



Doctoral Thesis in Sustainability studies

Certification Systems and Urban Experiments

Understanding Two Governance Instruments for
Sustainable Urban Development

JONAS SONDAL

KTH ROYAL INSTITUTE OF TECHNOLOGY



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Abstract

The aim of this thesis is to deepen understanding of how sustainability is integrated into urban development through different governance instruments. The thesis focuses on two central instruments in contemporary urban development in Sweden: certification systems for sustainable urban areas and urban experiments.

Previous research on certification systems has primarily examined the content, indicators, and structures of existing systems. This thesis instead focuses on how certification systems for urban areas are developed and shaped through trade-offs between competing principles and requirements that guide their design. By analysing a development process, the thesis contributes knowledge about the rationales and considerations that underpin certification as a governance instrument.

In the case of urban experiments, it is often assumed that experimental projects generate learning that can be transferred beyond individual cases. However, questions of how such learning is organised and scaled within municipal organisations have received less attention. This thesis therefore examines how learning from urban experiments can be identified, organised, and scaled in municipal practice.

The research draws primarily on transdisciplinary and design-oriented approaches, in which knowledge is developed through close engagement with practice. A central empirical component is the development of the certification system *Citylab Post-Construction*, in which the researcher was actively involved. This provided an in-depth basis for analysing the trade-offs and considerations that shape certification system design. In addition, the thesis

includes two empirical studies of urban experiments in municipal contexts, examining both the testing of new approaches to structuring upscaling and municipal practitioners' perspectives on learning and organisational conditions.

The findings show that the development of certification systems for sustainable urban areas is characterised by recurring trade-offs between competing principles, such as simplicity, comprehensiveness, and methodological credibility. Making these trade-offs explicit enhances understanding of why certification systems take the forms they do and what limitations follow from different design choices. The studies of urban experiments show that while experimentation can create opportunities for learning and innovation, such learning often remains project-bound unless supported by organisational structures. Upscaling learning depends primarily on organisational conditions within municipalities, including mandates, resources, and recipient capacity, rather than on the content or scope of individual experiments. Clarifying what should be scaled, how it can be scaled, and under what conditions is therefore a central part of making experimental knowledge actionable.

Overall, the thesis shows that certification systems and urban experiments shape sustainable urban development in fundamentally different ways. Certification systems tend to reinforce established standards and ways of working, while their reliance on measurable and influenceable indicators means that sustainability dimensions that are difficult to quantify or attribute to specific actors risk receiving less attention. Urban experiments, in contrast, often stabilise project-based approaches to sustainability work, where continuous cycles of pilots and innovation can overshadow the upscaling of already tested solutions. At the same time, both instruments can play important roles in supporting the integration of sustainability in urban development, provided that their governing effects and limitations are recognised and managed in practice.

Keywords

Sustainable urban development, governance instruments, certification system, Citylab, urban experiment, governance learning, process learning, organisational learning, upscaling, amplification, institutional capacity

Sammanfattning

Syftet med denna avhandling är att fördjupa förståelsen för hur hållbarhet kan integreras i stadsutveckling genom olika former av styrning. Avhandlingen fokuserar på två verktyg för att styra hållbarhetsfrågor i stadsutveckling, som varit centrala för stadsutvecklingen i Sverige senaste åren: certifieringssystem för hållbara stadsdelar och urbana experiment.

När det gäller certifieringssystem har tidigare forskning i huvudsak analyserat innehåll, indikatorer och strukturer i befintliga system. I denna avhandling ligger istället fokus på hur certifieringssystem för stadsdelar utvecklas och formas genom avvägningar mellan olika principer och krav som styr deras utformning.

Vad gäller urbana experiment finns det ofta en uttalad förväntan om att experimentella projekt inom hållbar stadsutveckling ska generera lärande som kan tas vidare och få genomslag i andra sammanhang. Samtidigt har själva testandet ofta stått i centrum, medan frågor om hur lärande faktiskt organiseras och skalas inom kommunala organisationer fått mindre uppmärksamhet. I detta sammanhang undersöker avhandlingen hur lärande från urbana experiment kan identifieras, organiseras och skalas i kommunal praktik.

Utifrån dessa empiriska studier analyseras även vad resultaten innebär för förståelsen av hur certifieringssystem och urbana experiment kan användas för att styra hållbarhetsfrågorna i stadsutveckling.

Avhandlingen bygger främst på en kombination av transdisciplinära och designorienterade forskningsansatser, där kunskap utvecklas i nära samspel med praktik. En central del av forskningen utgörs av utvecklingen av ”Citylab – certifiering av en stadsdels hållbarhet”, där forskaren varit aktivt involverad i utvecklingsprocessen. Detta arbete har möjliggjort en fördjupad analys av de avvägningar, spänningar och överväganden som präglar utvecklingen av certifieringssystem.

Utöver Citylab-studien omfattar avhandlingen två empiriska studier av urbana experiment i kommunal kontext. Studierna belyser lärande och uppskalning från urbana experiment genom både prövning av nya arbetssätt och analys av kommunala tjänstepersoners erfarenheter och organisatoriska förutsättningar.

Avhandlingens huvudsakliga resultat visar att utvecklingen av certifieringssystem för hållbara stadsdelar präglas av återkommande avvägningar mellan konkurrerande principer. Detta gäller exempelvis spänningar mellan att utforma system som är enkla att använda och samtidigt tillräckligt omfattande för att uppfattas som trovärdiga och metodologiskt tillförlitliga. Genom att synliggöra dessa avvägningar bidrar avhandlingen till en fördjupad förståelse av vilka frågor och prioriteringar som präglar utvecklingen av certifieringssystem, samt hur de val som görs kan motiveras och göras mer transparenta. Därigenom ger resultaten också ökad förståelse för varför certifieringssystem utformas som de gör och vilka begränsningar som följer av olika designval.

Studierna av urbana experiment visar att experiment kan skapa viktiga möjligheter för lärande och innovation i kommunal praktik, men att detta lärande ofta förblir situationsbundet och projektberoende. För att urbana experiment ska få genomslag bortom enskilda projekt krävs mer strukturerade arbetssätt för att identifiera, artikulera och ta tillvara lärdomar. Resultaten visar särskilt att uppskalning av lärande är beroende av organisatoriska förutsättningar inom kommuner, såsom tydliga mandat, resurser och mottagarkapacitet, snarare än av experimentens innehåll eller omfattning i sig.

Sammantaget visar avhandlingen att certifieringssystem och urbana experiment är fundamentalt olika sätt att styra hållbarhetsfrågor i stadsutvecklingen. Certifieringssystem tenderar att förstärka redan etablerade standarder, samtidigt som kravet på mätbarhet innebär att hållbarhetsfrågor som är svårare att kvantifiera riskerar att hamna i bakgrunden. Vidare förutsätter certifieringssystem att rådgivning kan avgränsas till enskilda aktörer, vilket står i kontrast till att många hållbarhetsfrågor behöver lösas genom

samverkan. Urbana experiment kan i stället bidra till att etablera ett mer projektbaserat arbetssätt, där återkommande pilotprojekt och innovationssatsningar ibland sker på bekostnad av att befintliga lösningar skalas upp och integreras i ordinarie verksamhet. Samtidigt visar resultaten att båda dessa verktyg kan spela viktiga roller för att stödja integreringen av hållbarhet i stadsutveckling, förutsatt att deras styrande effekter och begränsningar uppmärksammas och hanteras i praktiken.

Nyckelord

Hållbar stadsutveckling, certifieringssystem, Citylab, urbana experiment, uppskalning, organisatoriskt lärande, institutionell kapacitet

Acknowledgments

For me, it took ten years from the start of the first research project until this thesis was completed. During that time, much has happened, and many people have, in different ways, made it possible for this work to be carried through. I would like to express my sincere gratitude to the hundreds of people I have interviewed, who have participated in working groups, responded to consultations, and/or contributed to discussions. Without your trust, openness, and willingness to share your knowledge and perspectives, this thesis would not have been possible. I would also like to thank colleagues at SGBC, KTH, and IVL, who in various ways have supported me and contributed to creating interesting projects and a positive working environment along the way.

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Before starting my doctoral studies, I did not understand why it was so important to truly care about what you write about. I do now. To keep going despite setbacks, uncertainty, and periods of not quite knowing where you are headed requires commitment. Equally important is life outside of work, with friends and family, thank you for your constant support, and for reminding me of what matters beyond the work. Majken, Hedvig, and Jannike, when you come through the door shouting and I step away from the keyboard to run upstairs and meet your hugs in the hallway. That was the best part of writing this thesis.

List of publications

Paper I

Lind, J., Malmqvist, T., Wangel, J., & Belkert, A.-K. (2017). Citylab Action: Guiding sustainable urban development. In *Proceedings of the World Sustainable Built Environment Conference 2017 Hong Kong*. (pp. 2719–2724)

Paper II

Lind, J., Malmqvist, T., & Wangel, J. (2019). Key considerations when designing certification systems for urban sustainability and implications for the Swedish Post-Construction System Citylab. *Sustainability* 11(9), 2673. <https://doi.org/10.3390/su11092673>

Paper III

Lind, J., Malmqvist, T., & Wangel, J. (2020). Developing Citylab Post-Construction—A Swedish Certification System to Evaluate the Sustainability of Urban Areas. *Sustainability*, 12(11), 4454. <https://doi.org/10.3390/su12114454>

Paper IV

Sondal, J., Hellquist, A., & Balfors, B. (2024). From pilot to practice: navigating pre-requisites for up-scaling sustainable urban solutions. *Urban Transformations*, 6(1), 7. <https://doi.org/10.1186/s42854-024-00063-5>

Paper V

Sondal, J., & Hult, Å., (2025). Learning and amplifying urban climate governance through cutting-edge projects. *Journal of Environmental Policy & Planning*, 1-14. <https://doi.org/10.1080/1523908X.2025.2462904>

Contributions in co-authored papers

Papers I–III were published under the author's former surname, Lind.

For **Paper I**, Jonas Sondal contributed to the conceptualisation of the study in collaboration with the co-authors. He was actively involved in the development of the methodology and analytical framework and was responsible for conducting the empirical investigation. The formal analysis was carried out jointly with the co-authors. Jonas Sondal wrote the original draft of the manuscript. He was also responsible for revising the text, while the co-authors contributed through comments, language editing, and revisions of specific sections.

For **Paper II**, Jonas Sondal took the lead in the conceptualization of the study in dialogue with the co-authors. He was responsible for planning the study design, with particular responsibility for the interview study and its analytical approach. He conducted the empirical investigation independently and led the formal analysis in collaboration with the co-authors. Jonas Sondal wrote the original draft of the manuscript and was responsible for revising the text. The co-authors contributed through comments and by revising or adding text to specific sections.

For **Paper III**, Jonas Sondal was responsible for the conceptualisation of the study in close collaboration with the co-authors. He planned the study design in dialogue with co-authors and external collaboration partners. He led the empirical work, which was partly carried out in working groups, and was involved in all stages of the development process of the certification system, including independent work on identifying and compiling potential indicators. Jonas Sondal conducted the analysis and led the analytical work in collaboration with co-authors and collaboration partners. He wrote the original draft of the manuscript and was responsible for revising the text. The co-authors contributed through comments and revisions of specific sections.

For **Paper IV**, the initial orientation of the research project was informed by needs articulated by practice partners. Based on this orientation, Jonas Sondal formulated the academic research question and analytical focus. He was responsible for the study design and for conducting the empirical investigation, with some minor parts carried out in collaboration with practice partners. Jonas Sondal led and conducted the formal analysis, with the co-authors contributing to the interpretation of the results. He wrote the original draft of the manuscript and was responsible for revising the text. The co-authors

reviewed and commented on the content and structure of the paper, contributed to its further development, and provided deeper theoretical input.

For **Paper V**, Jonas Sondal was responsible for the conceptualization of the study. He led the methodological design in collaboration with the co-author. The empirical investigation, including interviews, was carried out jointly. Jonas Sondal led the analytical work, which was conducted in collaboration with the co-author. He wrote the main parts of the original draft of the manuscript, while the co-author contributed by writing the method section and a smaller part of the results. Jonas Sondal led the revision process, which was carried out in collaboration with the co-author. As the more experienced researcher in this collaboration, he had a leading role throughout the research and writing process.

Artificial intelligence tools were used in the writing of this cover essay for language refinement, improvements in textual clarity, and the structuring of arguments. All content, interpretations, and conclusions are the sole responsibility of the author.

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1 Introduction

Over several decades, scientific assessments have shown that prevailing patterns of production, consumption, and land use are undermining ecological systems and generating escalating social risks (e.g., IPCC, 2022; IPBES, 2019; Rockström et al., 2009). In response to these challenges, international policy frameworks developed at different points in time have increasingly emphasised sustainable development as a guiding principle, highlighting the interrelations between social, economic, and environmental dimensions (e.g., WCED, 1987; United Nations, 2015). During the same period, cities have increasingly been positioned as central arenas to address these environmental and social challenges. With more than two thirds of the world's population projected to live in urban areas by 2050 (UN DESA, 2019), the direction of urban development has become critical to broader sustainability ambitions (UN-Habitat, 2024; Elmqvist et al., 2013). This has contributed to a growing emphasis on sustainable urban development, understood as a reorientation of urban development practices towards mitigating environmental impacts and addressing social risks.

Against this background, increased attention has been directed towards the role of governance, recognising that sustainable urban development requires not only new technical solutions, but also new forms of governance capable of enabling their implementation and navigating the inherent complexity of urban systems (Bulkeley, 2010; Anguelovski & Carmin, 2011). In this thesis, governance is understood broadly as the processes and arrangements through which collective goals are pursued and action is steered across institutional levels. Such governance may involve different modes of coordination, including regulatory interventions, market-based mechanisms, standards, and

collaborative arrangements between public and private actors (Treib et al., 2007; Bulkeley & Kern, 2006).

To understand how sustainable urban development can be pursued in practice, this thesis examines urban governance through an empirical focus on the Swedish context, where municipalities have comparatively strong autonomy in planning and urban development, formally expressed through the municipal planning monopoly regulated in the Planning and Building Act (Plan- och bygglagen, SFS 2010:900). The thesis centres on two urban governance instruments that have become particularly salient in contemporary urban development: certification systems for urban areas, which structure sustainability work through formalised criteria; and urban experiments, which enable the development and testing of new approaches in practice. These instruments are enacted in the practices of multiple urban actors, including municipalities, property owners, and construction companies, and shape how sustainability ambitions are interpreted and operationalised in urban development processes. By examining different aspects of these two instruments, the thesis contributes to a deeper understanding of their roles as governance instruments for sustainable urban development.

1.1 Certification systems for sustainable urban development

Certification systems for sustainable urban development build on the longer-standing application of certification systems for individual buildings. These systems are structured assessments in which an urban area or a development project is evaluated against a predefined set of indicators and criteria. The assessment results in a formal rating or label, which signals sustainability performance and is intended to create incentives for more sustainable planning, design, construction and management practices (Cole, 2005; Haapio, 2012).

