **SINFONICA** project distinguishes itself by placing a specific focus on **vulnerable and under-researched groups**, aiming to identify and respond to their particular needs and perceptions regarding CCAM. To achieve this, a comprehensive social analysis was carried out at the outset of the project to define relevant research groups and establish **Groups of Interest (GOI)** in four Living Labs across Europe. This ensured that local insights and requirements were fully integrated into the development of inclusive CCAM strategies. Moreover, a unique aspect of the SINFONICA project is its commitment to **evaluating the participatory process itself**. Understanding whether engagement strategies are properly designed and implemented is crucial for enhancing their effectiveness and legitimacy (Diputación Foral de Gipuzkoa, 2019). A well-structured participatory process can effectively capture diverse perspectives, promote meaningful engagement, and create actionable recommendations (Kuhn et al., 2021). In contrast, superficial or tokenistic involvement risks discrediting the entire participatory approach, where stakeholder input is collected but not genuinely integrated into decision-making processes. Through a systematic assessment of the participatory

Participatory approaches in shaping the mobility of the future: SINFONICA evaluation methodology process—its design, execution, and results—SINFONICA contributes to establishing **best practices for participatory governance in future mobility projects** (SINFONICA Consortium, August 2024).

This paper presents the **evaluation methodology** developed within the SINFONICA project to assess the participatory process across three interlinked phases: **Design and Planning, Implementation, and Results and Impacts**. By examining how well these phases were executed and the outcomes achieved, this evaluation provides insights into the effectiveness of participatory approaches in mobility planning.

Methodology Overview

The SINFONICA participatory evaluation framework was designed to assess the effectiveness of stakeholder engagement strategies. The evaluation process was conducted across three rounds of feedback collection with representatives of the four Groups of Interest where the participatory sessions took place: City of Trikala (Greece), City of Hamburg (Germany), Province of Noord-Brabant (The Netherlands), and the region of West Midlands (United Kingdom). Feedback collection tools included bilateral meetings, collective brainstorming sessions and questionnaires. The evaluation framework focuses on three key phases of the participatory approach, each with specific criteria and variables (SINFONICA Consortium, December 2024):

- Design and Planning Phase
- Implementation Phase
- Results and Impacts Phase

Design and Planning Phase

The first phase of evaluation focused on the design quality of the participatory framework and the engagement strategies used to involve stakeholders. Key criteria included suitability, coherence, feasibility, and design quality. Nine members of the GOI (2 from Trikala, 2 from Hamburg, 2 from West Midlands and 3 from Noord-Brabant) were interviewed, specifically they were asked to evaluate the participatory approach's effectiveness by means of a 5-point scale (from 1 = not at all to 5 = to a great extent). Their feedback, reported in table 1, revealed that the participatory framework was well-received for its inclusivity, coherence, and feasibility. Participants appreciated the clarity of guidelines and the opportunity to shape the methodology, which fostered a sense of ownership. However, some GOI noted the need for more time to adequately prepare and conduct activities such as focus groups and interviews. The foundational elements of the participatory approach were successfully established, creating a solid basis for the following phases.

Key criteria considered in this phase:

- Suitability: Evaluates whether the engagement strategies aligned with stakeholder needs.
- Coherence: Assesses the alignment between the project’s objectives and the methodologies employed.
- Feasibility: Examines the resource allocation and logistical planning.
- Design Quality: Evaluates the inclusivity and adaptability of the engagement strategies.

Table 1. Evaluation of the design quality of the participatory framework

	City of Trikala M	City of Hamburg M	Province of Noord-Brabant M	Region of West Midlands M	Total Sample (N = 9) M
KPI 1 Suitability					
<i>Suitability of Interviews</i>	4.67	3.42	3.67	4.00	3.98
<i>Suitability of Focus Groups</i>	4.67	3.50	3.67	4.17	4.05

<i>Scope</i>	5.00	5.00	4.00	3.50	4.50
<i>Rules of games (interviews)</i>	5.00	4.50	4.00	3.50	4.31
<i>Rules of games (focus groups)</i>	5.00	3.50	4.00	3.50	4.13
KPI 2 Coherence					
<i>Interviews</i>	100%	100%	100%	100%	100%
<i>Focus groups</i>	100%	100%	100%	100%	100%
KPI 3 Feasibility					
<i>Use of resources</i>	Internal resources	Internal resources	External resources	External resources	
KPI 4 Design Quality					
<i>Leadership Satisfaction</i>	5.00	4.50	5.00	4.00	4.71
<i>Diversity of participants</i>	4.50	4.50	4.00	4.00	4.33
<i>Transparency of information</i>	5.00	5.00	5.00	5.00	5.00
<i>Accessibility of information</i>	4.50	4.50	4.00	4.00	4.29

