

Change – The transformative power of citizen science

## The MLE CS responsible and inclusive scalability toolkit

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### Abstract

This paper presents the Scalability Toolkit developed in 2021–2023 within the “Mutual Learning Exercise on Citizen Science Initiatives – Policy and Practice” to provide a theoretical and methodological framework to support the scaling of CS projects and initiatives responsibly and inclusively.

The Toolkit is made of three components: i) a multidimensional qualitative definition of scalability, ii) an operational scalability matrix composed of four models (scaling up, out, deep and down) and two approaches (top-down and bottom-up), and iii) eight action areas for policy making.

Building on this work, further research as well as a cultural mind shift is needed to further develop value-driven scalability models in CS according to more qualitative and ethical dimensions, the specific logic of CS projects as well as their domain and context dependency.

**Keywords:** citizen science, policy, practice, upscaling, scalability, sustainability, open science.

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## Introduction

This paper presents the Scalability Toolkit developed in 2021–2023 within the “Mutual Learning Exercise on Citizen Science Initiatives – Policy and Practice” (hereafter indicated as MLE CSI-PP). The MLE CSI-PP project was initiated by the DG Research and Innovation as part of the Policy Support Facility to focus on five specific and operational R&I topics related to citizen science (CS) with eleven EU countries participating in the MLE CSI-PP.

The Scalability Toolkit stems from Topic 5 of the MLE CSI-PP which focused on scaling up CS and aimed at filling a gap of knowledge about success factors and challenges for scaling up CS projects as well as generating insights on CS infrastructures and funding developed across Europe in support of upscaling CS.

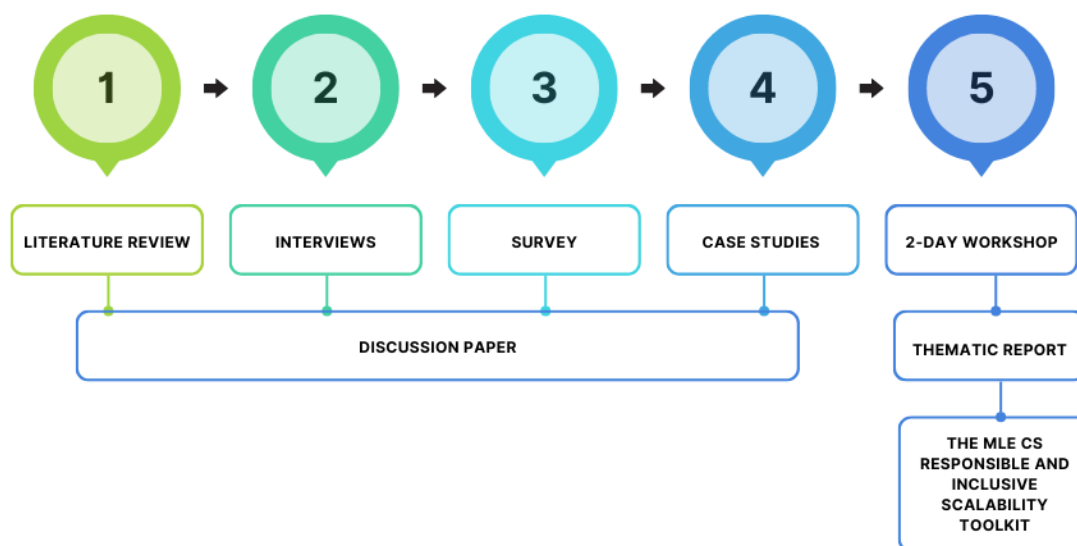
A literature review conducted in 2022 showed that only a few CS studies addressed the topic of scalability/up-scaling CS projects (i.e., Maccani et al. 2020, Maturano 2020), and that there was a lack of consensus on the meaning of scalability as either underexplored or used inconsistently as a synonym of spreading or replicating (Maccani et al. 2020). It furthermore showed limited knowledge about success factors and challenges for scaling up CS projects, apart from the 9-Drivers framework developed in a study supported by the Joint Research Center of the European Commission (Maccani et al. 2020).

Despite the «Scaling Ambition» of successful CS projects and initiatives developed across Europe in the past years (Maturano 2020), questions about what scalability means in CS, how to measure it, and how to scale CS projects and initiatives were still under-investigated in the field of CS.

## Methods

Considering the limited literature on the topic, a mixed-methods approach was applied to address the open questions mentioned above. It consisted of i) literature review, ii) interviews with seven experts in the field of CS and related disciplines, iii) a survey distributed among the participants in the MLE CSI-PP project and iv) three focus groups run during a 2-day workshop held in 2022 in Berlin with the project team and external stakeholders (Fig. 1).

Further details about the mixed-methods approach can be found in the Discussion Paper which was prepared as a baseline study for the participants in the Berlin workshop (Radicchi et al. 2022). The knowledge generated through the three focus groups held during the Berlin workshop was analysed through qualitative content analysis and leveraged to produce the Thematic Report, which includes the Scalability Toolkit (Radicchi et al. 2023).



**Figure 1** illustrates the mixed-methods methodology and outputs underpinning the development of the MLE CS Responsible and Inclusive Scalability Toolkit (image © Antonella Radicchi 2024, presented during ECSA24 conference)

## Results and Discussion:

### The MLE CS Responsible and Inclusive Scalability Toolkit

The MLE CS Scalability Toolkit offers a theoretical and methodological framework to support the scaling of CS projects and initiatives in a responsible and inclusive way.