Previous research has largely centred on comparative and critical assessments of the content and structure of existing certification systems, and on their application in different national contexts (Sharifi & Murayama, 2013; Wallhagen, 2016; Wangel et al., 2016). By contrast, the processes and rationales shaping their development have received limited attention, with a few exceptions (e.g., Malmqvist et al., 2011, which focuses on building-level certification). Consequently, how the design and content of certification

systems for urban areas are conceived, negotiated and justified remains insufficiently understood.

To address this gap, this thesis examines the development of the certification system **Citylab Post-Construction** (SGBC, 2019), a certification system developed and applied within the Swedish context. Citylab Post-Construction forms part of the broader Citylab framework, which comprises several certification systems used by municipalities, real estate owners, and construction companies, targeting different phases of the planning, construction, and management of urban areas in Sweden (SGBC, 2016). Within this framework, Citylab Post-Construction focuses on the management phase of already existing urban areas. By actively engaging in and analytically examining the development process of Citylab Post-Construction, the thesis seeks to generate insights into how certification systems can be developed in practice. Such insights are valuable not only for the future development and use of certification systems for urban areas, but also for advancing understanding of how certification can function as a governance instrument of sustainable urban development.

1.2 Urban experiments

The second focus of this thesis concerns urban experiments. Research on urban experimentation has emerged at the intersection of several research communities, most notably sustainability transition studies and environmental governance, with close links to urban studies and planning (Bulkeley and Castán Broto, 2013; Ehnert, 2023). Across these literatures, urban experiments are broadly understood as place-based initiatives to explore and test new forms of governance, technologies, practices, and modes of collaboration in order to advance sustainability transitions. In practice, such experiments are enacted by a range of urban actors, including municipalities, real estate owners, and construction companies, often in collaborative arrangements. A central assumption in this literature is that urban experiments generate learning that can be scaled, thereby contributing to broader processes of sustainable urban development beyond the single project or place (Sengers et al., 2019; Loorbach et al., 2015).

From a governance perspective, municipalities play a central role in initiating and coordinating urban experiments as part of broader efforts to steer urban development in new directions, given their formal responsibilities for planning, service provision, and local policy implementation. Therefore, the

role of municipalities in urban experimentation has been studied, particularly in the Swedish context where municipalities have comparatively strong autonomy in planning and urban development. These studies highlight the importance of institutional capacity, legitimacy, and enabling roles in such experimentation, while also pointing to the challenges of translating experimental initiatives into more durable organisational change within municipal planning and governance (Mukhtar-Landgren et al., 2019; Eneqvist, 2022; Witzell & Oldbury, 2023).

Despite these insights, there is limited knowledge about how lessons from urban experiments can be systematically identified, organised, and scaled within municipal organisations in practice. As Evans et al. (2021, p. 179) argue, “the process by which municipal organisations learn and change is surely a key ingredient of urban transformation and should be considered more centrally by funding instruments and researchers.” This call is echoed by Neij and Heiskanen (2021), who emphasise how municipalities *learn to learn*, and by Wolfram et al. (2019), who use the concept of *meta-learning* to describe the institutionalisation of reflexive learning processes within governance systems.

This thesis addresses this gap by examining how learning from urban experiments can be managed, and in particular how the lessons generated can be scaled within municipal organisations. By analysing these processes, the thesis contributes to a deeper understanding of the mechanisms and conditions through which urban experiments can inform and strengthen sustainable urban development.

1.3 Research aims and questions

The overall aim of this thesis is to advance understanding of governance instruments for sustainable urban development.

More specifically, the thesis examines the development of a certification system and analyses the considerations and rationales that shape how such systems are designed as instruments for sustainable urban development. Furthermore, the thesis examines how learning generated through urban experiments can be scaled beyond individual projects, in order to better understand how such initiatives function as governance instruments for sustainable urban development.

The following research questions guide the thesis:

1. How can certification systems for sustainable urban development be understood in terms of the considerations and rationales that shape their design and development?
2. How can the upscaling of learnings from urban experiments be understood and structured within municipal organisations?
3. What do the findings on certification systems and urban experiments imply for understanding these practices as governance instruments for sustainable urban development?

1.4 Delimitations and scope

This thesis examines sustainability certification systems and urban experiments from perspectives that differ from those commonly adopted in existing research. It is therefore important for the reader to be aware of these differences in analytical focus when interpreting the findings.

First, while sustainability certification systems are often studied with a focus on their criteria and application, this thesis does not examine the content or use of certification systems. This includes the use of the certification system Citylab Post-Construction, whose development constituted a central part of the research process. Instead, the thesis focuses on the development and design of Citylab Post-Construction, analysing the considerations and rationales that shape the formulation of certification systems for urban areas.

Second, although urban experiments are frequently analysed in terms of their content, technologies or project-level implementation, this thesis does not examine the internal design or outcomes of individual experiments. Rather, it focuses on how urban experiments are understood, justified and mobilised within municipal organisations, with particular attention to how learning and upscaling from such initiatives are conceptualised.

These delimitations allow the thesis to concentrate on the roles that certification systems and urban experiments play as instruments of governance, rather than on evaluating the performance or effectiveness of specific systems or projects.

1.5 Structure of the thesis

The remainder of this thesis is structured as follows:

The **Background chapter** situates the thesis within the broader research landscape on sustainable urban development and sustainability transitions, with a particular focus on urban governance. It introduces and discusses key concepts and strands of literature relevant to the study, including sustainability certification systems and urban experimentation, and identifies central knowledge gaps that the thesis addresses.

The **Research context and methodology chapter** situates the empirical studies within their specific institutional and organisational contexts. It describes the settings in which the different studies were conducted, including the development of the Citylab Post-Construction certification system, and clarifies how the research relates to and builds on earlier work in these contexts. The chapter also outlines the overall research design, the transdisciplinary and practice-based orientation of the thesis, and the role of collaboration with practitioners in shaping the research process.

The **Methods and materials chapter** details the empirical material and methods used across the five papers included in the thesis.

The **Results chapter** synthesises the empirical findings of the thesis and is structured around two main analytical areas. The first concerns the development and design of the Citylab Post-Construction certification system. The second addresses how learning from urban experiments is understood, organised and considered for upscaling within municipal urban governance.

The **Discussion and conclusion chapters** integrate the findings from the different empirical strands and relate them to the broader literature on governing sustainable urban development. These chapters discuss the implications of the results for understanding governance instruments in sustainable urban development, reflect on methodological limitations, and outline directions for future research.

2 Background and theory

2.1 Sustainability and urban development

As noted in the introduction, cities constitute central arenas for addressing contemporary sustainability challenges (UN-Habitat, 2024; Elmqvist et al., 2013). Urban environments account for a large share of greenhouse gas emissions, resource consumption and land-use change, while simultaneously offering opportunities for coordinated action, innovation and governance at scale (Seto et al., 2014; Creutzig et al., 2015). This dual role of cities is also reflected in international policy frameworks, such as the 2030 Agenda for Sustainable Development (Barnett & Parnell, 2016), where cities are positioned as critical sites for achieving global sustainability goals.

This emphasis on cities as key arenas for societal challenges is consistent with a long-standing tradition of urban research concerned with how planning, design and governance shape urban life and development. Across different periods and disciplinary traditions, urban studies have addressed a range of issues, including social and spatial qualities of the built environment (Jacobs, 1961; Gehl, 1971, 2010), ecological efficiency and the environmental implications of urban form, transport systems and resource use (Newman and Kenworthy, 1989), as well as questions of social justice and equity in urban development (Fainstein, 2010). Together, these perspectives illustrate how concerns that are today framed in terms of sustainability have long been central to urban research, although articulated through different conceptual lenses.

The concept of sustainable development itself has evolved alongside these shifts in focus. Early debates, influenced by systems-oriented analyses of environmental limits, highlighted tensions between economic growth and ecological constraints (Meadows et al., 1972; Wheeler and Beatley, 2009). The concept gained wider recognition through the Brundtland Commission (WCED, 1987), which framed sustainable development as a normative goal concerned with meeting present needs without compromising the ability of future generations to meet theirs. Since then, sustainable development has become an overarching framework within which diverse interpretations, priorities and strategies have been articulated.

In recent decades, concerns have been raised that the notion of sustainable development, while widely institutionalized in policy frameworks such as the UN's Agenda 2030 (UN, 2015), insufficiently captures the scale and depth of change required to address contemporary sustainability challenges (Rockström et al., 2015; Hölscher et al., 2018). In response, concepts such as sustainability transitions and sustainability transformations have emerged from different research traditions to more explicitly emphasise the need for profound societal change. While these concepts are sometimes used interchangeably, they are not equivalent. As Hölscher et al. (2018) argue, transition and transformation offer complementary perspectives on systemic change, differing in their system focus, analytical emphasis and underlying research communities. According to Hölscher et al. (2018) sustainability transitions typically focus on how change unfolds within specific societal subsystems, whereas sustainability transformations emphasise broader shifts in social-ecological systems and their systemic outcomes.

In this thesis, *sustainable urban development* is used as a broad and inclusive concept to capture efforts to steer urban development towards higher sustainability performance. The use of this term reflects the fact that urban development constitutes an established empirical and analytical domain within urban research and practice, within which questions of how to increase sustainability can be examined (Wheeler & Beatley 2009). While long-term sustainability ultimately requires profound societal transformations, cities and urban development can be understood as societal subsystems in which processes of change unfold in more situated and bounded settings than those typically addressed in sustainability transformations research (Hölscher et al., 2018; Seto et al., 2014; Elmqvist et al., 2013). In this sense, the analytical concerns of sustainability transitions research are particularly relevant to the

research context of this thesis, as they offer conceptual tools for examining processes of change within such subsystems. This framing allows the analysis to encompass both incremental and transformative forms of change in urban development, while recognising that these processes are embedded in, and contribute to, broader societal transformations.

2.2 Governance instruments for sustainable urban development

Research on sustainable urban development has increasingly highlighted that making cities more sustainable requires changes not only in technologies and practices, but also in how urban development is governed (Bulkeley, 2010; Anguelovski & Carmin, 2011; van der Heijden, 2019). Governance, in this context, can broadly be understood as how actors steer, coordinate, and influence urban development in pursuit of particular objectives. Governance takes many forms and operates at multiple scales, ranging from international frameworks and national regulation to local planning practices, standards, and project-based initiatives (see e.g. Bulkeley, 2010; Lascoumes & Le Galès, 2007).

At the same time, governance is not conceptualised in a single, uniform way in the literature. Rather, different research traditions distinguish different dimensions and categories in order to analyse how governance operates in practice. Treib et al. (2007), for example, define governance as encompassing three dimensions: polity, referring to institutional structures; politics, referring to processes of negotiation and decision-making; and policy, referring to the substantive tools and interventions through which collective goals are pursued. Majoor and Schwartz (2015), in turn, use the term governance instruments. They emphasise that the literature contains several different ways of classifying such instruments, depending on whether attention is directed towards, for example, the mechanisms through which they work, the resources they mobilise, their purposes, their application, or their effects.

In this thesis, the term governance instrument is used as an overarching concept to capture the various tools and arrangements through which actors seek to steer urban development processes. This use builds on Majoor and Schwartz (2015), while also drawing on Treib et al.'s (2007) distinction between polity, politics, and policy. Within this framework, policy instruments are interpreted as corresponding to what Majoor and Schwartz (2015) define as governance instruments. The concept is used here in a deliberately broad

sense in order to encompass both more formalised and standardised forms of steering, such as certification systems, and more process-oriented and collaborative forms of steering, such as urban experiments.

Acknowledging that governance instruments can be categorised in different ways, this thesis draws on two complementary perspectives. First, it uses Bulkeley and Kern's (2006) concept of modes of governance, elaborated below, to examine the broader ways through which municipalities and other actors exercise influence in urban development. Second, it uses Lascoumes and Le Galès' (2007) framework on policy instruments to analyse different logics of steering and the governing effects associated with the choice of instruments. Although these authors use different labels and operate within partly different research traditions, both perspectives are treated here as ways of analysing governance instruments. Using these two perspectives makes it possible to examine certification systems and urban experiments as two different governance instruments, while also illuminating them from different analytical angles. In this way, the following sections establish a conceptual foundation for understanding how these instruments are mobilised and what kinds of governing effects they may produce in sustainable urban development.

Bulkeley and Kern (2006) identify four modes of governance through which municipalities exercise influence in urban development. (1) Self-governing refers to the municipality's capacity to manage and reduce the impacts of its own operations, for example through energy efficiency measures in municipal buildings or internal sustainability targets. (2) Governing by provision concerns steering through the delivery of infrastructure, utilities, and services such as transport, housing, or energy, where municipalities shape sustainability outcomes through investment and service design. (3) Governing by authority encompasses the use of statutory planning and regulatory instruments, such as comprehensive plans, detailed development plans, and building permits, through which municipalities exercise formal authority over land use and development. (4) Governing through enabling captures the municipality's role in facilitating, coordinating, and encouraging action through partnerships with private and voluntary actors, as well as through community engagement, information provision, and support for collaborative initiatives.

Lascoumes and Le Galès (2007), in contrast, identify five main families of policy instruments, reflecting different logics of steering. (1) Legislative and regulatory instruments rely on legal mandates and formal rules to ensure

compliance. (2) Economic and fiscal instruments use financial incentives or sanctions, such as taxes or subsidies, to influence behaviour. (3) Agreement- and incentive-based instruments encourage voluntary cooperation through negotiated commitments or partnerships, often fostering collaboration between public authorities, private actors, and civil society around shared objectives. (4) Informational and communication-based instruments seek to shape action through the production and dissemination of knowledge, awareness raising, and transparency mechanisms. These tools aim to influence behaviour indirectly, by increasing visibility and understanding of sustainability challenges, for example through labelling schemes or voluntary reporting. (5) De jure and de facto standards establish norms and benchmarks, often through certification systems, indicators, or best-practice models, that define what counts as appropriate or sustainable behaviour. Unlike informational tools, which primarily communicate, standards stabilise expectations by formalising rules, metrics, and categories of “good practice” within institutional frameworks.

2.2.1 Governing effects of governance instruments

The choice of governance instruments is not a purely technical matter of selecting the most efficient means to address a predefined problem. Rather, as argued by Lascoumes and Le Galès (2007), instruments actively shape how problems are defined, which solutions are considered legitimate, and how action is organised in practice. Lascoumes and Le Galès (2007) identify three main effects of policy instruments. First, they create *inertia effects*, meaning that once introduced, instruments tend to reproduce their own logic and shape subsequent decisions and routines. Second, each instrument carries a specific *representation of the issue at stake*, defining what counts as the problem and which dimensions of sustainability are seen as relevant. Third, instruments lead to a specific *problematization* of the issue by hierarchising variables and embedding causal assumptions about what drives change. In other words, governance instruments both structure and constrain how sustainability challenges are understood and acted upon.

2.2.2 From control to collaboration and system innovation

Research on sustainability governance more broadly increasingly emphasises that sustainability cannot be achieved through single instruments or isolated interventions, but requires coherent policy mixes and policy integration (Kemp et al., 2005). Beyond this, research also highlights an increasing emphasis on

governance approaches that complement traditional forms of directing and controlling with facilitation, coordination and the enabling of collective action (Bulkeley, 2010). This has contributed to the development of theories of network governance (Rhodes, 1997; Sørensen and Torfing, 2005), collaborative governance (Ansell and Gash, 2008), participatory governance (Fung and Wright, 2001), and new public governance (Bhatia et al., 2024). More recent research on governance of sustainable urban development builds on these perspectives by emphasising experimentation, learning, and capacity development as central components of governing under conditions of uncertainty and complexity (Bulkeley et al., 2019; Wolfram et al., 2019; van der Heijden, 2019; Ehnert, 2023).

