

Co-Design for Systemic Change: Exploring How Design Practices Support Climate Neutrality in European Municipalities

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Abstract

European municipalities face the urgent and complex challenge of achieving climate neutrality. Within the “EU Mission for 100 Climate-Neutral and Smart Cities by 2030”, co-design has been promoted as a means to foster collaboration, build shared visions, and support systemic transformation. Yet, despite the growing recognition of design’s role in this context, limited empirical evidence exists on how it contributes to systemic change within municipal organizations. This doctoral research investigates the role of co-design in enabling systemic approaches to climate neutrality through a comparative case study across eight European mission cities, and examines the extent to which these practices become internalized within municipal routines. By framing co-design as a relational, systems-oriented, and learning-based practice, the study contributes to Participatory Design research and offers insights into how design capabilities can be embedded and sustained within public institutions to drive long-term climate transition.

CCS Concepts

• Human-centered Computing; • Interaction design; • Interaction design process and methods; • Participatory design;

Keywords

Co-design, Systemic Design, Public Sector, Organizational Learning, Climate Transition

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1 OVERVIEW OF THE PHD PROJECT

European city administrations and municipalities are increasingly confronted with the urgent and complex challenge of achieving climate neutrality. These types of challenges, often defined as ‘wicked problems’ [1], require simultaneous, cross-sectoral, and systemic approaches [2]. In response, the European Commission launched the EU Mission for “100 Climate-Neutral and Smart Cities by 2030”,

also referred to as “EU Cities Mission”, which encourages participating cities to adopt a systemic approach to climate neutrality – one that understands the complexity of urban challenges, designs coordinated actions and engage multiple stakeholders [3]. Within this framework, co-design has been increasingly promoted as a means to engage diverse actors in shaping strategies, developing portfolios of actions, and building shared visions for change.

However, while co-design in the context of systemic innovation and transitions is increasingly recognized, little empirical evidence documents how this unfolds in practice [4, 5].

For co-design to realise its systemic potential, it must move beyond isolated projects and become embedded in the everyday work of public institutions, leading to organizational change [6–8]. It has been argued that design tools and cultures within organisations are mutually reinforcing due to their experiential nature [9], and design has long been recognised as a creative process that enables learning [10]. In this sense, organizational change is conceptualised here as a process that unfolds through learning fostered by design.

Central to this PhD research is an understanding of co-design as (1) a relational practice that enables collaboration and shared sense-making [11, 12]; (2) a systems-oriented approach that privileges inquiry over predefined outcomes [4, 5]; and a (3) learning process through which participants make practice with the way designers work and engage in reflection [13]. This conceptual framing positions co-design not merely as a participatory method, but as a driver of organizational learning and systemic change within municipalities pursuing climate neutrality.

This PhD research addresses this challenge by exploring the role of co-design within municipal transition teams engaged in the EU Cities Mission. It investigates how co-design practices support the implementation of systemic approaches to achieve climate neutrality and how they foster organizational learning within municipalities, enabling the internalisation of design capabilities. The study adopts a comparative case study approach involving eight European Mission Cities, combining document analysis, semi-structured interviews with municipal actors, and co-design sessions with city advisors, as experts of city experiences. The research is conducted at Politecnico di Milano within the MSCA Doctoral Network CoDesign4Transitions, with empirical work carried out in collaboration with the NetZeroCities (NZC) project.

2 RESEARCH MOTIVATION AND QUESTIONS

As a design professional and researcher with experience across academia and industry, I am driven by an interest in how design can enable systemic change within society. Through my previous work as a design consultant in both private and public sector



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projects, I have often observed a limited understanding of the value of design beyond its traditional role of creating products or services. This experience has motivated me to explore how design can be better recognized and embedded within organisations for its contribution to address complex societal challenges. I have also recognised a persistent gap between theory and practice, and between academic discourse and its implementation within organisations. This PhD represents an opportunity to bridge that gap by investigating how co-design capabilities can be internalised within European municipalities to foster systemic change and support the transition toward climate neutrality. Beyond an academic pursuit, this research reflects a personal commitment to contributing to societal transformation in response to the urgent challenge of climate change.

Given the exploratory nature of the project, the current research questions are designed to guide the initial inquiry and will be refined as empirical work progresses:

Main Research Question: What is the role of design in the implementation of a systemic approach to achieve climate neutrality in the EU Cities Mission?

SRQ1: How do co-design practices support the implementation of a systemic approach within EU municipalities?

SRQ2: How are these co-design practices internalised in the everyday work of municipalities, as evidence of organizational learning?