This Toolkit is made of three components: i) a multidimensional qualitative definition of scalability, ii) an operational scalability framework and iii) eight action areas for policy making. These three components are summarised below and further described in (Radicchi et al. 2023).

It became evident in the MLE CSI-PP project that it is important to move beyond quantitative definitions of scalability, which refer to rapid growth in the size of the number of participants or the geographical area covered (Maccani et al. 2020). Conversely, we argue that (up)scaling should be (re)defined according to more qualitative, inclusive and responsible dimensions, the specific logics of CS projects and initiatives as well as their domain and context dependency.

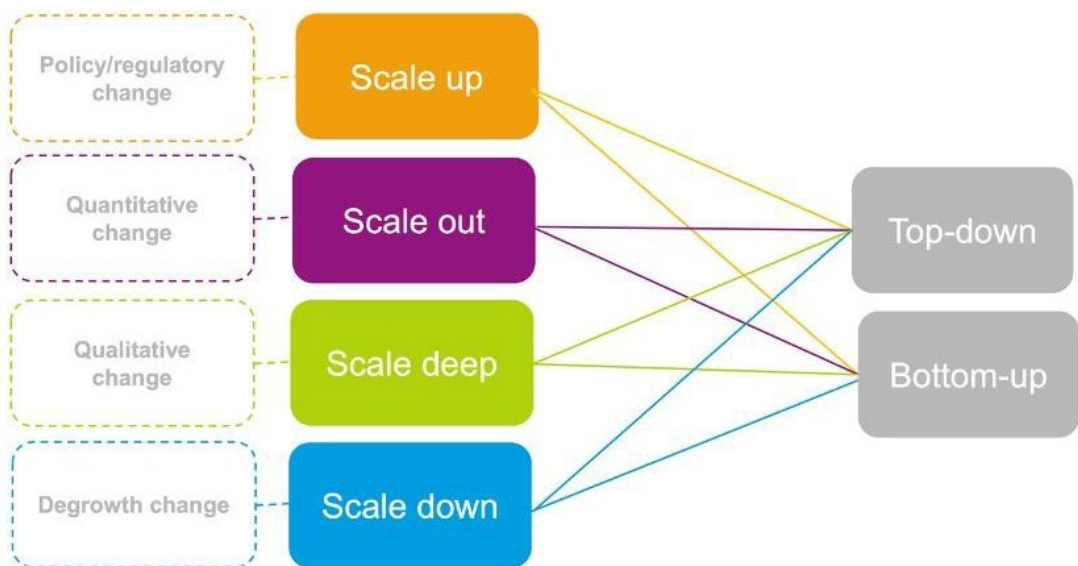
Following the logic of a qualitative, inclusive and context/domain-specific definition of scalability, four models and two approaches to scalability were identified (Fig. 2) building on systemic social innovation scholarship (e.g., Virani 2015) and the collective knowledge generated through the three focus groups (Radicchi et al. 2022; Radicchi et al. 2023).

These four scalability models (scaling up, out, deep and down) and the two approaches (top-down and bottom-up) are to be intended as not mutually exclusive. They are briefly explained in the following and in greater detail in (Radicchi et al. 2023).

The “scaling up model” refers to institutional changes achieved through the upscaled CS projects/initiatives, which can become an integral part of a policy or an approach within a given institution or lead to policy and/or legal changes. The “scaling out model” is mainly quantitative and refers to the replication and dissemination of CS projects/initiatives according to specific dimensions such as the geographic and the temporal spread, the research scope, the communities engaged, the amount of data collected, and the technology/methodology deployed. The “scaling deep model” is primarily qualitative and refers to CS projects that have an impact on cultural changes and beliefs such as trust in science by the citizens and trust in CS by the scientists. The “scaling down” model refers to quantitative change at the level of de-growth which can occur in relation to the geographic/temporal spread, the communities engaged, the amount of data collected, and the technology/methodology deployed, with the ultimate goal to remain aligned to the projects’ logic and aims.

Top-down approaches imply a deliberate (political, scientific or science engagement) strategy to up-scale a certain project (see, e.g., the Plastic Pirates project), whereas in the case of bottom-up approaches the scaling is more organic and fostered by grassroots movements with support from local stakeholders (see, e.g., the OpenStreetMap project).

The MLE CSI-PP project was meant to generate knowledge to inform CS policy and practice. During the Berlin workshop, one of the focus groups was dedicated to the discussion of scalability in CS for policy-makers willing to support the responsible and inclusive scalability of CS projects. From the analysis of the data generated by the participants in the focus group, eight action areas were identified. They revolve around the need to i) rethink the meaning of innovation and scalability and ii) foster and support responsible and inclusive scalability approaches through ad-hoc funding programmes and evaluation criteria. These action areas are further described in (Radicchi et al. 2023).



**Figure 2** illustrates the four models and the two approaches to scalability in CS which compose the MLE CS Responsible and Inclusive Scalability Framework (image © Antonella Radicchi 2024 presented during ECSA24 conference)

## Conclusions

The MLE CS Scalability Toolkit supports inclusive and responsible scalability in CS.

Building on this work, further research as well as a cultural mind shift is needed to further develop value-driven scalability models in CS beyond the profit-driven logic underpinning entrepreneurial innovation. Along these lines, it's encouraging to see novel EU projects currently underway (such as IMPETUS, OTTERS, ScienceUS and Crops) that aim to further explore the topic of scalability in CS in support of social, cultural and environmental innovation and responsible changes.

## Acknowledgements

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