Implementation Phase

The second phase focused on the execution of the participatory activities and the adaptability of the engagement strategies. Key criteria evaluated included process quality, execution, and flexibility. This phase demonstrated the adaptability and inclusivity of the participatory strategies. Tailored methodologies addressed the diverse needs of participants, including vulnerable groups, and created synergies with local initiatives. Feedback mechanisms enabled iterative improvements, enhancing the quality of engagement over successive rounds.

A collective internal brainstorming session held in Turin in March 2024, where representatives of the GOI together with the other consortium partners took part, provided valuable insights. This session allowed data collection leads to discuss challenges encountered and collaboratively refine engagement strategies. Despite the success in fostering meaningful participation, maintaining participant engagement and ensuring clear communication about the process and outcomes were identified as areas needing improvement.

Key criteria considered in this phase:

- **Process Quality:** Evaluates the effectiveness of interactions and the overall quality of engagement activities.
- **Execution:** Assesses the delivery of planned actions against the original objectives.
- **Flexibility:** Measures the ability of the process to adapt to evolving contexts and feedback.

In this case the analysis was conducted in a qualitative way, giving the opportunity to the GOI representatives to express in an open format their opinions regarding the different variables considered for each of these criteria. Regarding the Process Quality, as an example, Synergies with other processes; Adaptation to participants' needs and agendas; and Dynamization has been the variables analysed.

Results and Impacts Phase

The final phase of the evaluation assessed the long-term outcomes of the participatory process, focusing on its contribution to trust-building, empowerment, and societal impacts. Nine members of the GOI (2 from Trikala, 2 from Hamburg, 3 from West Midlands and 2 from Noord-Brabant) were interviewed, specifically they were asked to evaluate the results obtained on a 5-point scale (from 1 = not at all to 5 = to a great extent). The Key criteria included efficacy, efficiency, and impacts.

The evaluations of the GOI are reported in Table 2 and revealed that for participants the participatory approach delivered meaningful outcomes, fostering trust, empowerment, and inclusivity. Stakeholders reported increased awareness of CCAM technologies and expressed satisfaction with their ability to contribute to the process. The participatory process helped build trust and collaboration among stakeholders, creating a foundation for future engagement.

However, the evaluation highlighted the need to improve return mechanisms—ensuring that participants receive feedback on how their contributions have influenced decision-making. Strengthening these feedback loops will reinforce participants' trust and promote long-term engagement (Vaughn & Jacquez, 2020).

Key variables considered in this phase:

- Efficacy: Assesses whether the participatory process achieved its intended objectives.
- Efficiency: Examines resource utilization and cost-effectiveness.
- Impacts: Evaluates the long-term outcomes, including trust-building and participant empowerment.

Table 2. Evaluation of the results and impacts of the participatory framework

	City of Trikala M	City of Hamburg M	Province of Noord-Brabant M	Region of West Midlands M	Total Sample (N = 9) M
KPI 1 Efficacy					
<i>Achievement of objectives</i>	5.00	3.75	4.50	5.00	4.42
<i>Inclusivity and representation of target groups</i>	5.00	3.50	4.00	4.00	4.14
<i>Promotion of Social equity</i>	4.00	4.50	4.00	4.00	4.14
<i>Engagement (interviews)</i>	4.00	4.00	5.00	4.00	4.20
<i>Engagement (focus groups)</i>	5.00	5.00	5.00	4.00	4.80
<i>Engagement (workshops)</i>	5.00	4.00	4.00	4.00	4.20
KPI 2 Efficiency					
<i>Effort-benefit ratio interviews</i>	4.00	4.00	4.00	3.00	3.80
<i>Effort-benefit ratio focus groups</i>	4.00	4.00	4.00	3.00	3.80
<i>Effort-benefit ratio workshop</i>	4.00	3.00	4.00	2.00	3.20
KPI 3 Impact					
<i>Ability in engaging people</i>	4.50	4.50	4.00	4.00	4.14

