

A Systemic Design-Led Participatory Process to Address Meaningful Impact Pathways for Netzero Cities

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Abstract

This work explores the role of design in supporting public administrations to set up local-based NetZero city strategies. In particular the paper presents the design-led participatory process designed and led by the Service Design Lab team (authors) to support the Municipality of Prato in preparing the baseline for the Climate City Contract. Based on four pillars (energy efficiency, sustainable mobility, circular economy, agriculture and land use, urban forestry), the process aimed at spotting systemic barriers and laying the groundwork to co-design a portfolio of actions aimed at achieving carbon neutrality by the year 2030. The strategy supporting the process was based on two main phases (understanding the system and co-designing a portfolio) connected by an intermediary bridging phase, and another cross-cutting level of inquiry itself consisting of two stages: the front-end (the local-based facilitation process) and the back-end (the systemic interconnectedness process). Lastly we highlight the limitations of the process and the key takeaways of participatory infrastructuring actions, and specifically the benefits for the Municipality in establishing meaningful and context-based impact pathways.

Keywords

NetZero cities
Sustainability
Participatory process
Systemic design
Theory of change

Framing: Prato Carbon Neutral (PCN)

The NetZero Cities program, promoted as part of Horizon Europe's EU Missions, assigns cities the important mission of experimenting and testing innovative solutions to achieve climate neutrality by 2030: these solutions could set an example for other European cities to achieve the same goal by 2050. The Municipality of Prato has been selected to be among the 100 climate-neutral and smart cities that will implement the NetZero Cities goals by 2030. The following contribution presents the co-design process commissioned to Service Design Lab by the Municipality of Prato, which aims to support the city in drafting the Climate Change Contract (CCC), the document with which the city presents its commitment to climate neutrality through a concrete portfolio of actions. The Prato Carbon Neutral strategy (PCN) is based on four main pillars: energy efficiency, sustainable mobility, circular economy, agriculture, land use and urban forestation. In this scenario we were asked, as the Service Design Lab team, to design and lead the participatory process with two goals: to collect and analyze systemic barriers, challenges and opportunities for the city in its path to achieve climate neutrality, and to make the baseline for the transition at the local level explicit. Climate mitigation and adaptation represent the most complex challenge of our times both at local and global level having multiple fields-related implications (social, cultural, economic, and environmental); we therefore need to configure holistic solutions to face climate change combining them with participatory process which can actively involve all stakeholders calling for a more intense engagement of citizens. With the aim of activating individual and social capacities, (Saad-Sulonen et al., 2020) while generating sustainable solutions over time. To drive the presented process, we adopted the approaches proper to Participatory Design (Sangiorgi & Clark, 2004), involving stakeholders in the activities of 'understanding the system' to define the actions for climate neutrality (co-design portfolio) accordingly. In the present research the terms participatory and co-design will be used in the same way as specified in Meroni and Selloni (2022). In particular during this research we applied co-design as a process to increase the community engagement around the NetZero Cities goals. The active involvement of a community in this process fosters the emergence of new perspectives and the construction of innovative solutions. The co-design process presented in this contribution constitutes a pioneering experiment for the Municipality of Prato.

Systemic Design offers a comprehensive approach for tackling complex challenges by blending natural systems-based technologies with urban and human ecosystems. Rather than simply providing solutions, its goal is to regenerate both natural and man-made environments. This is achieved through collaborative, participatory processes that involve a wide range of stakeholders, ensuring long-term sustainability and resilience (Barbero et al., 2022).

The participatory process here presented was led by the people-centered perspective of Service Design (Sangiorgi & Clark, 2004), together with the Systemic Design approach. This alliance allowed us to develop a specific toolkit that, beyond detecting needs and setting solutions, helped us spot cross-sectors interconnec-

tions and prepare the ground for local collaborative governance which might steer such a complex transition in the medium-long term as well.