Taken together, these perspectives reframe the role of public authorities and raise questions about the capabilities of local authorities in relation to sustainable urban development. Research points to the growing importance of relational and reflexive capacities, understood as the abilities to collaborate, learn and adapt, alongside more traditional regulatory and managerial competencies (Kemp et al., 2005; Ansell and Gash, 2008; McNamara, 2012; Bhatia et al., 2024). McNamara (2012) stresses that successful collaboration requires the ability to manage networks, balance power asymmetries and sustain commitment among diverse actors. Bhatia et al. (2024) further identify measurement capabilities, referring to the ability to generate, interpret and use indicators to guide decisions, as well as reflexive capabilities related to experimentation and learning from experience.

Kemp et al. (2005) argue that sustainability governance requires not only the use of indicators and performance assessments to clarify priorities and support learning, but also a strategic combination of traditional economic incentives and more collaborative modes of governance. In this context, they position transition management as an approach for working with such collaborative and enabling forms of governance, emphasising the importance of engaging multiple actors in processes of visioning, experimentation and learning oriented towards systemic change. Anguelovski and Carmin (2011) echo this perspective, emphasising that municipalities need to strengthen their capacity for innovation and experimentation in order to translate sustainability ambitions into practice.

These developments in urban governance are particularly relevant to examine in the Swedish context, which constitutes the empirical focus of this thesis. Sweden is often characterised by a strong municipal level with extensive

responsibilities for spatial planning, service provision, and local sustainability policy, making municipalities central actors in urban development processes. Research on Swedish municipalities shows that local authorities increasingly combine more enabling and collaborative approaches with traditional regulative forms of steering in their efforts to address sustainability challenges (Mukhtar-Landgren et al., 2019; Gustafsson and Krantz, 2025;). However, some studies nuance this picture by highlighting tensions, limitations, and shifts towards more regulative approaches in certain contexts (Storbjörk et al., 2019).

2.3 Certification systems as a governance instrument

Certification systems for urban development constitute a particular governance instrument that steers sustainability through formalisation and standardisation. They translate broad sustainability ambitions into concrete, measurable, and comparable criteria by defining indicators and requirements related to planning, construction, and management. Typically, certification systems assess a wide range of individual sustainability issues through multiple indicators, which are organised into thematic categories and subsequently aggregated, sometimes involving weighting, into an overall rating or label for a building or urban area (Wangel et al., 2016). The resulting certificate functions as a simplified and communicable representation of sustainability, enabling comparison, benchmarking, and marketing of ambition to external audiences (Brown, 2017).

Globally, a wide range of certification systems for buildings and urban areas have been developed. Some systems are nationally specific (e.g. Miljöbyggnad in Sweden, CASBEE in Japan, BEAM in Hong Kong), while systems like LEED (United States) and BREEAM (United Kingdom) have achieved international reach. While several systems focus exclusively on individual buildings, many also include neighbourhood or community versions that extend certification to a broader urban scale. These versions typically retain a similar overall structure but incorporate additional indicators addressing sustainability issues that emerge at the level of urban areas rather than individual buildings. In some neighbourhood-level certification systems, building-level requirements are included as part of the assessment framework, for example by requiring that individual buildings are also certified. This makes it possible to account for

sustainability issues addressed at the building scale alongside indicators that capture sustainability at the scale of the urban area.

From another perspective, certification systems for urban areas can be understood as a specific form of urban sustainability assessment (Cohen, 2017), sharing key characteristics with local indicator initiatives such as Sustainable Seattle (AtKisson, 1996), as well as more recent ‘Voluntary Local Reviews of the SDGs’ developed in cities such as Montevideo (City of Montevideo, 2025) and Malmö (City of Malmö, 2021). The *SDGs* refer to Sustainable Development Goals adopted by the United Nations (UN, 2015). These initiatives translate global sustainability agendas into locally adapted indicator sets. This translation of global and often qualitative objectives to specific urban contexts is referred to in some literature as localising sustainability (Zinkernagel, 2017; Weitz et al., 2018). In the context of certification systems, this logic is made explicit in frameworks such as Citylab (SGBC, 2019) and the German system DGNB (2018), both of which map their indicators to the *SDGs*. This illustrates how certification systems can bridge international agendas and local implementation. Through this process, certification systems render sustainability tangible and operational, while also shaping what is recognised as sustainable in practice.

In relation to the governance frameworks discussed earlier, certification systems can be understood as *de jure* and *de facto* standards (Lascoumes & Le Galès, 2007), as they establish norms and benchmarks for what is considered appropriate practice. They can also be interpreted through Bulkeley and Kern’s (2006) typology of local governance, as certification may be used or have effects across different modes of governance. When municipalities and other urban actors use certification to set sustainability requirements in the procurement of buildings or public space, such governance reflects *self-governing*. Certification systems may also function as benchmarks that influence how municipalities manage the infrastructure and services they provide. For instance, certification criteria related to energy performance can prompt municipalities to reduce fossil fuels in district heating systems, thereby lowering the climate impact of the energy they supply. In such cases, certification is rather having an impact on *governing by provision*. Increasingly, however, certification is used as a form of *governing through enabling*, as it structures collaboration among municipal actors, developers, consultants, and residents around shared definitions and goals for sustainability. Private real estate companies also use certification in similar

ways, employing it as a framework for collaboration with contractors and consultants. In this sense, certification systems are not only instruments of assessment but also arenas for coordination and dialogue (see e.g. Lind, 2014; Brown, 2017).

2.3.1 How certification systems have been assessed in previous research

Previous studies have compared and analysed certification systems for buildings and urban areas, examining how they define and measure sustainability. Wallhagen et al. (2013) distinguish between *procedure indicators*, which focus on planning and decision-making processes; *feature indicators*, which assess spatial or physical characteristics; and *performance indicators*, which aim to measure actual outcomes. Comparative studies show that certification systems combine and weight these indicator types in different ways (Haapio, 2012; Sharifi & Murayama, 2013; Wangel et al., 2016). As a result, the same building or urban area may receive different ratings depending on the certification system applied. Wangel et al. (2016) further show that many neighbourhood-level certification systems place greater emphasis on assessing procedures and features of the urban area than on its actual performance. This reflects the fact that certification is typically conducted during planning and development phases, rather than through ex post evaluation of realised outcomes.

In addition to this critique, other concerns have been raised in the literature. Scholars argue that certification systems may lack methodological robustness (Gouda & Masoumi, 2018), overemphasise environmental aspects at the expense of social and economic dimensions (Sharifi & Murayama, 2013; Ameen et al., 2015), and include too few mandatory indicators, allowing developers to focus on easily achievable criteria rather than those most relevant for sustainability (Haapio, 2012; Sharifi & Murayama, 2013; Wangel et al., 2016). The limited contextual relevance of globally applied systems has also been noted, as many have been developed in specific national settings and do not align well with local planning frameworks (Haapio, 2012; Sharifi & Murayama, 2013; Gouda & Masoumi, 2018).

Because certification systems are intended to function as governance instruments that shape decision-making and coordination in urban development, their relevance and reliability are crucial (Wallhagen, 2016). Yet, while previous research has provided extensive comparisons of certification systems in terms of structure, content, and indicator composition, with few

exceptions (e.g. Malmqvist et al., 2011), little attention has been paid to how such systems are developed, what key considerations guide this work, and how design choices are made. In particular, limited insight exists into how these processes shape the governing effects of certification systems. This lack of research on the development and design of certification systems constitutes a research gap addressed in this thesis.

2.3.2 Certification systems for sustainable urban development in Sweden

Against this broader background, the following section turns to the Swedish context, which constitutes the empirical focus of this thesis. In the Swedish context, certification systems for buildings have been in use for several decades. A central actor in this development has been the Sweden Green Building Council (SGBC), a non-profit industry organisation with members from across the Swedish real estate and construction sectors. SGBC has promoted and managed several certification systems adapted to a Swedish context, most notably the national system Miljöbyggnad, alongside international frameworks such as LEED and BREEAM, which have also been widely applied (Brown, 2017).

Early efforts to extend certification to the scale of urban areas in Sweden centred on international systems. A first step was taken when the Masthusen district in Malmö was certified according to BREEAM Communities (Lind, 2014). This was followed by a series of workshops and pilot exercises in which ongoing Swedish urban development projects assessed how they would perform under the BREEAM Communities framework. These assessments highlighted both the perceived value of certification as a structuring and communicative tool and significant challenges related to contextual fit. Several indicators were poorly aligned with Swedish planning legislation, institutional arrangements, and professional routines, while sustainability issues central to Swedish urban development were insufficiently addressed (Lind, 2014).

Taken together, these experiences contributed to an increasing articulation of the need for a nationally adapted framework for sustainable urban development in Sweden. This discussion formed the background for the development of Citylab, Sweden's first national certification system for sustainable urban development, coordinated by the Sweden Green Building Council. The development and content of Citylab are examined in the results chapters of this thesis.

2.4 Urban experiments as a governance instrument

Urban experiments constitute, alongside certification systems, a second type of governance instrument examined in this thesis in relation to sustainable urban development. Research on urban experimentation has emerged across multiple academic fields concerned with sustainability transitions, urban transformation and environmental governance (Ehnert, 2023; Castán Broto & Bulkeley, 2013; Evans et al., 2016; Karvonen et al., 2014; Sengers et al., 2019; van den Heiligenberg et al., 2017). Within these literatures, urban experiments are commonly understood as deliberate, place-based initiatives through which cities and other actors test new technologies, practices and modes of governing urban development under real-world conditions. While such experiments may be initiated and carried out by a wide range of actors, including private companies, civil society organisations, and research institutions, municipalities are frequently positioned as central actors in sustainability-oriented urban development due to their formal responsibilities and coordinating roles (Bulkeley & Castán Broto, 2013; Kronsell & Landgren, 2018; Evans et al., 2021). Accordingly, this thesis focuses on how municipalities engage with urban experiments as governance instruments, and in particular on how experimental initiatives are used, interpreted, and integrated within municipal organisations in order to enable upscaling.

Drawing on insights from sustainability transitions research and transition management, urban experiments are often conceptualised as taking place in so-called niches, understood as relatively protected spaces in which new ideas, technologies and practices can be explored before potentially being translated into more established contexts called regimes (Geels, 2002; Loorbach, 2010). In addition, urban experiments are frequently described as arenas for collaboration and learning, generating actionable knowledge with the potential to inform, be scaled or become institutionalised beyond individual projects, thereby contributing to broader processes of sustainability-oriented change (Sengers et al., 2019; Bulkeley et al., 2019; Ehnert, 2023).

In the Swedish context, these orientations are reflected both in national funding programmes, such as Viable Cities (Larsson, 2023) and Impact Innovation (Brattström, 2024), and in how innovation projects related to urban development are organised and conducted. Such initiatives include a wide range of projects, from large-scale area-based developments to smaller

technological trials as well as organisational and procedural tests, which nevertheless often share a common logic of experimentation, learning and scaling aimed at informing future practice (see e.g. Algehed et al., 2019; Mukhtar-Landgren et al., 2019; Dóci et al., 2022; Oldbury & Isaksson, 2022; Witzell & Oldbury, 2023; Eneqvist, 2022; Grundel & Trygg, 2024; van der Leer, 2026). In Swedish municipal practice, however, the term urban experiment is rarely used. Instead, these kinds of initiatives are commonly described as tests, pilots, demonstrations, living labs, cutting-edge projects or similar. From an analytical perspective, many of these initiatives can nevertheless be understood as urban experiments, insofar as they involve the exploration of new solutions, practices or modes of collaboration with the explicit intention of generating learning that can inform future projects and urban governance practices.

In this thesis, the term *urban experiment* is therefore used as an analytical umbrella concept to capture this diverse set of practice-based initiatives. The focus is not on assessing the detailed design or technical content of individual experiments, but on how learnings from these initiatives can be mobilised and structured to support more structured upscaling. In this sense, the thesis draws on literature from multiple research fields as conceptual lenses, while remaining grounded in practitioners' own understandings and uses of experimental initiatives.

In relation to the governance frameworks discussed earlier, urban experimentation can be linked to several of the modes identified by Bulkeley and Kern (2006). When municipalities test new ways of managing their own operations, experiments function as a form of self-governing. When they involve developing infrastructures or services, they align with governing by provision. Mainly, however, urban experiments correspond to governing through enabling, as they rely on municipalities' ability to convene and coordinate multiple actors across sectors, providing arenas for collaboration, co-creation, and shared learning (Kronsell & Mukhtar-Landgren, 2018). From the perspective of Lascoumes and Le Galès (2007), experimentation can be understood as an agreement- and incentive-based instrument, insofar as it mobilises voluntary participation and negotiated commitments to explore innovative pathways rather than imposing predefined rules or standards.

2.4.1 Identifying the need of process learning and scaling

As noted above, a central assumption in both theory and practice is that urban experiments generate learning that can be scaled and integrated into broader governance processes. This assumption underpins the rationale for experimentation within sustainability transitions research, where experiments are commonly framed as vehicles for producing actionable knowledge that can inform policy and institutional change (Sengers et al., 2019; Bulkeley et al., 2019; Ehnert, 2023). Yet, despite this prominence of learning and scaling in the literature, relatively little is known about how such learning is actually created, organised and institutionalised within municipal organisations and governance systems (van den Heiligenberg et al., 2017; Mukhtar-Landgren et al., 2019; von Wirth et al., 2019; Evans et al., 2021; Metzger et al., 2025). As argued by van Doren et al. (2018) and Lam et al. (2020) without deliberate strategies for scaling, experimental initiatives risk remaining isolated examples, with limited capacity to influence mainstream planning and policy practices.

In the Swedish context, previous studies show that while upscaling does occur, it is often difficult to achieve in practice and remains largely unstructured, (see e.g. von Wirth et al., 2019; Eneqvist, 2022; Oldbury & Isaksson, 2022; Dóci et al., 2022; Witzell & Oldbury 2023). Research has also pointed to a limited focus on upscaling within experimental projects themselves (e.g. Grundel & Trygg, 2024; Fred, 2022), as well as to the need to better connect experimental initiatives to ordinary municipal work in order to avoid them becoming isolated from ongoing governance processes (e.g. van der Leer, 2026).

To make urban experiments effective instruments of sustainable urban governance, a more nuanced understanding of learning is required, one that extends beyond the technical evaluation of project outcomes to include how organisations and governance systems themselves learn and adapt. Evans et al. (2021) introduce the concept of *process learning* to describe the capacity of municipal organisations to reflect on and adapt their own processes of collaboration, coordination and decision-making through experimentation. As Evans et al. (2021, p. 179) note, “the process by which municipal organisations learn and change is surely a key ingredient of urban transformation and should be considered more centrally by funding instruments and researchers.” Neij and Heiskanen (2021) make this organisational dimension of learning explicit through the notion of *learning to learn*, highlighting the importance of developing mechanisms that enable insights from individual projects to inform

broader organisational routines, strategic orientations and cross-sectoral coordination. Along similar lines, Wolfram et al. (2019) propose the notion of *meta-learning*, learning about learning itself, referring to the ability of actors to critically examine and adjust the institutional and governance arrangements that shape how learning occurs. They argue that such meta-learning is crucial for developing the reflexive and adaptive capacities needed for transformative climate governance.