<i>Improved skill in participatory approach</i>	4.50	4.50	4.00	4.50	4.38
<i>Improved skill in identifying mobility challenges</i>	5.00	4.50	5.00	4.00	4.57
<i>Improved skill in identifying mobility needs</i>	4.00	4.00	4.00	3.00	3.67
<i>Improved skill in increasing CCAM acceptance</i>	4.00	3.75	3.75	4.00	3.86
<i>Participatory approach as enriching experience</i>	5.00	4.50	4.00	5.00	4.50

From lessons learned to policy insight: how participation shapes future mobility strategies

The evaluation process highlighted several key learnings:

- The importance of clear communication and transparency in fostering trust.
- The need for flexible engagement strategies to address diverse stakeholder needs.
- The value of iterative feedback loops to continuously improve the participatory process, adjusting and modifying the action plans based on received insights and feedback from the participants
- The necessity of tailoring methodologies to local contexts and participant characteristics.
- The importance of properly employing qualitative and quantitative methods to effectively gather information and data from participants. Participatory approach evaluation frameworks like the one developed in SINFONICA contribute directly to evidence-based policymaking. Participatory evaluation does more than validate project-level engagement efforts—it generates insights into how different population groups perceive risk, value safety, and define mobility needs. This information is essential for public authorities seeking to shape long-term strategies for sustainable urban mobility. In particular, it provides a mechanism for social validation of ITS policies, highlighting potential acceptance barriers and ethical implications early in the innovation cycle. Thus, it ensures that policy frameworks are aligned with citizen values and responsive to changing societal expectations (Cargo & Mercer, 2008; Vaughn & Jacquez, 2020). Furthermore, the proper implementation of participatory methods can help track public sentiment over time, acting as an ongoing “policy pulse” to inform adaptive regulatory strategies—especially in rapidly evolving fields like CCAM and ITS.

The modular nature of the SINFONICA evaluation framework makes it highly scalable and context-adaptable for citizens and stakeholders engagement processes for the design of future ITS applications beyond CCAM. For instance, elements of the framework could be embedded into Living Labs, pilot programs for MaaS (Mobility as a Service), or assessments of AI-enabled traffic management systems. By offering a structured yet flexible approach to assess the quality of the participatory process, the SINFONICA evaluation framework helps to ensure that ITS innovations remain human-centric and locally relevant, even when scaled across regions or countries (Kuhn et al., 2021; CIVITAS, 2011).

- With reference to other Horizon projects on mobility, the Common Evaluation Methodology (EU-CEM) that is being developed in the **FAME project** offers structured, comprehensive guidance for planning

Participatory approaches in shaping the mobility of the future: SINFONICA evaluation methodology and conducting evaluations in the CCAM context. EU-CEM methodology helped SINFONICA position its evaluation within the wider CCAM landscape by clarifying technical and societal impact evaluation strategies. Besides, participating in the FAME summer school deepened the SINFONICA team's understanding of CCAM evaluation principles and practices. On the other hand, it's noted that the EU-CEM methodology does not address participatory evaluation, which is central to SINFONICA's goals, highlighting a gap in existing CCAM evaluation tools. This experience emphasized the importance of creating evaluation frameworks that also assess process quality, such as inclusivity and responsiveness in citizen engagement, not just the outcomes.

Recommendations

Based on the evaluation findings, the following recommendations are proposed to enhance future participatory approaches in mobility planning:

- Establish robust feedback mechanisms to ensure participants understand how their contributions influence decision-making.
- Develop tailored communication strategies to maintain participant engagement throughout the process.
- Foster collaboration with local initiatives to create synergies and enhance the relevance of engagement activities.
- Ensure that engagement strategies are adaptable to evolving contexts and participant needs.

Conclusion

The evaluation of the participatory process within the SINFONICA project highlighted the significant role of inclusive, adaptive, and transparent engagement strategies in shaping future mobility solutions. The evaluation confirmed that participatory approaches, when well-structured and adequately supported, lead to more user-centric outcomes, enhanced stakeholder empowerment, and broader societal acceptance of technological innovation. Nevertheless, specific shortcomings—such as limited feedback loops and inconsistent engagement continuity—demonstrated the need for strengthened communication strategies and long-term involvement plans. The modular and scalable nature of the SINFONICA evaluation framework makes it a valuable tool for future ITS initiatives, helping to assess not only outcomes but also the quality of participatory processes. Its application in diverse European contexts demonstrates the framework's flexibility and potential for replication, supporting public authorities and project developers in aligning mobility innovations with the values, needs, and expectations of diverse communities.

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