Moreover, Systemic Design emphasizes adaptability, facilitating the collaboration of multiple stakeholders in addressing 'wicked problems' — complex, interconnected challenges without straightforward solutions (Collina et al., 2020) —. This interdisciplinary approach allowed for the development of a co-creation process that effectively engaged diverse participants, ranging from government officials to citizens, in designing sustainable solutions tailored to the territorial context. Digital and traditional tools were used to visualize and facilitate co-creation, ensuring that participants from various sectors could contribute meaningfully, regardless of their design background.

The Co-design Strategy

In recent decades, there has been a significant evolution in design practices, shifting from traditional, expert-driven approaches to more inclusive, user-centered models. Initially, design research was dominated by user-centered design, a methodology where designers observed users to gather insights for product development. However, as societal and technological complexities increased, this model evolved into participatory design and, more recently, co-design (Sanders & Stappers, 2008; 2014).

The co-design methodology we present Fig.1 is an experiment in which the Prato public administration together with a design research lab has 'infrastructure' participatory action research (Meroni & Selloni, 2022). According to Le Dantec and Di Salvo (2013, p. 247), "infrastructuring is the work of creating socio-technical resources that intentionally enable adoption and appropriation beyond the initial scope of the design, a process that might include participants not present during the initial design". In other words, 'infrastructuring' is an ongoing, long-term process where agency is distributed among different participants and fosters participants' appropriation, creating in turns opportunities for shared decision making within the design process itself (Marttila et al., 2014).

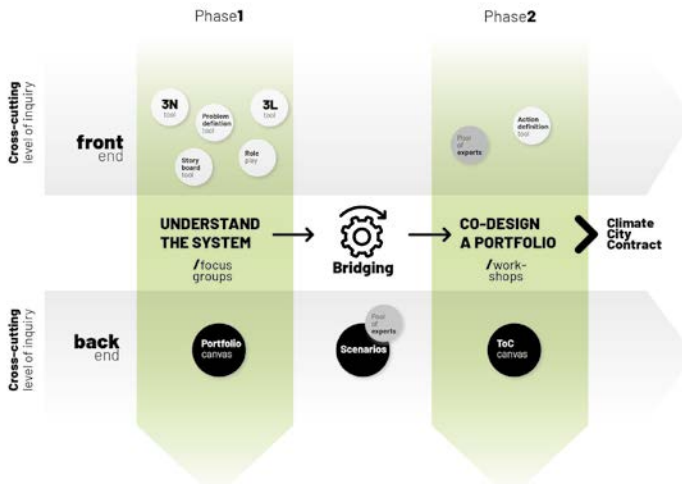


Fig. 1
Service Design Lab, Prato Carbon Neutral Project within The NetZero Cities program, the co-design strategy backbone (© Service Design Lab team, 2022).

The process presented was three-months long and meant to infrastructure the relations between multiple and heterogeneous actors, via a set of methods and tools from service and strategic design, to detect and unlock capacities and resources toward Prato climate neutrality. The project adopted a systemic approach to Strategic Design, inspired by the theories of Manzini and Meroni (Manzini and Vezzoli, 2003; Meroni, 2008). The use of tools such as the analysis of barriers and opportunities, the canvas for the definition of medium-long term challenges and scenarios, and the Theory of Change (ToC) method (Simeone et al., 2021), have allowed us to identify innovative and radical solutions, capable of generating value for the community and the environment in turbulent and uncertain contexts. This methodology, focused on the understanding of systemic dynamics and on the anticipation of change, allowed to develop a long-term strategic vision. As part of a very complex domain, in defining strategies for climate neutrality, the PCN participatory process was designed and implemented building on systemic design, which can be conceived as “optimizing processes for group design and decision making under conditions of overwhelming conceptual complexity” (Jones, 2018, p.16): hence systems co-creation identifies stakeholders as the designers in co-creation and designers as participants invested in their future aims, plans and outcomes (Christakis & Bausch, 2006; Jones, 2018). We conceived the participatory process leveraging on the NetZero Cities systemic approach¹ which suggests acting collaboratively to:

- Understand the interdependencies between the actors in the area and their actions in order to explain the barriers that hinder change (Understand the system, phase 1);
- Co-create a portfolio of actions that support overcoming the identified barriers (Co-design a portfolio, phase 2).