Together, these perspectives point to a persistent gap between the central role attributed to learning and upscaling in theories of urban experimentation and the limited understanding of how such processes are organised, sustained, and embedded within municipal governance in practice. While existing research has identified key challenges, there remains limited understanding of how learning and upscaling can be more systematically organised in practice. Thus, this thesis contributes by examining these processes and developing insights into how learning from urban experiments can be more effectively structured and translated into more durable organisational and governance change within municipalities.

2.4.2 Analysing learning and scaling from urban experiments

Building on the identified need for a deeper understanding of learning and scaling from urban experiments, this section introduces the theoretical perspectives used to analyse scaling from urban experiments within municipal governance. It focuses on the learning processes through which urban experiments can enable scaling beyond individual projects.

The concept of governance learning, as elaborated by Wolfram et al. (2019), offers a comprehensive framework for analysing how learning occurs within urban governance processes. Wolfram et al. (2019) identify four interrelated dimensions that are particularly useful for examining learning in this context: who learns, what is learnt, the depth of learning, and the interaction forms through which learning occurs. While these dimensions structure the analysis in this thesis, they are interpreted and elaborated by drawing on related theoretical perspectives, including organisational learning, sustainability transitions, and research on scaling urban experiments.

Concerning *who learns*, governance learning draws attention to what actors and organisational levels are involved in and benefit from learning processes. Learning may occur among individuals, departments, networks, or entire governance systems (Wolfram et al., 2019). This thesis focuses primarily on

learning within municipalities, while acknowledging that inter-municipal learning is also important but beyond the empirical scope. Dóci et al. (2022) use the metaphor of *ripples* to describe how learning outcomes spread from a core group directly involved in a project to other parts of an organisation. Their study illustrates how the further these ripples extend, the more difficult it becomes to achieve deep and transformative learning. From the perspective of urban experimentation, Grin (2020) distinguishes between two generations of experiments depending on *who learns*: early experiments were led by radical innovators seeking to challenge incumbent structures, whereas more recent experiments are initiated by incumbents themselves. This shift expands the potential for institutional change but also introduces tensions, as incumbent actors must navigate between experimental ambitions and established organisational logics (Grin, 2020).

When discussing *what is learnt*, Wolfram et al. (2019) argue that learning can affect different aspects of governance: polity, referring to institutional structures; politics, referring to decision-making processes; and policy, referring to specific tools and interventions. In a complementary typology, Van Poeck et al. (2020) distinguish between practical learning, which produces new actions, routines, or procedures; relational learning, which concerns the development of trust, collaboration, and shared understanding; and conceptual learning, which involves critical reflection and reframing of problems. Together, these perspectives show that learning within urban governance is not limited to acquiring technical knowledge but encompasses relational and cognitive shifts that reshape how sustainability challenges are perceived and addressed.

The *depth* of learning determines its transformative potential. Drawing on organisational learning theory, Wolfram et al. (2019) use the concept of learning loops to describe how reflection can lead to deeper change. Single-loop learning focuses on improving existing practices, asking whether actions are performed correctly; whereas double-loop learning challenges the assumptions and norms that guide these practices, asking whether the right things are being done (Basten & Haamann, 2018; Stam et al., 2023). Some scholars also identify triple-loop learning, which concerns reflexive learning about learning itself, variously described as learning how to learn or as reflecting on why learning occurs in particular ways (Stam et al., 2023). In the context of urban governance, deeper forms of learning are essential for transformative change, as they allow organisations to question entrenched

routines and institutional logics (Dóci et al., 2022). Related to the notion of depth of learning, research on urban experimentation often approaches similar questions through the lens of scaling. Rather than focusing explicitly on how deeply learning transforms underlying assumptions and practices, this body of literature distinguishes between different forms of scaling, embedding, or amplifying the outcomes of experimental projects (van Doren et al., 2018; Fuenfschilling et al., 2019; von Wirth et al., 2019; Lam et al., 2020; Sengers et al., 2021; Eneqvist, 2022; Adams et al., 2023). These perspectives thus shift attention from the depth of learning itself to how learning is taken forward, translated, and institutionalised in different ways. While terminology and categorisations vary, Lam et al. (2020) provide a useful conceptualization with amplification as an umbrella term, showing that upscaling can happen through different processes in different dimensions. In this thesis, *upscaling* is nevertheless used as the overarching term. This choice reflects both its close conceptual and linguistic proximity to the Swedish term *uppskalning*, which is commonly used by practitioners in municipal contexts and in research. This choice is also consistent with the terminology used in the papers included in the thesis.

The final dimension concerns the *interaction forms* through which learning occurs. Wolfram et al. (2019) differentiate between sequential learning, where insights are drawn from past experiences, and parallel learning, where reflection and governance take place simultaneously. This duality highlights the importance of both retrospective evaluation and real-time learning during ongoing processes. Organisational learning theory adds further depth by explaining how knowledge is created, transferred, and internalised within organisations. Within this literature, Basten and Haamann (2018) describe a spiral of organisational knowledge creation involving four iterative steps. Through *socialisation*, tacit knowledge is shared informally; through *externalisation*, this knowledge is articulated and made explicit; through *combination*, explicit knowledge is disseminated across the organisation; and through *internalisation*, it is re-embedded as new tacit knowledge. This cycle shows how learning can evolve from isolated individual experiences into collective organisational competence, but only if there are structures in place to document, reflect on, and communicate these insights.

Table 1. Amplification processes, modified from Lam et al. (2020).

Categories	Amplification/upscaling processes	
Amplifying within – doing the same initiative longer or faster	Stabilising	Strengthening and more deeply embedding initiatives in their context, making them more resilient to upcoming challenges and ensuring that they last longer.
	Speeding up	Increasing the pace by which initiatives create impact or are brought to fruition.
Amplifying out – doing the same initiative in a similar or dissimilar context	Growing	The expansion of the impact range, where the initiative works in the same way across a geographical location, organisation, or sector.
	Replicating	Copying an initiative to a dissimilar context.
	Transferring	Taking an initiative and implementing a similar but independent one in a different place, adapted to the new but similar local context.
	Spreading	Disseminating core principles and approaches to other places with a dissimilar context.
Amplifying beyond – changing rules and values	Scaling up	Impacting higher institutional levels by changing the rules or logics of incumbent regimes.
	Scaling deep	Change in values and mindsets.

Beyond the learning dimensions captured by Wolfram et al.'s framework, the literature also points to a set of broader contextual and organisational conditions that shape the possibilities for upscaling. These conditions are not specific to urban experimentation alone, but relate more generally to the governance of sustainability and climate action in cities.

van der Heijden (2019), for example, identifies a range of enabling factors for urban climate governance, including political support, municipal autonomy, access to funding, and effective coordination both vertically across governance levels and horizontally across municipal departments. From an organisational perspective, Basten and Haamann (2018) similarly highlight enablers such as systematic problem solving, deliberate experimentation, and mechanisms for transferring knowledge within organisations.

From a sustainability transitions perspective, structural conditions at the regime and landscape levels can further shape the extent to which insights from niche experiments can be upscaled within more established governance and institutional arrangements (Geels, 2002; Köhler et al., 2019). At the organisational level, tensions between an experimental logic emphasising innovation and risk-taking, and a bureaucratic logic prioritising predictability and control, have been shown to constrain the scaling of new approaches (Bögel et al., 2019; Berglund-Snodgrass & Mukhtar-Landgren, 2020; Hellquist et al., 2025).

Within this broader set of conditions, a particularly emphasised aspect in the literature concerns institutional capacity (Norell Bergendahl, 2016; Isaksson & Heikkinen, 2018; Eneqvist, 2022; van der Leer, 2026), building on earlier work by Healey (1998) on collaborative planning. In this literature, institutional capacity is a combination of knowledge resources, relational resources and mobilisation capacity, that is, actors' ability to generate and interpret knowledge, build and maintain networks, and actively mobilise these resources in pursuit of change (Isaksson & Heikkinen, 2018). Within this body of work, several scholars highlight the critical role of individual actors who operate across organisational and sectoral boundaries. Such actors contribute to institutional capacity by facilitating coordination, translating knowledge and aligning practices across domains. They are variously described as bridging agents (Hughes et al., 2020), mainstreaming connectors (Adams et al., 2023), institutional entrepreneurs (van der Heijden, 2019; Wolfram et al., 2019), or entrepreneurial coordinators (Evans et al., 2021). By linking different arenas and translating knowledge between them, these actors play a crucial role in ensuring that learning becomes actionable and embedded within regular governance practices.

Together, these theoretical perspectives form an analytical foundation of this thesis. They guide the analysis of who learns, what is learnt, and the depth and forms of learning associated with urban experiments, as well as the contextual and organisational conditions that shape these processes. These perspectives are subsequently used in the discussion to interpret the empirical findings and to reflect on the role of upscaling in sustainable urban governance.

3 Research context and methodology

This thesis builds on work in three different research projects, presented in the five appended papers. The first project, reported in Papers I–III, focuses on the development of a certification system for sustainable urban areas. More specifically, these papers analyse the development of the certification system Citylab Post-Construction through a collaborative research process between KTH Royal Institute of Technology and the Sweden Green Building Council (SGBC), in which the certification system was developed in close interaction with Swedish practitioners.

The second and third projects, presented in Papers IV and V respectively, both explore issues related to scaling learnings from urban experiments. Together these papers constitute a second empirical strand of the thesis focusing on how municipalities engage with and learn from urban experimentation in the Swedish context. Paper IV builds on a transdisciplinary research approach carried out in collaboration with the environmental departments of the municipalities of Stockholm, Gothenburg and Malmö, where researchers and practitioners jointly explored how learning and upscaling from urban experiments can be supported. Paper V, by contrast, is based on a qualitative case study conducted in one anonymised Swedish municipality examining how urban experiments are understood and mobilised within municipal organisations.

While the papers share several methodological characteristics, they also differ in important respects, particularly in terms of the degree and form of

practitioner involvement and the role of the research in relation to ongoing practices. In particular, Papers I–IV draw on transdisciplinary research processes involving close collaboration with practitioners, in which researchers and practitioners jointly engage in knowledge production and problem framing in relation to real-world sustainability challenges (Lang et al., 2012), whereas Paper V follows what is here described as a knowledge-first approach (Wittmayer & Schöpke, 2014), where the primary aim is to generate analytical understanding of existing practices rather than to intervene in them through collaborative processes. The following section introduces the research contexts of the individual papers, as well as the methodological approaches employed across the studies.

3.1 Transdisciplinarity in the research processes

As just mentioned, Paper I–IV are all part of research processes characterised by an epistemological orientation in which practitioners' experiences and perspectives are at the centre of the knowledge production process. This orientation reflects the overall aim of the thesis, which is to examine how governance instruments for sustainable urban development are developed, interpreted, and mobilised in practice. Addressing such questions requires methodological approaches that allow insight into the processes through which certification systems are designed and negotiated, and through which learning and upscaling of urban experiments are organised in real-world governance settings. Accordingly, the research was carried out *with* practitioners rather than *on* or *about* them. This approach aligns with what Lang et al. (2012) describe as a transdisciplinary research process. According to Lang et al. (2012), such a process can be divided into three phases. In Phase A, the research team and societal actors jointly define the problem to be addressed and establish a shared understanding of objectives and scope. In Phase B, researchers and practitioners collaboratively generate knowledge by integrating scientific insights with practice-based experience, typically through iterative cycles of developing, refining and discussing concepts, approaches or solution pathways. In Phase C, the results are reintegrated into both practice and science, meaning that the knowledge produced is applied and adapted in real-world contexts while also being analysed and further developed in academic settings.

3.1.1 A transdisciplinary approach to developing Citylab Post-Construction

To provide a more concrete account of the context in which the research was conducted, Paper I-III examine the development of a certification system for existing urban areas, Citylab Post-Construction, which was developed as part of the broader Citylab framework for the certification of urban development. While other components of the Citylab framework address sustainability considerations in the planning and implementation phases of urban development projects, Citylab Post-Construction focuses on the assessment of sustainability in completed or already existing urban areas. The development of Citylab Post-Construction thus built on earlier Citylab components, which provided an important contextual backdrop but did not form part of the empirical analysis.

In line with the transdisciplinary research process described by Lang et al. (2012), it is important to recognise the dual outcomes (Phase C) generated by the research. On the one hand, the research resulted in a certification system (SGBC, 2019) intended to be used primarily by Swedish municipalities and large property owners; on the other hand, it produced theoretical insights of relevance to the scientific community, presented in Papers I–III and this thesis. Throughout the research process, representatives from municipalities, construction companies, real estate firms, consultancy companies and interest organisations were involved. In Phase A, their involvement centered on clarifying what a post-construction certification of urban areas should address, particularly in relation to the existing components of Citylab which focused on planning and construction phase of urban areas. In Phase B, practitioners participated in several iterative stages of the design process, ranging from formulating overarching principles to defining what the system should assess and, finally, specifying detailed criteria and evaluation procedures. How this involvement was organised and enacted throughout the design process is further elaborated in chapter 4.

3.1.2 A transdisciplinary approach to learning and scaling in urban experiments

Paper IV is also based on a transdisciplinary research process in line with Lang et al. (2012), although in a different empirical and organisational context. The research was conducted in collaboration with environmental administrations in Stockholm, Gothenburg, and Malmö, where researchers and municipal practitioners jointly explored challenges related to learning and scaling from urban experiments.

In Phase A, practitioners and researchers co-defined the problem by identifying organisational barriers, limitations in existing routines, and broader challenges related to achieving more structural approaches to scaling.

Phase B involved collaborative knowledge production through the iterative development of a supportive tool designed to strengthen municipal capacity to work more structured with scaling. The tool was shaped through the integration of theoretical insights with practitioners' situated experiences and was refined through collaborative discussions and testing.

In Phase C, the results were reintegrated into both practice and theory. For practitioners, the research resulted in a supportive tool consisting of both a process-oriented description of how municipalities could approach scaling, and a set of guiding questions intended to support reflection during the planning for upscaling. The research team defined the tool and the testing framework, whereas practitioners contributed by allocating time and organisational resources to conduct the testing. The supportive tool, including both the process description and the guiding questions, was presented in a practitioner-oriented, popular science report in Swedish (Sondal et al., 2022). In parallel, the theoretical and analytical implications of the development process were elaborated in Paper IV.

