

CLIMATE PROTECTION AND ADAPTION

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## CONNECTING URBAN SUSTAINABILITY LABS

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ENERGY AND DIGITALISATION



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## Transformative Governance through Embedded Scientific Collaboration

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### 1. Introduction

Urban areas worldwide are becoming increasingly vulnerable to the various impacts of climate change, such as rising temperatures, altered precipitation patterns, and intensified extreme weather events – along with their cascading physical and societal consequences. Proactive adaptation strategies are required to strengthen urban resilience and to protect urban infrastructure, while maintaining the quality of life for city inhabitants. Municipal administrations play a key role in developing and implementing these climate adaptation initiatives. However, significant barriers to integrating climate adaptation measures into existing urban planning frameworks have been identified, including institutional inertia, limited resources and missing background data as well as fragmented policy landscapes (Boehnke et al., 2023; Boehnke et al., 2022; McClure & Baker, 2018).

To address these challenges, innovative approaches such as Urban Living Labs have emerged as effective platforms for fostering collaboration between researchers, policymakers, and community stakeholders. Urban Living Labs operate as experimental arenas within real-life urban settings, facilitating the co-creation and testing of sustainable, innovative solutions tailored to specific local contexts (Bulkeley et al., 2016; Steen & van Bueren, 2017).

This paper presents a novel transdisciplinary approach, implemented through an embedded collaboration between researchers and municipal planning authorities. Although not formally framed as a real-world laboratory, the setting adheres to the fundamental principles of real-world laboratory research and while adapting to the constraints imposed by the administrative context that hinder innovative transformation. This approach aims to bridge the gap between scientific research and municipal practice, fostering a more resilient and adaptive urban environment.

### 2. Operationalising Embedded Scientific Collaboration in Urban Planning

This study was developed through a collaborative proposal initiated by two senior researchers in partnership with the municipality's planning department. The involvement of these scientists, one of whom was already well known and trusted within the administration, was a crucial factor in securing institutional support and fostering confidence in the research team's scientific expertise. Their existing relationships paved the way for the integration of a third postdoctoral researcher who worked in and closely with the planning department. This allowed for an unprecedented level of cooperation and insights into the internal dynamics, procedures and routines of municipal planning.

The project's main objective was to incorporate climate adaptation measures into an ongoing large-scale urban development project. To this end, the postdoctoral researcher spent an average of two days per week at the city planning office over a period of one and a half years. They collaborated with city planners and administrative staff from various climate adaptation-related departments (e.g., civil engineering, green spaces and climate protection), as well as external consultants who had been commissioned for the planning task at hand. The senior researchers provided sustained, parallel support throughout the process with their expert knowledge and reputation, e.g. by contributing

essential input to relevant meetings and maintaining close contact with senior management and the key figures responsible for urban development planning.

The study focused on two key informal planning phases that preceded the legally binding development plan: the drafting of the local development plan and formulating a comprehensive framework plan for the entire redevelopment area. These phases provided strategic entry points for integrating climate adaptation measures into fundamental planning decisions.

The methodological approach was structured around three iterative stages inspired by adaptation frameworks proposed by Moser and Ekstrom (Moser & Ekstrom, 2010) and Hamin and Gurran (Hamin & Gurran, 2015)

- **Assessing Climatic Needs:** The researchers conducted an in-depth assessment of climatic vulnerabilities in the planning area. This involved analysing internal municipal reports, climate studies, and other environmental data relevant to identify key adaptation challenges as well as possibilities based on local conditions.
- **Developing Adaptation Strategies:** A literature review was conducted to compile relevant adaptation measures, which were then refined in consultation with urban planners and external experts. This step ensured that the selected measures aligned with local planning regulations and practical feasibility.
- **Integrating Adaptation into Planning Processes:** The researchers introduced climate adaptation strategies into municipal decision-making by contributing technical recommendations in meetings, integrating measures into framework planning documents, and facilitating discussions with city council members and the public. Additionally, informal interactions with municipal staff, such as coffee break discussions and routine meetings, helped foster awareness and acceptance of adaptation measures as well as increasing mutual trust between the embedded researcher and the administrative staff.

By embedding a researcher within the city administration, together with the pivotal support of the senior scientists, this project not only facilitated the direct implementation of climate adaptation strategies but also found a way to bridge the gap between research and municipal governance through trust-based and mutually appreciative collaboration.

### 3. Advancing Municipal Climate Resilience through Research Integration

The integration of the researchers into the city administration yielded several tangible advancements in embedding climate adaptation strategies within urban planning. One of the most far-reaching transformations resulting from the targeted involvement of the researchers was the enhancement of urban ventilation within the existing design concept. Collaborating closely with municipal planners and an external bureau during the drafting of the land-use plan, the researchers recommended targeted modifications to building structures to improve airflow and mitigate heat accumulation. These recommendations were ultimately incorporated into a revised design, directly strengthening the urban climate resilience of the planned district.

Another key outcome was the subsequent commissioning of a heavy rainfall adaptation concept for the planning area—an initiative that would not have been pursued without the researchers' influence. Throughout the project, the embedded researcher employed various strategies to emphasize the critical relevance of this adaptation task: internal expert presentations, the development of two alternative concept proposals for heavy rainfall management, and the consistent introduction of the topic into planning meetings. However, it was not until the flood events triggered by extreme rainfall in Aachen in late 2018 that the urgency of this planning task became fully apparent to all stakeholders, ultimately ensuring its integration into the land-use plan.