These two main phases crosscut another level of inquiry, made up of two more stages, which helped us to continuously connect the local context to the systemic level:

- Front-end, the local-based facilitation process: this was the co-creation level, where stakeholders act as designer in identifying systemic barriers and co-create experiments to make the change possible via a set of tools and methods;
- Back-end, the systemic interconnectedness process: this was the systemic level, where we continuously zoomed from the micro (our process) to the macro (the PCN strategy) and back to help the city steer the whole process toward a context-based Climate City Contract elaboration.

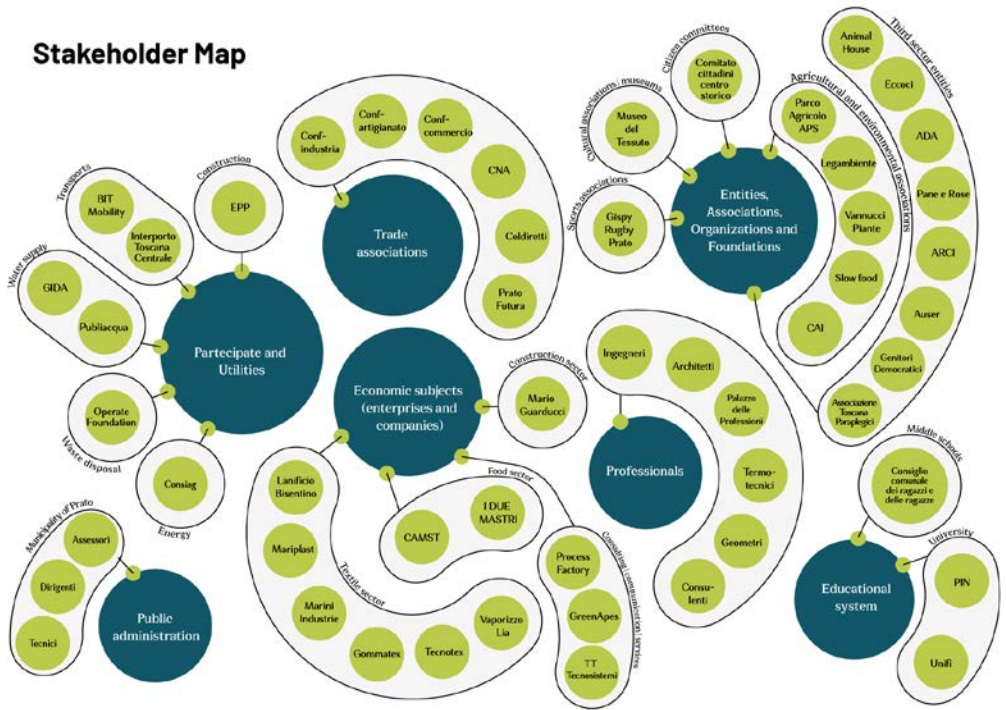
Moreover, to ensure the Municipality of Prato defined and addressed meaningful impact pathways towards climate neutrality, we designed a bridging phase between first and second phase in order to create the baseline for a meaningful co-creation process.

To prepare the ground for the whole process, we mapped the climate ecosystem stakeholders in collaboration with the Municipality of Prato. We decided to convene stakeholders Fig. 2 already involved in previous Municipality-led projects clustering them in four main groups:

- First group: utilities, trade associations, banks and foundations, research institutes, large-scale retailers, GMO, companies, short agriculture supply chain associations, farms, professionals, environmental associations, mobility companies and public administration;
- Second group: trade associations, businesses and start-ups, sports clubs, public administration;
- Third group: third sector organizations, citizens' committees and public administration;
- Fourth group: the 'Consiglio Comunale dei ragazzi e delle ragazze', a students' council held by public administration aimed at citizenship education.

As convened stakeholders were already used to attending Municipality-led participatory processes, we benefited from fruitful conversations which, leveraging also on previous experiences, allowed us to activate a fertile ground where proposals and suggestions arose. Finally, to facilitate cross-sectoral collaborations even beyond the end of the participatory process, we took advantage of digital tools (together with paper ones) to provide the Municipality of Prato with platform to keep on working toward CCC elaboration and beyond.