3.1.3 Research through design as a complementary lens

While Paper I-IV primarily align with a transdisciplinary research process, they also share characteristics that can be understood through the lens of Research through Design (RtD). RtD highlights how knowledge can emerge through acts of making, by constructing and refining an artefact as part of the inquiry rather than analysing design processes from a distance (Zimmerman et al., 2010; Koskinen et al., 2011). In transdisciplinary research, practical relevance is a central aim, but the concrete form of the practical outcome is not necessarily designed or produced by the researchers themselves. In Paper I-IV, however, the researchers actively participated in shaping the artefacts that would ultimately be used in practice: a certification system in Paper I-III and a supportive tool in Paper IV. This means that the artefacts were not only practical outputs, but that their development functioned as a methodological pathway through which theoretical insights were generated. Engaging directly in the shaping of what practitioners would later use, rather than leaving this construction entirely to practitioners, revealed assumptions, trade-offs and

challenges that would likely have remained invisible through observation or dialogue alone.

Identifying the research processes in this thesis as both transdisciplinary and as design processes in line with Research through Design (RtD) highlights important similarities as well as notable differences between the two approaches. As presented in Table 2, these types of processes share several similarities, particularly in their emphasis on collaboratively understanding and framing the problem and exploring potential solution pathways. They are also characterised by an iterative relationship between these phases, in which insights gained in one step continuously inform and reshape the others. The design process, however, differs by including an explicit phase dedicated to testing what has been developed (Maher et al., 2018), and such tests constituted a central methodological element in the research processes. These tests functioned not merely as validation exercises but as integral parts of the inquiry process, generating insights that actively shaped both the practical artefact and the emerging theoretical understanding. RtD therefore provides a complementary perspective for understanding how theoretical contributions in this thesis emerged through the intertwined development of knowledge and artefacts.

Table 2. Connections between the phases in a design process and a transdisciplinary process

Design process according to Maher et al. (2018)	Transdisciplinary process according to Lang et al. (2012)
Problem/opportunity framing	Collaborative problem framing and building a collaborative research team
Solution development	Co-creation of solution-oriented and transferable knowledge through collaborative research
Testing	
Critical reflection	(Re-)integrating and applying the co-created knowledge

3.1.4 The role of the researcher

The transdisciplinary orientation of this thesis resonates with what Wittmayer and Schöpke (2014), drawing on Miller (2013), describe as process-oriented research settings, where knowledge production is intertwined with the structuring of learning and reflection among societal actors. Their framework was originally developed in relation to research settings where researchers take on relatively explicit roles as change agents within sustainability transitions. While this thesis is situated within the broader field of sustainability

transitions, the researchers did not assume a change agent role in the direct, interventionist sense. Nevertheless, the framework presented by Wittmayer and Schöpke (2014) provides a useful analytical lens for reflecting on the different roles enacted by the researcher.

Against this background, the researcher engaged with several of the roles outlined by Wittmayer and Schöpke (2014). This included acting as a *self-reflexive scientist*, by continuously examining how methodological choices, facilitation strategies and personal assumptions shaped the research process and its outcomes; as a *reflective scientist*, by analysing empirical material and contributing conceptual clarity to the issues practitioners were addressing; as a *process facilitator*, by structuring the interactions through which practitioners jointly explored problems, developed ideas and tested emerging outputs; and as a *knowledge broker*, by translating theoretical insights into accessible formats and helping practitioners relate these insights to their own organisational contexts. In some sense, the role also involved elements of a *change agent*, as the research processes themselves created arenas for practitioners to reconsider current practices and explore more sustainable alternatives. However, this did not entail acting as a change agent within or between organisations in the direct, interventionist way described by Wittmayer and Schöpke (2014).

3.2 Knowledge-first approach to urban experiments

In contrast to earlier discussed papers, Paper V is based on a knowledge-first approach, as described by Wittmayer and Schöpke (2014). Within this approach, the primary aim of research is to generate analytical understanding of existing practices rather than to intervene in or shape them through collaborative processes with practitioners. Paper V is based on a single case study of one anonymised municipality, in line with Gummesson (2004), and relied primarily on qualitative interviews following the research-conversation approach described by Gustavsson (2004) (also see Chapter 4). This design reflects the aim of the thesis to examine how urban experiments are understood and mobilised as governance instruments within municipal organisations. Focusing on one municipality enabled an in-depth examination of how learning from urban experiments is interpreted, negotiated, and shared across different building departments, thereby providing insight into organisational conditions that shape possibilities for upscaling. The study

represents a snapshot in time rather than a longitudinal investigation, capturing how learning and coordination are enacted within existing organisational structures.

This type of study entails certain limitations, particularly in relation to generalisability. However, single case studies are widely used within sustainability transitions research, as noted by Köhler et al. (2019), who emphasise their value for generating situated insights within complex governance settings. Gummesson (2004) similarly underlines that a single case cannot establish general truths, yet it can deepen understanding and contribute to the concretisation of theoretical concepts within a field of study. In this sense, the purpose of the study is not to generalise to a broader population but to contribute to analytical generalisation, where insights from the case are related to and inform theoretical understandings of the studied phenomenon. In Paper V the single-case design therefore provides an opportunity to explore how practitioners perceive the role of urban experiments in contributing to a sustainable transition.

An important difference compared to the other papers is that Paper V aligns with what Wittmayer and Schöpke (2014) describe as a knowledge-first approach. This stands in contrast to the process-oriented approach described earlier. Within a knowledge-first approach, the primary aim is to generate analytical understanding rather than to facilitate learning processes, co-create tools, or design change-oriented activities together with practitioners (Wittmayer and Schöpke, 2014). Consequently, no new working practices, methods, or tools were developed or tested. Instead, the researcher's role was to collect and analyse practitioners' perspectives on urban experiments through qualitative interviews and document studies, and to interpret these perspectives in relation to existing research. The researcher's role was therefore more delimited and analytically oriented than in the process- and design-oriented research processes.

4 Methods and Materials

This chapter describes the methods and empirical material used across the papers included in this thesis. As outlined in Chapter 3, the thesis is structured around two complementary empirical strands: one focusing on the development of a certification system (Papers I–III), and one focusing on learning and upscaling from urban experiments within municipal organisations (Papers IV–V). While the papers employ several recurring methods, they also differ in how the research processes were designed and carried out. As discussed in Chapter 3 these differences reflect variations in methodological approaches, but also in research aims and empirical contexts.

While several of the studies constitute transdisciplinary research processes, such an approach does not follow a predetermined or linear sequence of methods. Rather, methodological choices and research procedures are adapted to the questions being examined and to the contexts in which the studies are conducted (Lang et al., 2012). This chapter begins with an overview of the overall research processes and the methods used across them. This is followed by thematic sections that describe in more detail how the different methods were applied in the individual research processes.

4.1 Overview of the research processes

The choice to focus on the development of Citylab Post-Construction in Papers I–III reflects the aim of the thesis to understand how certification systems are shaped through design processes. Rather than studying certification as a finished assessment framework, the research followed and contributed to the

actual development of a Swedish certification system for existing urban areas, through a collaborative research process involving KTH Royal Institute of Technology and the Sweden Green Building Council (SGBC). The process provided a unique opportunity to study such a development in real time and informed the choice of research design. This made it possible to analyse the considerations and rationales that emerged as theoretical perspectives on sustainability assessment and governance were translated into a practically applicable certification tool in collaboration with practitioners. The research process was thus closely integrated with the development of the certification system itself, while also involving the development of a framework of key considerations, informed by earlier research, which was used to structure and guide reflection on the trade-offs and rationales involved in design decisions.

As noted in Chapter 3 and described in more detail in Table 3, the development of Citylab Post-Construction began with a problem-framing phase aimed at building an understanding of the existing parts of the Citylab framework, the views and experiences of practitioners using these existing parts. This phase included observations conducted within the Citylab Action programme, which provided deeper insight into how Citylab was used in the planning and construction phases of urban development projects. These observations were particularly valuable because actors engaged in planning new urban areas according to Citylab were also considered a key target group for later using the Post-Construction component once projects had been completed.

This was followed by the actual development of the certification system in a second phase, in which different methods were used to relate the certification system to existing indicators from other contexts, as well as to relevant regulations and guidelines, while also enabling the co-creation of the certification system together with practitioners (see Table 3). Throughout this phase, the framework of key considerations functioned as a tool for reflecting on the trade-offs and rationales involved in the co-creation process.

In the testing phase, various methods were used to examine whether the trade-offs and rationales underpinning the proposed certification system were regarded as reasonable and relevant by practitioners (see Table 3). These methods included an open consultation procedure in which a draft version of the certification system was circulated to all members of the Sweden Green Building Council (SGBC), comprising approximately three hundred organisations and companies at the time. In total, twenty-five organisations submitted written responses, representing a broad range of actors within the

urban development sector. This process generated further reflection in relation to the framework of key considerations and contributed to the continued refinement of the certification system.

A detailed, step-by-step account of the development of Citylab Post-Construction is provided in Paper III, while the present chapter focuses on the overarching methods and materials applied.

Table 3. Overview of the methods used in Papers I–III. Methodological details are presented thematically later in the chapter. The phases correspond to the transdisciplinary and design process phases presented in Table 2.

Method (see section 4.2 to 4.5 for details)	Materials/respondents	Paper	Conducted
Problem framing			
Observation	Pilot version of the Program Citylab Action	I	2016-2017
Document analysis	Existing parts of the Citylab certification system considering planning and construction of urban areas	I	2017
Conceptual review of scientific literature	Relevant scientific literature on indicator development	II	Spring 2018
Interviews	13 representatives of potential future users of Citylab Post-Construction	II	Spring 2018
Solution development			
Document analysis	Indicators used in other contexts. 40 sources of different kinds included.	III	Spring 2018
Participatory sessions	22 practitioners working with selecting indicators and suggest detailed criteria	III	Autumn 2018
Document analysis	Regulations, government reports/guidelines	III	Autumn/winter 2018
Interviews	33 experts on specific sustainability aspects	III	Autumn/winter 2018
Testing			
Open consultation	Comments on draft version of the certification system by 25 organisations	III	Spring 2019
Participatory sessions	Two sessions focused on evaluating the indicator criteria by comparing them with observed conditions in an urban area.	III	Autum 2019
Participatory sessions	12 representatives from real-estate owners, developers, consultancy firms and municipalities functioning as a reference group with five meetings during the project period.	II, III	Spring 2018, winter 2018, spring 2019, summer 2019, autumn 2019

The second empirical strand of the thesis, presented in Papers IV and V, focuses on scaling learnings from urban experiments. While both papers address this overall theme, they represent two complementary research designs that together provide a broader understanding of how urban experiments function as governance instruments in practice.

The study for Paper IV was conducted as a transdisciplinary research process in collaboration with the environmental administrations of the municipalities of Stockholm, Gothenburg, and Malmö. These municipalities were selected because they had ongoing experience of working with sustainability-oriented initiatives described in practice as pilots or tests, and had identified a lack of organisational structures for working with upscaling learnings. This created an interest in developing and testing new working methods within their organisations. The study focused on developing and testing a supportive tool aimed at structuring reflection on learning and upscaling from urban experiments. The process began with a problem-framing phase, in which practitioners' experiences of challenges related to learning and upscaling were explored, together with examples of situations where upscaling had occurred, and insights from previous research on these issues. This provided the basis for an initial version of the supportive tool. The tool was then further developed, tested and refined through iterative cycles of interviews and participatory sessions, in close collaboration with practitioners, as outlined in Table 4. This iterative process allowed researchers and practitioners to jointly explore how learning from experiments could be better organised and embedded within municipal organisations.

Table 4. Overview of the methods used in IV. Methodological details are presented thematically later in the chapter. The phases correspond to the transdisciplinary and design process phases presented in Table 2. In Paper IV, solution development and testing were carried out in an iterative and tightly integrated manner, which makes it analytically difficult to separate them into distinct phases in the table.

Method (see section 4.2 to 4.5 for details)	Materials/respondents	Paper	Conducted
Problem framing			
Interviews	Seven civil servants (project team members from municipalities participating in the research project) regarding why upscaling do not happen	IV	Spring 2020
Participatory session	Seven civil servants (same as in interviews made earlier) to confirm and elaborate on results from interviews	IV	Summer 2020
Participatory sessions	Two similar sessions held with eight respectively six representatives from participating municipalities to identify examples of sustainable solutions being upscaled in Stockholm respectively Gothenburg and Malmö	IV	Autumn 2020
Interviews	Four respectively six representatives from Stockholm and Malmö municipality regarding their experience of sustainable solutions that had been upscaled	IV	Autumn 2020
Solution Development and testing (iteratively)			
Conceptual review of scientific literature	Relevant scientific literature on upscaling and institutional capacity	IV	Autumn/winter 2020-2021
Participatory session	Eight participatory sessions were conducted, each involving three to five municipal civil servants who collaborated in responding to the questions included in a draft version of the supportive tool. Each session focused on the potential upscaling of a specific urban experiment.	IV	Autumn 2021
Participatory session	Seven civil servants (project team members from municipalities participating in the research project) to cluster and priorities comments on draft version	IV	Winter 2022
Participatory session	Seven civil servants (project team members from municipalities participating in the research project) putting comments on the draft version into context	IV	Spring 2022

In contrast, Paper V follows a knowledge-first approach (Wittmayer & Schöpke, 2014), as introduced in Chapter 3, and is based on a qualitative single-case study of one anonymised Swedish municipality. The case was selected due to its ongoing building boom, involving both conventional construction projects and more ambitious “cutting-edge” initiatives with high and well-recognised climate mitigation ambitions. This provided a relevant empirical setting for analysing how urban experiments can be mobilised within a municipal organisation, as well as how lessons from such initiatives can be generated and spread within and across organisational boundaries. While the study focuses on a single case, it aims to support analytical generalisation (Gummesson, 2004) by relating the empirical findings to, and informing, theoretical understanding. The study relied primarily on qualitative interviews and document analysis (see Table 5), providing insight into the role of urban experiments in advancing sustainable urban development, and how lessons from these initiatives are shared within and across different parts of municipal organisations. This complements the more intervention-oriented approach of Paper IV by offering a detailed account of how such processes are understood and enacted within existing governance arrangements.

Table 5. Overview of the methods used in Papers V. Methodological details are presented thematically later in the chapter.

Method (see section 4.2 to 4.5 for details)	Materials/respondents	Paper	Conducted
Document analysis	Organisational strategies, climate governance documents, programmes and targets for sustainable construction and related municipal policy frameworks.	V	Spring 2024
Interviews	11 interviews with respondents representing all ‘building departments’,	V	Spring 2024

The remainder of this chapter elaborates on the four main categories of methods used across all or several of the studies: Document review and analysis, conceptual reviews of scientific literature, interviews, and participatory sessions.

4.2 Document reviews and analysis

While not all document-based work in the thesis constitutes document analysis in a strict sense, documents played a central role in informing both the design and interpretation of the studies. Thus, document review is used here as an umbrella term covering several ways of engaging with documents, ranging from systematic forms of document analysis involving the identification,

categorisation and comparison of data across sources (Bowen, 2009), to exploratory reviews aimed at building contextual understanding.