Beyond physical planning, the researchers played a key role in climate adaptation advocacy within the municipal decision-making processes. Through participation in internal meetings, council discussions, and public forums, the researchers were able to introduce and support the implementation of targeted climate adaptation measures - beyond urban ventilation and heavy rainfall

management. This ensured that climate considerations were integrated into various stages of the planning process, from its conceptualization to stakeholder engagement.

In addition to influencing immediate planning decisions, the approach also included engagement in capacity building within the administration. Through internal presentations and workshops, municipal staff were introduced to climate adaptation principles, expanding their knowledge and sensitivity to these issues. This educational effort is anticipated to foster a more proactive approach to climate considerations in future administrative actions, supporting long-term institutional change.

#### 4. From ULL Ideals to Institutional Realities: Reflecting on Embedded Practice

The following section aims to position the applied method of this study within established research approaches in the social sciences. By comparing our approach with Urban Living Labs (ULLs), reflecting on innovation constraints in planning practice, and aligning our method with principles of transdisciplinary research, the following contributes to a clearer theoretical classification of our research design.

The research design presented shares several structural and conceptual similarities with the Urban Living Lab (ULL) approach. Comparing the key characteristics of ULL described by Voytenko et al. (2016), the methodology i) was placed in a geographical area and “real urban context where the process in focus is taking place”; ii) comprised participation and user involvement of key relevant stakeholders for city governance, such as the planning department and decision makers in charge of the project, external practitioners, other city departments and citizens (only to be informed) and iii) greatly benefited from the leadership of the planning office, which organized routine meetings with various stakeholders as well as proactively supported further meetings, information presentations, etc. that were developed in collaboration with the scientists - ensuring a high level of participation, collaboration and co-design. Similarly, the researchers collaborated with city planners and other administrative staff to integrate climate adaptation strategies and measures into the ongoing urban planning process. In this context, the “co-design” aspect focused on the researchers’ attempts at adaptation integration and the stakeholders’ response to these efforts (integration, concerns, restrictions, further ideas, etc.). This approach fits well with the understanding of ULLs “as a means through which to set up demonstrations and to trial different kinds of intervention in the city” [...] “intended to bring together multiple actors that seek to intervene in order to address contemporary urban challenges and foster learning through forms of open and engaged experimentation” (Bulkeley et al., 2016: 13).

However, an important distinction lies in the innovation logic. ULLs are described as typically focusing on the development and piloting of new solutions by co-design between scientists and stakeholders (Voytenko et al., 2016) or on innovation as a development of new products or as the discovery of new solutions (Steen & van Bueren, 2017). In the project presented, however, the emphasis was on applying and integrating pre-existing climate adaptation measures into an ongoing planning process. This nuance aligns with Wirth et al. (2019), who argue that ULLs are also capable of institutionalizing existing innovations through mechanisms such as policy embedding, awareness-building, and especially “experimenting with new ways of engagement and participation” (Wirth et al., 2019: 246). One might even argue that not the measures proposed but the integration of adaptation as a rather new planning concern was innovative at that time. Another distinction lies in the special role citizens are often given in the ULL context, from giving valuable feedback to being collaborative co-creators (Rizzo et al., 2021). In contrast, citizen participation was largely limited to information events, a classic instrument aimed at transparency rather than engagement.

Our findings resonate well with critical reflections by Rizzo et al. (2021), who argue that the institutional culture of urban planning is often not conducive to transformative innovation. From their perspective, the incremental nature of planning, which was very apparent in our study (Boehnke et al., 2023), “hinders a broader understanding of co-produced knowledge-making that challenges conventional public participation” and even “counters the idea of ULL” (Rizzo et al., 2021: 1753). Following their thoughts about traditional living lab settings (:1753), one could even argue that by

trying to implement measures into an existing plan and building on compromises in meetings, our approach comprises usual participatory planning workshops as an accompanying tool within the ULL context.

#### 5. Conclusion

This study has introduced and reflected on an embedded scientific collaboration that, while structurally resembling Urban Living Labs (ULLs), followed a markedly different logic of intervention. Rather than co-designing new solutions or testing experimental technologies, the project focused on integrating well-established climate adaptation measures into an ongoing urban development plan—thereby operating at the intersection of applied research and institutional practice. The embedded approach mirrored core ULL elements such as place-based engagement, cross-sectoral collaboration, and iterative dialogue with stakeholders. However, it differed in two significant ways: first, innovation was not located in the generation of novel ideas or tools but in the procedural integration of climate adaptation as a relatively new planning concern; and second, citizen participation was limited to classic information formats, diverging from the idea of citizens being central actors for co-creation as emphasized in ULL theory.

Despite these differences, the approach proved effective in achieving concrete results. The integration of targeted adaptation measures—such as improved urban ventilation and a comprehensive concept for heavy rainfall management—into formal planning instruments highlights the potential of researcher-administration collaboration to shape policy outcomes from within. Moreover, the iterative presence of the embedded researcher contributed to institutional learning, particularly by raising awareness of climate risks, fostering interdepartmental exchange, and supporting the long-term anchoring of adaptation knowledge within the planning administration. In light of often-cited institutional inertia in urban planning (Rizzo et al., 2021; Boehnke et al., 2023), these outcomes underscore the pragmatic potential of embedded scientific collaboration—not as a transformative laboratory in the idealized ULL sense, but as a grounded mechanism for embedding evidence-based climate strategies into the everyday routines and decision-making processes of local governments.

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