Stakeholder Map



The presented co-design strategy can be intended as a “public service” that public administration may offer to citizens with two aims: fostering more democratic and inclusive societies and infrastructuring more collaborative networks of stakeholders (Meroni & Selloni, 2022).

Fig. 2 Service Design Lab, Prato Carbon Neutral Project within The NetZero Cities program, PCN Stakeholders Map (© Service Design Lab team, 2022).

Phase 1: Understand the System. Detecting existing initiatives and systemic barriers

The aim of the first phase of the process was twofold: put together the existing pillars-related initiatives undertaken from the different stakeholders — while understanding their interdependencies — and detecting systemic barriers to address to make the change happen Fig. 3.

Phase 1: Understand the System

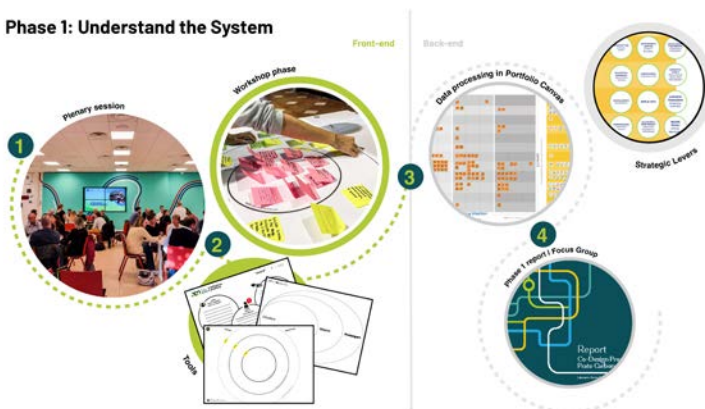


Fig. 3 Service Design Lab, Prato Carbon Neutral Project within The NetZero Cities program, Phase 1: Understand the System (© Service Design Lab team, 2022).

We organized nine focus groups sessions (in some cases we group categories to optimize the process) where we set roundtables for every convened category. Every focus group aimed at interrogating participants about one of the topics related to the Prato strategy four pillars: energy efficiency, sustainable mobility, circular economy, agriculture and land use and urban forestation. As part of an exploratory highly context-dependent journey, our mindset was set accordingly: we were indeed all learning together to discover and pave the way forward. The goal was mapping both the activities already set in motion toward climate neutrality and related barriers hindering the change. Each session was set-up as follow:

- A first theoretical part introducing the NetZero Cities program and policies and concrete actions the Municipality had been already undertook for climate neutrality;
- A working phase where participants were asked to put together (via the 3N tool specifically designed) the climate neutrality activities on time's horizons-basis, that is activities they had already launch (NOW), to be launch in the short term (NEAR) or planned in the next 10 years (NEXT). When it comes to Circular Economy focus groups, we asked participants to collect on going or planned activities on circular loops-basis² (close, reduce, extend) via a tool we designed and supporting the 3 mentioned loops;

In the final plenary session, each table was asked to return their outcomes to reflect collectively about the barriers hindering the transition towards climate neutrality. Every spotted barrier was described in a dedicated tool where interconnections across sectors were spotted.

When it comes to the focus-groups with the 'Consiglio Comunale dei ragazzi e delle ragazze', the working phase was facilitated via a storyboard and the 3N tools. In the plenary session each student shared a set of proposals for achieving climate neutrality.

Backend

In order to visualize and detect the systemic interconnectedness, we organized all the data collected in the Frontend stage via a strategic tool, the Portfolio Canvas³ Fig. 4. The tool was our compass to organize the detected existing initiatives along two main dimensions: strategic levers and horizons of time. Levers can be defined as tools capable of guiding the change of individuals and the community towards systemic changes (Ellen McArthur Foundation, 2019; Circle Economy, 2020): strategic levers are regulations, financial support, new materials, data and their monitoring, education and training, capacity building or communication of ongoing initiatives aimed at change. Simultaneously the horizons of time dimension helped us to visualize the current initiatives already take over (NOW), the ongoing (NEAR) and the planned ones (NEXT). Regarding the detected systemic barriers, we organized and visualized all the gathered data according to the same strategic levers logic in order to scope out the main intervention areas for the Municipality of Prato to be preferred.