One strand of this work involved a more systematic document analysis (Bowen, 2009) of sustainability indicators used in international, national and local frameworks (Paper III). The selection of sources was guided by the ambition to align the certification system with established societal sustainability goals that public actors are expected to work towards, while at the same time drawing on existing indicator initiatives rather than developing indicators in isolation. In addition, municipal monitoring systems were included to account for indicators where data are already collected in practice. The analysis involved a structured review of forty sources, including the UN Sustainable Development Goals (United Nations, 2015), national objectives such as Sweden's Environmental Quality Objectives (Naturvårdsverket, 2018), and local municipal monitoring systems (Kolada, 2018). Through an iterative process of identifying, comparing and categorising indicators across these sources, approximately 1,100 individual indicators were compiled and organised into one hundred thematic groups relevant to district-scale sustainability. This categorisation informed the subsequent collaborative process of selecting indicators for inclusion in the certification system (see Section 4.5).

In contrast to this more systematic form of document analysis, the development of Citylab Post Construction also involved several more exploratory document reviews of different strands of grey literature. During the initial phase, one document review focused on the existing components of the Citylab framework, primarily the certification manuals and criteria used for assessing the planning and implementation phases of urban development projects (Paper I). This review provided essential background for understanding the structure and logic of Citylab and, together with observations from the Citylab Action Programme described earlier, was important for analysing how the framework was used in practice.

A third set of documents reviewed comprised relevant regulations, governmental reports, and policy guidelines linked to the indicators selected for Citylab Post-Construction (Paper III). These documents were not analysed systematically across sources, but were used to ensure alignment with existing regulatory frameworks and established practices. This work was conducted in parallel with 33 interviews with subject-matter experts (see section 4.4), focusing on technical and regulatory aspects of the indicators, such as

requirements related to urban air quality, stormwater management, and nature value assessments.

Similarly, document-based materials also formed an important part of Paper V, which examines how urban experiments are used within a single municipality. The reviewed material included organisational strategies, climate governance documents, programmes and targets for sustainable construction and related municipal policy frameworks. These documents provided critical contextual understanding and informed the interview design by clarifying how the municipality organised and articulated its work on sustainable urban development.

4.3 Conceptual reviews of scientific literature

Since Papers I–IV are grounded in transdisciplinary and process-oriented approaches, an important aim has been to use theoretical knowledge actively to inform how practice can be developed. In addition to the general theoretical backgrounds, two distinct conceptual reviews of scientific literature were therefore conducted as explicit methodological steps in Paper II and Paper IV. These reviews are referred to as *conceptual* reviews because they were not intended to function as systematic literature reviews based on exhaustive search strategies, but as targeted knowledge syntheses designed to directly support the empirical and collaborative work of the research processes. Following Cooper's (1988) taxonomy of literature reviews, the two reviews are characterised primarily by three central features. First, in terms of goal, the reviews were oriented towards integration, with a specific emphasis on identifying central issues and developing a shared conceptual and linguistic understanding across different strands of literature. Second, in terms of coverage, the reviews were deliberately focused on central or pivotal contributions, rather than guided by an exhaustive ambition. The selection of literature was carried out iteratively, drawing on key references, citation tracking, and purposive identification of influential contributions, rather than through predefined database searches. Third, the results of the reviews were organised conceptually, rather than chronologically or by methodological approach, in order to make the outcomes usable within the subsequent co-production processes.

In more concrete terms, this meant that the reviews were designed to synthesise selected and strategically identified bodies of scientific literature into two distinct outcomes: a framework of key considerations for certification

system development and a supportive tool consisting mainly of guiding and reflective questions related to upscaling. These outputs were subsequently used as formative inputs in the respective research processes, shaping discussions with practitioners and informing the development of empirical artefacts.

In the development of Citylab Post-Construction, the conceptual review of scientific literature focused on literature addressing certification systems and sustainability indicators for urban areas and was designed to directly support the development work. The review resulted in a framework of key considerations for designing certification systems for urban areas, derived inductively from the reviewed literature (Paper II). Here, key considerations refer to the qualities that a certification system needs to possess and the corresponding aspects that must be taken into account in order to design a system that fulfils those qualities. How these key considerations informed the development of the certification system is discussed in Chapter 5.

The literature review concentrated on scientific publications that could directly inform the design questions addressed in the study. The selection of literature was guided by targeted and iterative identification of relevant contributions which identified three main bodies of work: (1) studies analysing the content and structure of existing certification systems for urban development, such as LEED for Neighbourhood Development and BREEAM Communities (e.g., Haapio, 2012; Wangel et al.,); (2) studies developing local indicator sets for assessing sustainability at the scale of a city (e.g., Tanguay et al., 2010) or community (e.g., Turcu, 2012); and (3) publications considering sustainability indicators more broadly (e.g., Niemeijer & de Groot, 2008; Bell & Morse, 2008), including policy-oriented frameworks such as the indicator work linked to the UN Sustainable Development Goals (United Nations, 2015).

The emerging thematic structure was iteratively refined in relation to newly reviewed literature throughout the process. The review was considered sufficiently saturated when additional publications no longer introduced new conceptual themes, but instead reinforced, refined, or nuanced the categories already identified. This judgement followed the qualitative logic of saturation described by Saunders et al. (2018) and ensured that the resulting framework rested on a robust and diverse knowledge base, while remaining focused on literature of direct relevance for the development of the certification system.

In Paper IV, challenges described by municipal officers concerning the difficulty of scaling solutions developed through urban experiments served as the analytical point of departure for identifying relevant theoretical

perspectives. An iterative and purposive review of scientific literature was therefore undertaken to examine how similar challenges had been described and conceptualised in previous research. This review indicated that three bodies of literature were particularly relevant for understanding the issues raised by the practitioners: institutional logics, institutional capacity, and the upscaling of urban experiments. Together, these strands of research provided conceptual explanations for the constraints and opportunities reflected in the practitioners' accounts.

These theoretical perspectives subsequently informed the development of a supportive tool consisting primarily of reflective questions, designed to help municipal officers work more systematically with issues related to scaling solutions from urban experiments. The literature review was not designed as a full systematic review; rather, it was deliberately delimited to publications that directly addressed the types of challenges described by the practitioners and could therefore meaningfully inform the design of the tool. Although the literature review was central for shaping the supportive tool and thus for the empirical work of the research process, it is not presented as a standalone result in the same way as the framework of key considerations in Paper II. Instead, the theoretical insights derived from the literature are embedded in the structure, content, and rationale of the supportive tool itself.

4.4 Interviews

Paper II-V use semi-structured interviews as a method for generating empirical material, often these interviews are central for data collection. With the exception of one set of interviews, which is described separately below, all interviews were conducted in line with what Gustavsson (2004) describes as research conversations. While this approach is consistent with semi-structured interviewing, it places particular emphasis on the interpretative and dialogical character of the interview situation. In this approach, the purpose of the interview is to access participants' subjective experiences, interpretations, and understandings of the issues being explored. Rather than approaching the interview as a neutral extraction of facts, the conversation is understood as a relational and meaning-oriented interaction in which the researcher creates space for participants to articulate their thoughts, perceptions, and concerns. The aim is not to standardise responses, but to facilitate dialogue that allows participants to express their personal perspectives as fully as possible.

Study-specific interview guides were used to provide overall structure while allowing for flexible conversations through follow-up questions, requests for clarification, and opportunities to explore issues that emerged during the dialogue. This reflects Gustavsson's (2004) emphasis on the interview as an open and responsive knowledge process aimed at eliciting rich and nuanced accounts. The interviews typically lasted approximately one hour and were conducted at the respondents' workplaces or digitally. All interviews were audio-recorded and subsequently reviewed in detail, with systematic notes taken to capture key arguments, reflections, and critical statements.

4.4.1 Research conversations in Paper II-IV

In Paper II an interview study was conducted by the author with 13 representatives of potential future users of Citylab Post-Construction. The interviews focused on perceived potentials and preferred areas of emphasis for a certification system targeting the post-construction phase of urban development. Respondents were selected to represent urban development projects with ambitious sustainability objectives and to ensure diversity in terms of stakeholder roles and geographical contexts. To maintain a comprehensive and integrative perspective, participants were selected as generalists rather than subject-specific experts. Thus, the respondents represented a mix of roles, including strategists, project managers, sustainability specialists, and advisors, working with sustainability issues at both strategic and operational levels within their organisations.

In paper IV, two sets of interviews were conducted by the author (see Table 4). The initial set included seven civil servants working as project managers within the environmental departments of the participating municipalities, with responsibility for developing and coordinating municipal sustainability work. These interviews focused on respondents' views on why upscaling of sustainable solutions from urban experiments had not taken place and what they perceived as necessary conditions for successful upscaling. The results were synthesised and subsequently validated through follow-up discussions with the same respondents (see section 4.5).

Based on these initial interviews and the emerging problem formulation, an additional set of interviews were conducted with representatives from Stockholm and Malmö municipalities. These included four and one respondents respectively and focused on their experiences of sustainable solutions from urban experiments that had been successfully upscaled. These

solutions were identified through the initial interviews and participatory sessions, which pointed to them as examples where upscaling had occurred.

All interviews mentioned above were audio-recorded and subsequently reviewed and documented in detail through systematic note-taking supported by the recordings, focusing on capturing central arguments and reflections, including key statements in close-to-verbatim form where relevant. This approach reflects the purpose of these interviews, which was to develop an understanding of practitioners' perspectives as a basis for subsequent design and development processes, rather than to conduct in-depth interpretative analysis of meaning-making in the interview material. The research design instead relied on iterative engagement with practitioners and the testing of emerging outputs to ensure the robustness and relevance of the results.

The material was then analysed using design-oriented methods such as why-how laddering and the formulation of problem statements to identify underlying challenges and user needs (Doorley et al., 2018; Carlgren et al., 2016). These analyses supported the development of problem framings that subsequently guided the iterative development work in the transdisciplinary research process, leading either to the formulation of design alternatives for the overall structure of the certification system or, in the second case, to a refined problem understanding that informed subsequent research and the development of the supportive tool for upscaling.

4.4.2 Research conversations in Paper V

Paper V included 11 semi-structured interviews conducted by the author together with a co-author, with respondents representing all 'building departments', that is, departments that either commission or carry out construction and infrastructure projects, within one Swedish municipality. The respondents held a range of roles, including project managers, unit managers, and sustainability strategists, working at both strategic and operational levels. The focus of the interviews was on cutting-edge projects [spjutspetsprojekt] understood as a form of urban experimentation, as discussed in Section 2.4.

In line with the logic of research conversations (Gustavsson, 2004), respondents were invited to share their personal perspectives on the role of cutting-edge projects in generating governance learning and amplifying climate mitigation efforts, rather than to provide exhaustive inventories of projects or outcomes. Accordingly, respondents were not presented with a strict definition of what constitutes a cutting-edge project. Instead, part of the

analytical interest lay in understanding how respondents themselves conceptualised such initiatives.

An interview guide was used, in line with Gustavsson (2004), covering questions related to: how departments work with climate mitigation in new construction projects; how efforts to improve climate mitigation are pursued; examples of cutting-edge projects; the purposes of such projects; learning outcomes associated with cutting-edge initiatives; and factors that enable or hinder learning and change. All interviews were conducted between April and June 2023, lasted approximately one hour and transcribed verbatim to enable detailed interpretative analysis of the interview material.

The interviews in Paper V were analysed using thematic analysis to identify and interpret recurring patterns of meaning in the interview material (Braun & Clarke, 2006), involving a condensation of the material in line with the interpretive logic described by Gummesson (2004). Interview transcripts were examined to identify recurring topics, ideas, and patterns of meaning. Each interview was first analysed individually by one of the authors of the Paper, after which insights were compared and cross-checked by the other author. Although the analysis was largely exploratory and inductive, it was informed by five themes derived from governance learning theory (Wolfram, 2019), which also structure the presentation of the results in this thesis.

4.4.3 Interviews in Paper III

In the development of Citylab Post-Construction, an additional set of 33 semi-structured interviews was conducted by the author, using an approach that differed from the research conversation approach described above. These interviews focused on identifying appropriate and consistent ways of formulating indicators and assessment criteria for the indicators that had been selected through earlier participatory sessions (see Table 3). In this case, the interviews were conducted in line with what Gustavsson (2004) categorises as more classical interviews. While still semi-structured in form, these interviews placed greater emphasis on clarifying established practices, requirements, and factual considerations, rather than exploring participants' subjective experiences and interpretations.

The interviews were documented through detailed note-taking. This approach was considered appropriate given the focus on capturing concrete knowledge, definitions, and requirements, rather than conducting in-depth interpretative analysis of the interview material. The interviews were carried out in parallel

with the document review including regulations, governmental reports, and policy guidelines (see Section 4.2). Respondents included subject-matter experts from national authorities such as the Swedish Environmental Protection Agency and the National Board of Housing, Building and Planning, as well as practitioners from consultancy firms and municipal organisations. By interviewing experts representing different types of actors, the interviews enabled a discussion around how to balance the need for reliable and robust measurement requirements with considerations related to feasibility and cost, ensuring that the resulting indicators were both credible and practically applicable. How this was balanced is elaborated in the result part, in chapter 5.

4.5 Participatory sessions

In Paper III and IV, collaborative discussions between researchers and practitioners constituted a central part of the transdisciplinary and design-driven research process, enabling joint exploration of problems, interpretations, and potential solutions (Lang et al., 2012; Maher et al., 2018). For the purposes of this thesis, these activities are collectively referred to as participatory sessions (see Table 3 and Table 4 for overview). The term is used as an umbrella label rather than to denote a specific method, encompassing different forms of facilitated discussions adapted to the purpose and phase of the research process (see phases in Table 2). In this respect, the participatory sessions can be understood as concrete instances of the process-oriented research settings discussed earlier in the thesis, in which the researcher assumes multiple roles, including those of reflective scientist, knowledge broker and process facilitator (Wittmayer & Schöpke, 2014). Accordingly, the participatory sessions did not follow a fixed methodological sequence or standardised set of workshop questions. Instead, their form, facilitation, and use of methods were developed case by case in response to the specific context, participants, and objectives of each phase of the research process, in line with transdisciplinary, design- and process-oriented research frameworks (Lang et al., 2012; Maher et al., 2018; Wittmayer & Schöpke, 2014).

4.5.1 Participatory sessions in Paper III

In Paper III collaboration between researchers and the Swedish Green Building Council (SGBC) took place continuously through meetings within the project group, primarily focusing on coordination and decision-making. Beyond this ongoing collaboration, the first major participatory session

involved practitioners working with the selection of indicators and the formulation of detailed assessment criteria. At this stage of the process, the overall structure and logic of the certification system had already been outlined. The participatory work therefore focused on selecting and refining indicators for inclusion in the system, clustering and comparing alternative formulations, assessing their relevance for different types of urban development projects, and specifying detailed criteria and instructions for how each indicator should be fulfilled.

The work was organised into four working groups tasked with formulating general indicators to measure sustainability performance in urban areas. 22 Practitioners were recruited through open calls via SGBC's website and newsletters. Participants included mainly representatives from consultancy and architectural firms but also developers, one municipality, a real estate company, a university, and the Swedish Environmental Protection Agency. The overall structure and scope of the work were defined by the author through preparatory work and the formulation of the assignments given to the working groups. To support the work, the working groups were provided with inputs from a conceptual review of scientific literature identifying key considerations for certification system design (see Section 4.3), as well a compilation of approximately 1200 sustainability indicators, organised into around 100 thematic categories, derived from international, national, and local frameworks (see Section 4.2). This material served as the main starting point for the work.