3 LITERATURE REVIEW

3.1 Context & background

European municipalities are increasingly confronted with the urgent and complex challenge of achieving climate neutrality. Such challenges—often characterised as wicked problems (Rittel & Weber, 1973)—require cross-sectoral and systemic approaches capable of addressing the interconnected social, environmental, and institutional dimensions of urban transitions (Mayne et al., 2020). Although cities cover only about 3% of the Earth's land surface, they produce roughly 70% of global greenhouse gas emissions, placing them both at the centre of the problem and at the forefront of sustainability transitions [3, 14, 15]. In response, the European Commission launched the Mission for 100 Climate-Neutral and Smart Cities by 2030, which calls on municipalities to adopt systemic approaches that integrate innovation, governance, and citizen participation (European Commission, 2020). Within this framework, co-design has emerged as a key approach to involve diverse actors—within and beyond city administrations—in shaping strategies, developing portfolios of actions, and building shared visions for transition.

The Mission is implemented through the NetZeroCities (NZC) project, a service-oriented platform that supports cities in overcoming structural, institutional, and cultural barriers to climate neutrality. NZC provides instruments, methodologies, and tools that help public administrations develop systemic plans and new governance models for climate action. The notion of “missions,” as adopted in the Horizon Europe programme, builds on [16]’s work and refers to strategic, outcome-oriented goals that require transformative systems change [17]. This mission-oriented framework establishes the policy context within which this PhD research

investigates how co-design can enable systemic approaches and organisational learning within municipalities pursuing climate neutrality.

In response to these systemic challenges, design has evolved from a practice centred on artefacts and solutions toward one concerned with relationships, systems, and learning. The following sections conceptualise co-design along three interrelated dimensions—relational, systemic, and learning-oriented—that together form the theoretical foundation of this research.

3.2 Co-design as a relational practice

While the long-term transformations required to address sustainability challenges are not designable per se, co-design plays a key role in meaningfully engaging the multiple stakeholders necessary for societal change [4, 5, 18]. Within the public sector, this has prompted a shift in perspective—from viewing design as a set of tools and methodologies to recognising it as a socially situated, fluid, and interconnected practice. Co-design thus operates as a relational practice, building cooperation and trust among heterogeneous actors while creating the social conditions for change [11, 12].

By engaging diverse stakeholders, including communities, third-sector organisations, universities, municipalities, government agencies, and other public-sector actors, as in the case of the EU Cities Mission, design is increasingly understood as part of a broader network where agency is distributed across actors. This networked and situated orientation embodies what has been termed the relational turn in design [12], which carries significant implications for its role in the public sector and its potential to address complex, systemic challenges. For municipalities, adopting this relational stance implies fostering collaboration and shared sense-making across departments, sectors, and communities—conditions that are fundamental for enabling systemic change.

3.3 Co-design as a systems-oriented approach

While co-design's relational dimension highlights its collaborative and participatory character, its systemic orientation emphasises its role as a form of inquiry into complex systems. In the growing complexity of societal challenges, such as the transition to climate neutrality, design has increasingly been recognised as a practice capable of engaging with complex systems and driving societal transformation [19, 20].

This challenged traditional design methods and led to the emergence of systemic and transition-oriented paradigms. [21] was one of the first to articulate what he termed the “fourth order of design,” referring to the design of complex systems and environments, while others have proposed frameworks such as DesignX [22] and Transformation Design [8, 23], which view design as a means of enabling organisations to navigate change. The integration of systems thinking and design practice has led to the emergence of Systemic Design [24] and System Oriented Design [25], which combines systems theory, design methods, and participatory approaches to address multi-level, socio-technical problems. In parallel, sustainability research has stimulated further expansion of design's role in shaping systemic transitions, with concepts such as Transition Design [26, 27] and Design for Sustainability Transitions (DfST) [28]

who have positioned design as an active contributor to long-term societal transformations. These perspectives advocate for systems-oriented (co-)design approaches that engage multiple stakeholders, build shared visions, and co-produce systemic interventions [4, 18].

This research builds on these theoretical developments by examining how co-design practices support the implementation of systemic approaches within European municipalities working toward climate neutrality. It seeks to understand co-design not only as a relational practice but as a mechanism that fosters inquiry into complex systems.

3.4 Co-design as a learning process

Beyond fostering relationality and systemic inquiry, co-design also functions as a learning process through which organisations build new capabilities and transform their practices over time. For co-design to realise its systemic potential, it must move beyond isolated projects and become embedded in the everyday functioning of municipalities including the development of new roles, skills, and routines, and leading to often requires organisational change [6, 7]. Design tools and organisational culture are mutually reinforcing due to their experiential nature [9]. It is this reflective and iterative nature of design that fosters experiential learning in individuals and, in turn, drives organisational transformation [9, 29]. This view aligns with Schön's (1983) conception of design as an inherently reflective practice, where learning occurs through "reflection-in-action" as designers continuously adapt their thinking and doing.

In this research, learning is conceptualised as organisational learning—a systemic and strategic process that engages the organisation as a whole rather than only individuals [30]. In the context of sustainability transitions, learning can be understood as an ongoing social process that emerges through interaction, reflection, and the interpretation of feedback [31]. Within this perspective, co-design is understood as a mechanism that enables such learning by creating opportunities for experimentation, reflection, and adaptation within municipal teams. The study therefore investigates not only the role of co-design in implementing systemic approaches within municipalities but also the extent to which co-design becomes internalised in their everyday practices as evidence of organisational learning and transformation.