We took inspiration from the Ellen McArthur Foundation's Butterfly Diagram.

We were inspired by EIT Climate-KIC's 'Transformation, in Time' strategy, which adopts portfolio logic in its work with a cohort of European cities committed to ambitious climate action by 2030. The portfolio canvas on which we built was developed by Dark Matter Laboratories in the context of the EIT Climate-KIC's Healthy, Clean Cities demonstration.

Looking at the existing initiatives and barriers through the lens of strategic levers allowed us to give back to all actors involved in the system as a whole and to analyze it in order to understand whether opportunities for development were emerging and whether gaps, weaknesses or strengths were present: participants were in turn able to unlock their capabilities (thanks to the arisen and visualized interconnections) for new partnerships envisioning.



Bridging phase: turning barriers into scenarios

In order to allow the city to develop meaningful impact pathways for PCN strategy, it was necessary to provide the Municipality of Prato with a set of local future scenarios rooted in the context previously analyzed to start with. In this phase we therefore clustered detected systemic barriers from the previous phase under a set of main topics and turned them into scenarios. The result was a set of 13 future scenarios pathways (3 scenarios for energy efficiency, 4 scenarios for sustainable mobility, 3 scenarios for the circular economy and 3 for agriculture, land use and urban forestry) and 2 additional cross-cutting scenarios. Moreover, before kick-off the second phase of the process (Co-design a portfolio), a pool of experts, each related to one of PCN pillars (energy efficiency, sustainable mobility, circular economy, agriculture and land use and urban forestation) were convened to validate the scenarios and enrich them. Scenarios became therefore a meaningful bridge between the two main phases: they were simultaneously the tail of the first and the head of the second one.

Fig. 4
Service Design Lab, Prato Carbon Neutral Project within The NetZero Cities program, The Portfolio Canvas (© Service Design Lab team, 2022).

Phase 2: Co-design a portfolio. Overcoming barriers through local actions

In this second phase four thematic workshops were set up — and strengthened thanks to the experts' support — to feed and validate the scenarios with stakeholders, in order to co-create a first portfolio draft of place-based activities according to PCN pillars Fig. 5. The main goal was to create and strengthen synergies between public administration, climate stakeholder ecosystem, private sector, citizens, academia, research & innovation institutions: it was a matter of detecting the existing connections and links with the stakeholders across sectors to report on the conditions that might prepare the ground for collaborations and actions.