The working process was design-oriented and iterative, resembling what Doorley et al. (2018) describe as user-driven prototyping, with elements of brainstorming and the deliberate use of constraints to guide exploration and comparison of alternative indicator formulations. The groups met physically for at least one half-day workshop, during which they discussed the relevance of different indicators and collectively identified which ones should be included in the certification system. The discussions focused on assessing the advantages and limitations of different indicators in relation to the intended purpose of the certification system. The group meetings were facilitated by practitioners appointed by the project group, while the author of this thesis took part in the discussions. Following the workshop, the appointed facilitators compiled preliminary selections of indicators, which were in some cases further refined through written feedback within the groups. The exact organisation of this follow-up work varied somewhat between groups.

The integration of the groups' proposals into a coherent certification system was subsequently carried out by the project group, consisting of representatives from KTH and SGBC, and led by the author of this thesis. The resulting synthesis, as well as the key considerations and challenges encountered in the selection process, are further elaborated in Section 5.1

To test and further develop the certification system, another form of participatory session was conducted in which a draft version of the system was applied to concrete urban development contexts. These sessions involved the assessment of two different urban areas: Örebro Campus and the Hornstull area in Stockholm. Each session was organised as a full-day workshop, where main stakeholders of the urban areas and project group jointly worked through the draft certification system in a structured, criterion-by-criterion manner. Prior to the sessions, preliminary assessments had been carried out by participating practitioners, who reviewed the selected urban areas in relation to each requirement of the certification system. These pre-assessments served as the basis for workshop discussions. The discussions focused on issues such as what data was available to support the assessment, what additional data would be required, the feasibility and potential costs of data collection, and whether the requirements were reasonable and applicable in practice. This testing-oriented form of participation is close to what Doorley et al. (2018) call testing with users and enabled detailed discussions of how the criteria functioned in practice and supported the identification of potential ambiguities, limitations, or unintended effects that were less visible through written feedback alone. These sessions were facilitated by the author. The outcomes of these discussions, as well as the key considerations and challenges identified, are further elaborated in Section 5.1.

The work was also anchored through five meetings with a reference group consisting of twelve representatives from SGBC's member organisations, including real estate owners, developers, and municipalities. These meetings were held at key decision points in the process and served as forums for consulting the reference group and discussing major design choices with the project team before final decisions were made by the project group. These sessions were facilitated by the author.

4.5.2 Participatory sessions in Paper IV

In Paper IV participatory sessions took several forms throughout the research process. In addition to regular project meetings, where researchers and

practitioners met to discuss ongoing work and emerging insights, a number of more extended participatory sessions were organised at key moments in the process in order to enable more substantial progress. It was primarily these extended sessions that had a significant influence on the empirical results and analytical outcomes of the research process.

The first such session focused on presenting and discussing the results of the interview study addressing challenges related to the upscaling of sustainable solutions tested in urban experiments. The session was facilitated by the author and brought together the same practitioners who had participated in the interviews. The session was conducted digitally and lasted approximately two hours. During the session, the author presented a synthesis of the interview findings, including key themes and patterns identified across the seven interviews. These results then formed the basis for a structured group discussion, in which participants were invited to reflect on, nuance, and critically assess the interpretations. The session thus functioned as a form of respondent validation (see Section 4.4.1) aimed at assessing whether the analytical interpretations resonated with practitioners' experiences, as well as identifying potential nuances or missing perspectives. While some clarifications were added during the discussion, the overall patterns were largely confirmed, indicating that the interview results captured relevant and meaningful challenges from a practitioner perspective.

This was followed by two participatory sessions aimed at deepening the understanding of upscaling in practice. Two similar sessions were facilitated by the author with eight and six representatives, respectively, from participating municipalities. The sessions were conducted digitally and lasted approximately one hour each. They focused on identifying concrete examples of sustainable solutions originating from urban experiments that had been successfully upscaled in Stockholm, Gothenburg, and Malmö. Each session began with a brainstorming exercise (Doorley et al., 2018), in which participants were invited to suggest examples of projects or initiatives that had led to implemented and sustained changes in practice. This was followed by a collective discussion, where the suggested examples were assessed in terms of their relevance and potential for further analysis. Based on these discussions, a smaller number of cases were selected for closer examination. The participants also helped identify relevant individuals within their organisations who had been involved in these processes and could provide further insight into how

upscaling had occurred in practice. The selected cases subsequently formed the basis for interviews focusing on specific upscaling processes (see Section 4.4.1).

Once an initial draft of the supportive tool had been developed, a series of participatory sessions were conducted to test and refine the tool together with potential users, drawing on principles of user-centred testing as described by the Doorley et al. (2018). Eight sessions were organised, each involving three to five municipal civil servants, who collaboratively worked through the questions included in the draft version of the tool. The sessions were conducted as approximately two-hour workshops, in which participants collaboratively worked through the questions included in the draft version of the tool. Each session focused on the potential upscaling of a specific urban experiment that practitioners considered promising but insufficiently scaled. The supportive tool consisted of a set of structured, reflective questions addressing different aspects of upscaling, including what elements of a solution could be scaled, how scaling could be achieved, how the solution contributed to broader sustainability goals, as well as potential drawbacks, barriers, and organisational conditions affecting upscaling. During the sessions, participants applied these questions to the selected cases, using them as a basis for structured discussion and reflection. This enabled participants to assess the relevance, clarity, and applicability of the tool, while also identifying aspects that were perceived as unclear, missing, or problematic. These structured tests played a central role in shaping the tool, as they revealed practical tensions, missing components, and areas requiring adjustment.

In addition to the testing sessions, two further participatory sessions were conducted with seven civil servants (project team members from municipalities participating in the research project) to review and interpret feedback on the draft version of the tool. Both sessions were conducted as approximately two-hour workshops and were facilitated by the author. The sessions draw on a *prototype-to-decide* logic, where alternative revisions were compared and prioritised to inform decisions on further development (Doorley et al., 2018). In the first session, practitioners clustered, compared, and prioritised the comments, needs, and challenges that had emerged during testing. In the second session, these prioritised issues were discussed in relation to possible revisions, with researchers presenting alternative design options for consideration. This process resulted in shared decisions regarding how the tool should be adjusted and further developed. Together, these sessions helped ensure that the supportive tool aligned with practitioners'

routines, terminology, and organisational contexts. The iterative combination of testing and refinement contributed not only to improving the tool itself, but also to deepening the analytical understanding of how upscaling processes unfold within municipal organisations.

4.6 Ethical considerations

Ethical considerations in this thesis have been guided by established principles of good research practice as outlined by the Swedish Research Council (Vetenskapsrådet, 2024), including informed consent, voluntary participation, and careful handling of personal data and potential risks to participants. A central aspect of these guidelines is that ethical considerations involve balancing different principles and interests, particularly the generation of valuable knowledge and the protection of research participants. This entails making context-dependent trade-offs, for example between detailed transparency of empirical material and the need to safeguard participants' integrity. These considerations took different forms across the empirical strands of the thesis.

In Papers I–III, data collection primarily involved interviews and participatory sessions with practitioners who either volunteered through open calls or were selected to ensure a diversity of perspectives. The topics addressed were generally not sensitive in nature, and it was typically possible to maintain a high degree of anonymity. In participatory processes contributing to the development of the certification system, it was made clear that the resulting framework would be owned and managed by the Sweden Green Building Council (SGBC), clarifying the purpose and use of participants' contributions.

In Paper IV, the research was conducted as a transdisciplinary collaboration with specific municipalities and organisational units explicitly described in the thesis. This created a different ethical context, as participants could potentially be identifiable within their organisations, even if not named in the text. To mitigate this risk, the presentation of results avoids linking specific statements to identifiable individuals, instead referring to participants in general terms (e.g., “one civil servant”). Further, the analysis focuses on patterns and shared challenges rather than individual accounts.

In Paper V, the study involved a more in-depth exploration of organisational processes within a single municipality, which increased the potential sensitivity of the material. As a precautionary measure, the municipality was

fully anonymised. While the empirical material did not include explicit criticism of individuals or management, the study addressed internal practices and perceptions that could be considered sensitive in context. The combination of in-depth accounts and the use of illustrative examples increased the risk of indirect identification, which motivated a more cautious approach to anonymisation compared to the other studies.

Across all studies, participation was based on informed consent, and participants were informed about the purpose of the research and its publication in scientific outputs. Audio-recordings and other interview data were handled with restricted access, limited to the researchers conducting the interviews. While no direct dependencies between the researcher and participants were identified, it cannot be excluded that participation in collaborative settings may have been influenced by implicit expectations. In this context, particular attention was given to how results were presented, in order to minimise potential risks for participants. As described above, this included careful consideration of anonymity and the avoidance of linking statements to identifiable individuals, thereby reducing the potential consequences of participation.

5 Results

This chapter presents the main results of the thesis. The results are organised in two parts that together examine how different governance instruments shape the pursuit of sustainable urban development.

The first part of the results chapter draws on Papers I–III and analyses the development of the certification system Citylab Post-Construction. In line with the methodological approach presented in chapter 3, the development process of the certification system is examined in order to understand how certification systems are designed and how such systems may function as governance instruments. Accordingly, this part of the results chapter focuses on the key considerations that guided the development process, rather than on the detailed content of the certification system itself.

The second part of the results chapter draws on Papers IV and V and examines urban experiments as governance instruments, with a particular focus on how upscaling is approached and organised in municipal practice. Paper IV examines how alternative, more deliberate approaches can support structured forms of upscaling and governance learning. Paper V reports on a single case study that analyses how a municipality currently organises, interprets, and makes use of learning from urban experiments. Taken together, these two studies clarify how learning generated through urban experiments can be scaled beyond individual projects. In doing so, they contribute to an understanding of how urban experiments function as governance instruments that shape municipal routines, organisational structures, and longer-term governance processes.

5.1 Designing a certification system for sustainable urban areas

This section presents results from the development of Citylab Post-Construction (Papers I–III). Citylab Post-Construction forms part of the broader Citylab framework, which comprises several certification systems used by municipalities, real estate owners, and construction companies, targeting different phases of the planning, construction, and management of urban areas in Sweden (SGBC, 2016). Within this framework, Citylab Post-Construction focuses on the management phase of already existing urban areas. At the outset of the development process, the actors expected to apply for and hold certification was not explicitly defined. Instead, the system was developed with the recognition that different types of actors, particularly municipalities and property owners with larger, spatially coherent property portfolios, could potentially be relevant users. Keeping this question open in the initial stages was a deliberate choice, allowing the structure and logic of certification to be explored before specifying how responsibilities and roles would ultimately be organised.

Building on how Citylab had previously been used to support sustainability work during planning and implementation, the section first situates the development of Citylab Post-Construction in relation to this prior context. The section then illustrates how key considerations regarding certification system design were identified and how the key considerations guided decisions throughout the development process. This includes, first, decisions about the overall aim and structure of the certification system, understood as what type of evaluation the system should entail and how results should be reported. Second, it addresses the selection of indicators, that is, decisions about which sustainability aspects the evaluation should focus on. Third, the section describes how detailed assessment criteria were developed, specifying how performance should be measured for each indicator, what level must be achieved for an urban area to be considered compliant, and what documentation is required to demonstrate that the assessment has been carried out appropriately. For a detailed presentation of the finalised certification requirements, including indicators, stated purposes, and associated criteria, see the appendix to Paper III.

5.1.1 Citylab certification of planning and construction

Citylab Post-Construction builds on the earlier development of Citylab, which targets the planning and construction of urban areas. At the time of the initiation of this research, Citylab existed primarily as a guide for sustainable urban development (SGBC, 2016) rather than as a certification system. This *guide* articulated a shared understanding of sustainability in urban development and provided an important point of reference for the subsequent development of Citylab Post-Construction. As documented retrospectively in Paper I, this shared understanding had been co-produced prior to the initiation of the present research through an iterative process involving multiple research projects and a broad range of practitioners from the Swedish built environment sector, organised through a series of workshops and collaborative meetings across municipalities and other actors. As presented with more detail in paper I, the guide was structured around a set of thematic focus areas, covering key aspects of urban sustainability, and complemented by a small number of cross-cutting processes intended to support how sustainability work should be organised and carried out in practice. Together, these elements outlined both what sustainability in urban development should address and how work with sustainability should be approached.

In the development of Citylab Post-Construction, particular emphasis was placed on the so-called desired effects defined in the Citylab guide (SGBC, 2016; Paper I), sometimes also referred to as Citylab's sustainability goals (Table 6). Rather than prescribing specific measures, these desired effects articulate overarching ambitions for sustainable urban development by describing the conditions that cities should enable. As such, the desired effects provided a key point of reference for determining what aspects of sustainability could meaningfully be evaluated in a post-construction phase of urban development. How the desired effects were used in the development of Citylab Post-Construction is discussed in more detail below.

Prior to the development of Citylab Post-Construction, Citylab was used in practice through a programme based on the guide. The programme consisted of six two-day sessions over one year and involved twelve participating urban development projects in 2016 and ten projects in 2017. As documented in Paper I, which reports on the pilot version of the programme, participants perceived both the guide and the programme as useful for structuring sustainability work in their projects. One example was a project that

reorganised its internal structure so that sustainability became integrated into overall governance rather than being handled as a parallel process.

Table 6. Desired effects in Citylab guide. Translated from the first version of the “Citylab - Guide for sustainable urban development” launched by Sweden Green Building Council 2016, (SGBC, 2016).

1.	Health and wellbeing
2.	Equality and social cohesion
3.	Participation and influence
4.	Safe living environment
5.	Good livelihoods
6.	Attractive city-life
7.	Resource management
8.	No negative climate impact
9.	No negative environmental impact
10.	Resilience and flexibility

Thus, while the Citylab guide provided a shared interpretation of sustainability in relation to urban development in the Swedish context, the implementation of the Citylab programme illustrated how Citylab was interpreted and operationalised in practice (Paper I). These experiences formed an important contextual background for the subsequent development of Citylab Post-Construction, particularly in shaping how the need for follow-up and evaluation of sustainability outcomes was understood.

5.1.2 Key considerations when designing a certification system for urban areas

Beyond the existing parts of Citylab described above, the development of Citylab Post-Construction required additional considerations related to how sustainability ambitions could be translated into a formal certification system. These considerations were concerned not with the substantive content of assessment criteria as such, but rather the design and functioning of certification as a governance instrument.

To identify these *key considerations*, a conceptual review of relevant literature was conducted, as described in Section 4.3. Based on this review, a framework of key considerations for designing certification systems for urban areas was developed (Paper II), and is presented in Table 7. The framework first articulates the benefits that certification systems should provide. These include providing value for the organisation using the system, supporting practitioners by structuring and simplifying sustainability work, and contributing to positive sustainability outcomes for the urban area concerned. The framework then identifies three guiding principles for their design: scientific credibility, practicality, and the ability to drive change. To clarify how these principles operate in practice, each principle is specified through a set of sub-principles that together outline what a certification system must achieve. In addition, an overarching requirement for stakeholder and public participation is defined as a condition for complying with the principles.

Table 7. Framework of key considerations when designing a certification system for urban areas (Table 2 in Paper II). The framework defines the benefits a certification system should provide, the principles guiding its development in order to fulfil these benefits, the associated sub-principles, and the requirements for complying with the principles.