Taken together, the literature highlights co-design's potential to act as a relational, systemic, and learning-based practice capable of fostering transformation within public institutions. Yet, limited empirical evidence exists on how these (co-)design processes unfold in practice, particularly within municipal organisations seeking to implement systemic approaches to climate neutrality [5, 32, 33]. Addressing this gap, the following section presents the methodological approach adopted to explore how co-design practices are enacted and internalised within European municipalities participating in the EU Cities Mission.

4 METHODOLOGY & APPROACH

This PhD research employs a comparative case study of eight to ten municipalities participating in the EU-funded NetZeroCities (NZC) project to examine the role of co-design practices in implementing a systemic approach within the EU Cities Mission and how they become embedded in municipal organisations. The multiple case

study method provides an appropriate framework for investigating a contemporary phenomenon in its real-life context, especially as it evolves and boundaries remain blurred [34]. A qualitative approach enables an in-depth exploration of this bounded system over time through multiple sources of evidence [35].

4.1 Case selection

The selection of cases followed a purposeful sampling strategy aimed at capturing both diversity and depth within the EU Cities Mission under the NetZeroCities (NZC) project. Specifically, the research adopts an information-oriented approach based on the logic of maximum variation sampling [36], selecting cases that differ across different dimensions. Selection criteria include geographical and national diversity, city size, Climate City Contract (CCC) timing, local enabling conditions, and the city's approach to co-design and participation. This diversity enables the study to examine how systemic co-design practices are shaped and operationalised under varying conditions.

This approach aligns with the diverse case method [37, 38], which emphasises that variation—rather than uniformity—enhances the exploratory potential of qualitative research by revealing patterns, contrasts, and new questions across contexts.

4.2 Data collection

Data collection will be organised in multiple phases. The first phase will involve desk research through the review of documents and archival records, including NZC official materials (e.g., cities' Climate City Contracts), municipal records, and project reports. The second phase will consist of field research, comprising semi-structured interviews with municipal staff who are part of transition teams or involved in NZC activities and familiar with the city's internal structure and learning processes. These interviews will be followed by co-design activities with city advisors, aimed at further exploring insights that emerge from the fieldwork.

Data triangulation will be employed to integrate findings from both desk and field research, thereby enabling a comprehensive understanding of each case. To ensure rigour, a case study template has been developed to provide a structured, narrative approach for data collection. To manage and interpret the significant amount of qualitative data generated through the case studies, deductive (a priori) coding will be applied prior to data analysis. This approach supports the organisation of data into predetermined categories derived from existing literature and theory [39]. As [34] notes, the a priori consideration of analytical procedures is critical to ensuring coherence between the research design, data collection, and interpretation phases. The data analysis will combine both deductive and inductive approaches, allowing new codes, categories, and patterns to emerge as the researcher engages iteratively with the data.

5 WORK IN PROGRESS / PRELIMINARY FINDINGS

Preliminary findings from the review of cities' Climate City Contracts (desk research) indicate that many municipalities employ co-design tools and practices by following the guidelines and resources available on the NZC digital platform. However, some cities appear

to reference co-design without fully understanding its role or value. The analysis also suggests that cities supported by intermediary partners who actively use design as a systems-oriented approach tend to engage with co-design more consistently. Similarly, cities that participated in the official NZC Schools - training programmes designed to build skills and knowledge related to achieving climate neutrality - were more likely to recognise co-design as an official and effective method for municipal transformation.

6 PLANNED CONTRIBUTION

Framed within the PDC2026 theme “Living Together”, this study investigates the relevance of co-design in supporting sustainable transitions through collaborative decision-making, co-creating visions, and prototyping systemic interventions. It positions co-design as a *relational practice* that fosters collaboration and shared sense-making among diverse actors; a *systems-oriented approach* that enables inquiry and experimentation within complex contexts; and a *learning process* through which public institutions build new capacities for reflection and adaptation. In doing so, the research advances an understanding of design as a facilitator of transformation within municipalities pursuing climate neutrality. Specifically, this study advances Participatory Design (PD) by providing empirical evidence of its role in addressing climate transition challenges in local public institutions, and in understanding how design capabilities can support internal organisational processes for change.

7 CURRENT CHALLENGES & POINTS FOR FEEDBACK

The research currently lacks a strong theoretical and empirical foundation on the relationship between system-oriented co-design and organisational learning within municipalities. The upcoming data collection will help refine this focus by identifying specific challenges and tensions related to the use of design practices to advance climate neutrality goals in municipal contexts. I expect to further narrow the scope of the study as data collection begins in November 2025. The PDC Doctoral Colloquium provides a valuable opportunity to reflect on this ongoing work and to share my interpretation of co-design as an agent of change in sustainability transitions. I look forward to engaging in dialogue and receiving feedback that will help sharpen the conceptual and methodological direction of my research.

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