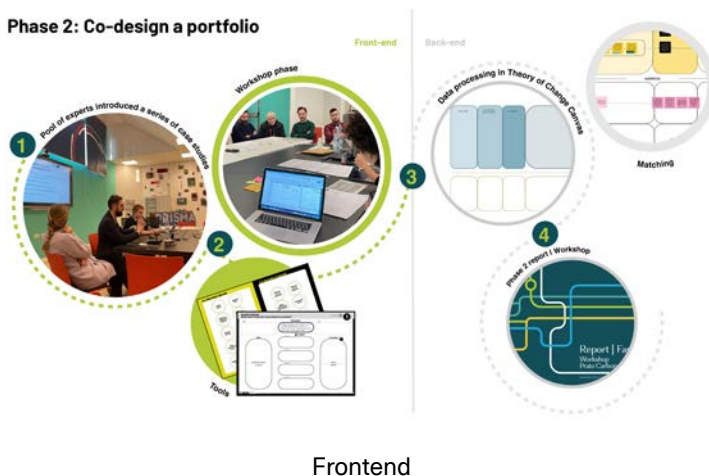


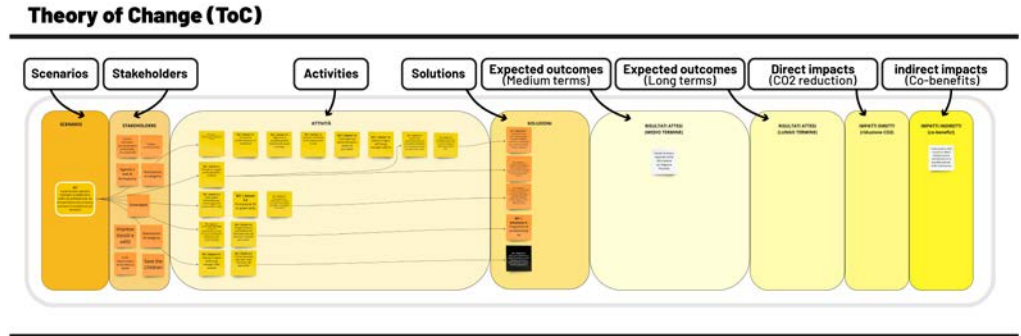
Fig. 5
Service Design Lab, Prato
Carbon Neutral Project
within The NetZero Cities
program, Phase 2: Co-de-
sign a portfolio (© Service
Design Lab team, 2022).

Thematic workshops were set up on two step-basis:

- A preparatory step where the pool of experts introduced a series of case studies to deepen the related topics and future scenarios were presented to participants;
- The co-creation activity where participants were encouraged with specific tools to envision actions and experiments feeding the future scenarios, pointing out stakeholders' systems and how to deliver envisioned activities.

About the 'Consiglio Comunale dei ragazzi e delle ragazze' co-design workshop, students were asked to play a responsibility role (e.g., city administrator, young citizen, adult citizen, farmer and entrepreneur) aiming at generating ideas to be envisioned and negotiated with their colleagues. This process helped us to make them experience active listening (Sclavi, 2003) while introducing them — even in a simple manner — wicked problems: “ill-defined complex systemic problems [...] comprised of diverse constituencies and stakeholders with conflicting agendas and concerns” (Irwin et al., 2020, p. 33).

In this very last stage, it was important to prepare the ground for the CCC elaboration, where the city stated its commitment to climate neutrality. To this end we organized all the data collected during the co-design workshops via a strategic tool based on the Theory of Change method. ToC is the description of the sequence of events necessary to achieve the desired change (Simeone et al., 2021). The tool Fig. 6 allowed us to visually support the definition of logical concatenations and connectivity between our scenarios, stakeholders, stakeholders and their activities, outputs, long-term objectives and impacts.



Each scenario was therefore visually presented showcasing the linkages between its stakeholders, activities, outputs and long-term objectives. In some cases activities referred both to one of the 4 PCN topics (energy efficiency; sustainable mobility; circular economy; agriculture, land use and urban forestation) and a cross-cutting scenario: in that case the connection had been visually highlighted. Moreover, the bottom side of the tool allowed the connection between the activities emerging from the co-creation process we led and the draft portfolio of actions the Municipality was elaborating in parallel during the final stage of our process: this connection was crucial to align the processes and to ensure addressing meaningful impact pathways toward climate neutrality. Finally, it's important to stress that all the material elaborated during the whole process was shared with all the participants involved via two reports and two Miro-boards: in particular, the latter were the platform we provided the Municipality of Prato with as a legacy. The aim was twofold: on one side to let the Municipality keep on working to the CCC elaboration building on a strong context-based support. On the other side, to provide all the participants with a clear visualization of the interconnections to foster future collaborative actions while understanding interdependencies to uncover the barriers blocking change.

Fig. 6
Service Design Lab, Prato
Carbon Neutral Project
within The NetZero Cities
program, The ToC canvas
(© Service Design Lab
team, 2022).

Conclusion

Limits and main takeaways

Keeping a systemic vision, our effort was to give representatives in the CCC at the work made up with the city, meeting administration, companies, topic-experts, and citizens, ranging from representatives of the 'Consiglio Comunale dei ragazzi e delle ragazze' to members of the General Confederation of Italian Industry.

