Developing Tools for Cross-Sectoral Collaboration: Seven Principles to Design Boundary Objects for Systemic Change

This **multi-case study** of two cross-sectoral sustainability initiatives proposes a framework to improve the design, deployment, and assessment of science-based tools that help to facilitate systemic change. **Systemic change**, addressing socio-ecological problems, such as climate change or biodiversity loss, requires **cross-sectoral collaboration (CSC)**, that is: collaboration between actors from government, business, associations, civil society, and academia (Dentoni et al., 2020; Stadtler et al., 2024). As these actors join the CSC with different assumptions and goals, a shared set of **management tools** can help them to bridge cognitive gaps, find a common language, coordinate activities, and build a shared identity (Carlile, 2002, 2004; Sharma et al., 2022; UNDP, 2022).

Whilst many management tools to support collaboration exist, these tools are often not fit to support cross-sectoral systemic change (Waddell et al., 2015). This can be attributed to two issues. First, management tools tend to be highly task- and goal-oriented. For example, in sustainability management, life-cycle assessment focuses on just one product and how it can become more efficient, leaving many systemic opportunities unnoticed (Finnveden et al., 2009). Thus, using task-specific tools bears risks when facilitating systemic change: root causes can be obscured, salient connections remain unnoticed, leverage points go unrecognised (Dentoni et al., 2020; Dorado et al., 2022). Second, management tools are often developed with specific user groups in mind and follow implicit assumptions. For example, a business model canvas assumes profit as the main goal (Osterwalder et al., 2005), which can become problematic when the tool is used to collaborate with not-for-profit actors. Therefore, traditional management tools are not fit to address the demands of cross-sectoral collaborative boundary work.

The emergent gap in tool development for systemic change is mostly filled by CSC-tools that are being developed by intermediaries, brokers, consultants, and researchers who want to address collaborative challenges they encounter in the field (cp. Brouwer et al., 2016; Jordan et al., 2021; UNDP, 2022). Some CSC-tools are high level frameworks, such as the United Nations Sustainable Development Goals or the Systemic Design Framework (Nonet et al., 2022; UK Design Council, 2021). Other times, the CSC-tools address specific parts of the collaboration process or focus on facilitating work on a specific concept, such as a circular economy (Blomsma & Brennan, 2022; UNDP, 2022). Sometimes such tools are are grounded in scientific frameworks and co-developed with practitioners (Sharma et al., 2022). But **across all these CSC-tools, we lack coherent design principles that would allow to assess their effectiveness**. This is problematic because without a proper design framework tool developers lack the means to develop and iterate their tools towards better results. Therefore, in this paper we ask the **research question**: *How can we support the process of designing, deploying, and assessing cross-sectoral collaboration tools towards systemic, socio-ecological change?*

We address this research question through an **Action Design Research (ADR)** study within two cross-sectoral initiatives that want to create more sustainable and circular place-based ecosystems. Our inquiry and data interpretation draws on ADR methodology and the corresponding principles (Sein et al., 2011; Sein & Rossi, 2019) complemented by further literature on collaborative inquiry in Action Research (Bradbury et al., 2019; Coghlan, 2011; Torbert, 2003) and Design Science (Collatto et al., 2018; Romme, 2003; Simon, 1996; Tuunanen et al., 2024). First, we identify the problem that informs our research question. Next, we develop design principles building on the theoretical foundation of **boundary objects** and **collaborative boundary work** (Carlile, 2002, 2004; Langley et al., 2019; O'Mahony & Bechky, 2008; Star, 2010; Star & Griesemer, 1989). We validate the emerging design principles in the field while co-developing tools within the **two cross-sectoral initiatives**. The collaborations lasted 13 months (Slovenia Deep Demonstration) and 11 months (Bergisch Circular). Our **data** includes observations, surveys, collaborative design and reflection sessions, interviews, auto-ethnographic notes, written communication, and formal reports and documents.

The **findings** point to two additional design principles that have not been covered in previous literature on boundary objects and collaborative boundary work. The first principle illuminates the salience of different **reflexivity modes** (Archer, 2003, 2012) when developing CSC-tools. We demonstrate that some actors are more likely to embrace systemic tools, while others will feel resistant due to their dominant reflexivity modes. Therefore, tools will require translations to the respective reflexivity modes of their users. Accordingly, the second principle highlights the role of **internal change agents** (Heucher et al., 2024) in translating and customising collaboration tools inside their own organisation. The result is a design framework the proposes 7 principles for developing system transformation tools that are grounded in organisational theory, sociology, and empirical data. We refer to this framework as the **Seven Principles for Transformative Collaboration Tools (7P-TraCT)**. The framework supports the initial design, iteration, and assessment of tools that facilitte cross-sectoral systemic collaboration.

This paper contributes to the literature on **impact scholarship** and **cross-sectoral collaboration** by proposing a framework that enables the development of better collaboration tools. With that, the paper has strong implications for practitioners who engage in tool development. We also contribute to the literature on **boundary objects** and **boundary work** by highlighting the role of cognitive boundaries and the roles of change agents. Further, we demonstrate how research on boundary objects can support ongoing transformation processes towards desirable futures (Gümüsay & Reinecke, 2024). This is new as previous research on boundary objects mainly looked backwards employing ethnographic or historical data.

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