As a result, the effectiveness of the co-design process enabled the Municipality to compile the CCC with three important outputs: (1) the ecosystem map, (2) the systemic barriers definition and (3) a first baseline for the portfolio of actions definition. From both the frontend and backend stages, results highlighted the cross-sectoral nature of barriers to climate neutrality, where the main strategic levers (or areas of intervention) are: Education & training, Capacity buildings, Regulation, Legislation & procurement, Convening & partnerships, Physical assets, Financial-support, Communication and Data & Tech. Simultaneously, we foresaw the need to strengthen the CCC value giving more voice to the citizens, going deeply in citizens' awareness via capillary actions that should be embedded in the PCN strategy.

However, the research also faced several limitations, both in the field and within the process itself. On the ground, one of the primary challenges was maintaining a productive focus during co-design activities. Participants frequently expressed frustrations, which risked diverting discussions from the goals of the process. Moreover, while the activities often included playful, game-based elements designed to facilitate engagement, it was difficult to convince all participants — particularly representatives of trade associations — to take these activities seriously. In some cases, these participants attended merely as observers, displaying a sense of austerity and reluctance to engage, and often resisted questioning their own roles in the system. In contrast, representatives from smaller enterprises and freelance professionals were more open to collaboration and willing to engage fully in the activities.

Another significant limitation was the mismatch in stakeholder representation. Despite the request to involve experts, not all stakeholders sent participants with adequate knowledge of the topics at hand, leading to discussions that could have benefitted from deeper expertise. As a result, the level of discourse was sometimes lower than needed to tackle the complex issues at play.

At the process level, while the collaboration between the Municipality and designers proved fruitful, it also highlighted the fragility of this partnership. Despite some initial successes, the experience did not lead to a more structured or sustained collaboration. Municipalities, being subject to frequent political changes and the shifting preferences of individual politician, often find it difficult to build long-term partnerships with external actors like designers. This instability makes it challenging to maintain a consistent path of collaboration over time. Moreover, there remains a risk that designers' work is instrumentalized by political forces, where citizen engagement is treated as an immediate tool for public relations rather than a genuine means for better governance and policymaking.

The research has investigated current opportunities for designers and municipalities to collaborate together in driving societal challenges such as the green and just transition. The experience of the participatory process described in the paper demonstrates the active role played by the Service Design Lab (UNIFI) in preparing the baseline for the Climate City Contract, the main milestone for the Municipality of Prato along the European NetZero Cities program. Methods and tools provided to the co-design process belong to the Participatory Design, Service Design, Systemic Design and Circular Economy approaches. The methodology proposed ensured the Municipality of a proper representativeness and involvement of all the different stakeholders among the dialogue on the four pillars: energy efficiency, sustainable mobility, circular economy, agriculture and land use, urban forestry.

Finally, the demonstration of the significant contribution of this work to the design research debate, arrived with the award of the Municipality of Prato with from the prestigious EU Mission Label on October 8, 2024. This label, awarded to 20 cities under the EU Mission for Climate-Neutral and Smart Cities, acknowledges Prato's ambitious plans to achieve climate neutrality by 2030.

The success of the CCC of the Municipality of Prato, demonstrates how co-design can serve as a catalyst for cross-sectoral collaboration and governance in urban contexts, especially under the pressure of urgent climate goals. The project presented here has provided a tangible pathway for embedding systemic thinking in city planning and empowered local actors to take collective ownership of the climate agenda.

The obtaining of the EU Mission Label will facilitate the city's access to public and private funding through the Climate City Capital Hub, providing opportunities to translate its strategic climate action plans into a pipeline of projects, further advancing its sustainability objectives. This recognition underscores the importance of participatory design processes in creating impactful, scalable, and financeable solutions for climate resilience.

Given these reflections, we proposed as the next step to attempt a series of Open Labs in order to open a direct channel of communication and awareness with the city and aim at establishing a long-lasting engagement of citizens in the PCN framework. Hence, the main takeaway for the Municipality is to capitalize the identified pooling of distributed assets and resources, allowing to move forward carbon neutrality strategy as a coral action. As part of a long-term transition, this work aimed therefore at preparing the ground for a local collaborative governance, that is as a long term, systemic process of steering and coordination of all the different levers in cities — policy, regulation, funding, knowledge, collective intelligence, and many others — in such a way that allows distributed capacity, legitimacy and agency for change across public and private sectors.

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