Benefits to be Provided	Principles	Sub-Principles	Overarching Requirement for Compliance with the Principles
Beneficial for the organisation Beneficial for practitioners Beneficial for the urban area	Scientifically credible	Comprehensive	Stakeholder and public participation
		Integrative	
		Valid	
		Reliable	
	Practical	Intelligible	
		Simple	
	Driving change	Influenceable	
		Determining what is good enough	
		Guiding a discussion among relevant stakeholders	
		Including different kinds of indicators	
		Presenting the results in a way that enables action	

As illustrated in Table 7, and further elaborated in Paper II, a scientifically credible certification system should be comprehensive by including all sustainability aspects of relevance to an urban area, and integrative by

acknowledging that issues such as climate change, justice and biodiversity influence each other and therefore need to be addressed in relation to one another. Scientific credibility also requires validity, meaning that indicators should measure sustainability performance, and reliability, meaning that measurements should reflect what they are intended to measure in a repeatable way.

A practical certification system should be intelligible so that the purpose and meaning of the indicators and criteria can be easily understood, simple enough not to demand excessive specialist competence or resources, and influenceable so that the results reflect actions within the control of those working towards certification.

A certification system that drives change should determine what is good enough by defining clear expectations for sustainability performance, guide discussions among relevant stakeholders as part of the learning and negotiation process, include different kinds of indicators to analyse state and cause of sustainability, and present results in ways that enable action.

The framework also emphasises the need for participation. Involvement of local actors and relevant experts is necessary both to capture how sustainability is understood in the local context and to ensure that locally important issues are reflected when selecting and formulating indicators. Participation also supports balancing the principles and sub-principles throughout the development process of the certifications system, since it brings together different forms of knowledge and perspectives.

5.1.3 Using key considerations to decide on the overall structure of the certification system

The key considerations guided the entire development of Citylab Post-Construction, and the following sections outline how these principles informed decisions throughout the process.

Beginning with the overall aim of the certification system, four alternatives emerged from interviews with potential users of the system (Paper II). In these interviews, respondents highlighted different advantages and drawbacks associated with alternative ways of framing what should be assessed in a post-construction phase. These alternatives were to assess (1) the sustainability performance of the urban area, (2) whether the stakeholders involved had drawn important learning, (3) whether planned measures to strengthen sustainability had been implemented or (4) whether operation and

maintenance of the urban area continued to work towards the sustainability objectives.

When these alternatives were discussed in relation to the framework of key considerations (Table 7), the choice to focus on performance (Alternative 1) became central (Paper III). This alternative prioritised the sub-principles of *validity* and *determining what is good enough*, as it provided the clearest link to actual sustainability outcomes in the urban area. The decision also reflected earlier critiques of certification systems for placing too little emphasis on performance (see Wang et al., 2016), as well as the recognition that a post-construction phase offers a particular opportunity to assess outcomes rather than intentions.

At the same time, the interview material made clear that this choice involved important trade-offs (Paper II). Several respondents noted that focusing on performance reduces the degree of *influenceability*, since no single actor can fully control outcomes such as travel behaviour or perceived safety. Others, however, emphasised that evaluating sustainability performance at the level of the urban area was essential, even though such outcomes depend on collective action among municipalities, property owners, and other local stakeholders. Consequently, the certification system was designed to create incentives for collaboration on sustainability performance rather than attributing responsibility to individual actors alone. The project group considered this tension to be consistent with governance perspectives on urban sustainability (Bulkeley, 2010), which emphasise coordination and collaboration as central to achieving sustainability outcomes.

Across the discussions of different alternatives, the sub-principle of *comprehensiveness* also emerged as central (Paper II). Respondents stressed that the certification system needed to address sustainability issues that were both globally relevant and locally significant, a concern that was also reflected in observations from the Citylab programme reported in Paper I. To accommodate this, the system was designed to include two types of indicators: general indicators that apply to all urban areas in Sweden and define a good-enough level of sustainability performance, and site-specific indicators that identify locally important issues through a participatory process (Paper III). This combination supported *comprehensiveness*, facilitated structured *discussions among relevant stakeholders*, and aligned with the overarching requirement for *stakeholder and public participation*.

Another key decision concerned how results should be presented. Aggregated scoring is common among certification systems, but has also been criticised for obscuring underlying results and for encouraging credit-chasing behaviour (Haapio, 2012; Sharifi & Murayama, 2013; Wangel et al., 2016). Instead, it was considered more meaningful to assign a baseline level to each general indicator that all urban areas must meet, and to present results using a radar diagram, in line with earlier work on visualising sustainability performance (e.g. Bell and Morse, 2000). This approach supported an *intelligible* system that *presents results in ways that enable action*, even though it results in a more complex answer to the question of whether an urban area is sustainable by explicitly acknowledging this complexity.

5.1.4 Using key considerations to select indicators

Following the decision to focus on sustainability performance and the overall structure of the system, the next step was to select indicators representing the sustainability aspects to be assessed. As a starting point a broad set of potential indicators was collected from international, national and local sources (see section 4.2). In total, this resulted in approximately 1200 indicators, organised into around 100 categories linked to Citylab's desired effects (Table 6). Indicators that were not directly related to urban development were then removed, using the focus areas of Citylab's Guide for sustainable urban development to determine which sustainability aspects fall within the scope of urban planning (Paper III).

The remaining indicators were then discussed and reviewed with practitioners in participatory sessions (see 4.5.1). In these discussions, the tension between the sub-principles of *validity* and *influenceable* became particularly evident (Paper III). Practitioners pointed out that some indicators, such as energy use, were considered strong in relation to both principles, as they provide a direct measure of environmental performance and can be significantly influenced through design choices, technologies, and energy systems in urban development. Other potential indicators, such as the proportion of impermeable surfaces, were regarded as highly *influenceable*, since they can be directly shaped through planning and design decisions, but less *valid* in relation to desired sustainability outcomes, as their effects on issues such as flooding or ecosystem services depend on local context and interacting factors. Indicators related to perceived safety were, in contrast, repeatedly highlighted as *valid* measures of social sustainability outcomes that are central to everyday urban life. At the same time, such indicators were described as difficult to

influence directly through urban planning by any single actor, since perceptions of safety are shaped by a range of social, institutional, and behavioural factors beyond the control of individual urban development actors.

Across the discussions, participants noted that environmental sustainability aspects were generally perceived as more straightforward to operationalise through indicators with both high *validity* and *influenceability*, whereas social sustainability aspects were seen as involving more complex and indirect causal relationships (Paper III). Several respondents cautioned against allowing measurability to determine what counts as sustainability, emphasising that this would risk marginalising social aspects that are central but harder to capture through quantified indicators.

In response to these discussions, the project group worked with different types of indicators and adjusted the indicator type, the level defined as good enough, and the level of detail in the requirements in order to balance validity, influenceable, simplicity, and comprehensiveness. This balancing was discussed both at the level of individual indicators and in relation to the system as a whole. Following this, the indicator list was refined further. Indicators that were better handled at regional or national scales, such as locally grown food or nutrient emissions, were removed. Finally, overlapping indicators were consolidated to maintain a simple and intelligible design. The process resulted in a final shortlist of indicators with a clearly specified aim (see Table 8).

Table 8. Short list of general indicators and how they relate to Citylab desired effects (Paper III).

Name of Indicator	Aim of Indicator, i.e., To promote urban areas...	Desired effects (Table 2)
Safety	... where people feel safe.	1, 2, 4, 6
Trustful community	... with a trustful community.	1, 2, 3, 4, 10
Places	... with a diversity of places for different groups of people at different times of the day and during the whole year.	1, 2, 3, 6
Functions and services	... where everyone has access to basic service functions.	2, 5, 6
Mixture of dwellings	... that counteract segregation through a diversity of dwellings.	2, 4, 5
Noise	... with a good acoustic environment outdoor.	1
Air quality	... with good air quality outdoor.	1, 9
Indoor environment	... with a healthy indoor environment.	1, 9
Household waste	... with little generated waste and high degree of waste sorting.	7, 8, 9
Travel behaviour	... where a high share of personal travel is by walking, cycling or public transport.	1, 7, 8, 9
Energy use in buildings	... with buildings with low energy use.	7, 8, 9
Climate impact	... with a mapped and low climate impact.	7, 8, 9
Biodiversity	... where the biodiversity and nature values are kept and developed from an ecosystem perspective.	9, 10
Purification of stormwater	... where stormwater does not contaminate recipient waters.	9
Flooding risk	... where flooding results in minor consequences.	10

5.1.5 Using key considerations to formulate detailed criteria

While the previous section focused on selecting indicators through working group discussions with practitioners, this section addresses the formulation of detailed criteria, that is, how the urban area is evaluated in relation to the aim of each indicator. This work combined a review of grey literature, a new set of interviews conducted with 33 experts, and iterative design work within the project group. Through this iterative process, the difficulties and trade-offs involved in defining workable and meaningful criteria became apparent (Paper III).

When formulating detailed criteria, two recurring balancing acts between sub-principles (see Table 7) were identified. One concerned ensuring that criteria were *comprehensive* in relation to the aim of an indicator while still being *simple* enough to be practical. More concretely, experts in interviews and project group discussions emphasised that overly detailed criteria risked becoming difficult to apply in practice, even if they captured sustainability issues more fully (Paper III). The second balancing act concerned defining *good-enough* levels that could *drive change* while remaining *influenceable*. This tension was particularly evident in discussions about how ambitious threshold levels should be. Setting levels too low risked limiting the system's capacity to *drive change*, while overly ambitious levels risked placing requirements beyond the control of local actors (Paper III). Air quality can be used as an example: including measurements of a large number of pollutants was seen as increasing *comprehensiveness* but reducing *simplicity*, while setting ambitious threshold values was viewed as a way to *drive change* but also as risking that certification would become less *influenceable*.

To navigate these tensions, the project group worked iteratively to balance the principles both within individual indicators and across the system as a whole. An important part of this work was the use of different reference points to define the good-enough level for each individual indicator, depending on how the indicator was assessed in relation to the sub-principles. National sustainability goals were used where *influenceable* was considered relatively high and ambitions could therefore be set at a demanding level, for example for air quality and noise. Consensus documents and sector-developed standards were used where such references were recognised within the field, for example certification systems for buildings and for climate impact commonly agreed roadmaps and industry standards provide shared benchmarks for action. Best practice was used where neither societal goals nor

agreements existed, for example for stormwater purification. Finally, national averages were used for indicators where *influenceable* was assessed to be low and where the intention was primarily to exclude clearly unsustainable urban areas rather than to certify only the best-performing ones, for example in relation to perceived safety. This balancing did not only concern the level defined as good enough, but also how criteria were operationalised in practice, including choices regarding assessment formats, requirements for documentation, the number and type of respondents in indicators assessed through surveys, and the level of detail expected in reporting. Across these decisions, the project group repeatedly had to balance the same set of sub-principles, both in relation to individual indicators and in relation to the certification system as a whole (Paper III).

The conclusion of the overall development process was that the framework of key considerations made the design process more transparent by clarifying the rationale behind design choices and by exposing tensions between principles (Paper III). A central insight was that no principle could be prioritised in advance, and that balancing them was a continuous process throughout the development. Balancing also needed to be maintained across levels. For example, if some indicators became more demanding in order to ensure *validity* or *comprehensiveness*, the overall structure sometimes had to be simplified to preserve *simplicity* and *influenceable* at the system level. As outlined in Paper II, the principles may be understood as coordinates in a design space for developing certification systems, where each design choice shifts the position within that space and requires new adjustments to maintain balance.

5.2 Upscaling learning from urban experiments

This section of the results shifts the focus from certification systems to urban experiments as a governance instrument for sustainable urban development. It examines how learning from urban experiments is managed, and in particular how lessons generated through such projects can be upscaled in different forms, with focus on municipal organisations.

As described in Chapter 3, Paper IV builds on a transdisciplinary research process conducted in collaboration with the cities of Stockholm, Gothenburg, and Malmö. The paper focuses on the development and testing of a supportive tool designed to structure practitioners' reflection and discussion on learning and upscaling from urban experiments. The tool consists of a set of reflective

questions addressing different aspects of upscaling. In line with this approach, the results section does not present the supportive tool in detail (although its content is introduced in Section 5.2.4). Instead, it draws on the process of developing and testing the tool to deepen the analysis of how learning from urban experiments can be understood and more systematically structured for upscaling beyond individual projects.

Paper V draws on a single case study conducted in one anonymised municipality. It is based on interviews with respondents from all ‘building departments’, that is, departments that either commission or carry out construction and infrastructure projects. The study examines how urban experiments are understood and mobilised as governance instruments for sustainable urban development.

Although the papers differ in research design, they converge on several key insights, which are highlighted in this section. To structure the presentation of the empirical findings, this section draws on Wolfram’s (2016) conceptualisation of governance learning, as presented in Section 2.4.2. Accordingly, the results are organised around who learns, what is learned, the depth of learning, and the forms of interaction through which learning and upscaling occur.

5.2.1 Urban experiments in studied municipalities

Before analysing learning processes, it is necessary to clarify which urban experiments are included in the empirical material. Paper V is based on interviews with representatives from one municipality, with respondents from several “building departments.” Each respondent was asked to identify one or more initiatives they were involved in that they themselves referred to as cutting-edge projects, tests, pilots, or similar. While these initiatives were described using practitioners’ own terminology, they are analytically understood in this thesis as urban experiments, a scientific term used to capture such practice-based initiatives, (see section 2.4). The reported urban experiments included:

- land allocation processes with heightened sustainability ambitions, leading construction companies to align their proposals accordingly
- ground preparation for new industrial areas on previously undeveloped land including stringent climate requirements for machinery, material handling, and the use of biochar

- framework agreements for road operation and maintenance incorporating incentives for climate mitigation as a key governance mechanism
- the commissioning of preschools with low embodied climate impact and a high-rise building with a wooden frame
- procurement models integrating a pricing mechanism for both embedded and operational CO₂ emissions

In Paper IV, interviews and participatory sessions were not only centred on specific experiments or projects in the same way. Instead, participants discussed upscaling more conceptually, reflecting on the institutional and organisational challenges involved. However, in some participatory sessions and especially as the research collaboration progressed and a supportive tool for learning and upscaling was tested (see more on the research context in section 3.1), discussions increasingly drew on concrete examples of cutting-edge projects, tests, pilots, or similar to facilitate reflection and support the testing of the tool. These discussions were based on previously conducted projects that participants identified as relevant in relation to the aim of the tool and the themes that had emerged through earlier discussions in the research collaboration, including the following:

- energy demand in new buildings exceeding regulatory requirements
- the use of social impact analysis as an emerging approach to addressing social sustainability in urban development projects
- the development of multifunctional mobility hubs and mobility stations
- the implementation of rain gardens incorporating biochar
- the procurement, use, and operation of electric waste collection vehicles
- the procurement and installation of solar panels on existing municipal buildings
- the organisation of consolidated city logistics and deliveries
- the sustainable management and reuse of excavated soil
- pop-up centres for reuse, recycling, and upcycling

Taken together, these examples illustrate the wide range of urban experiments that form the empirical basis of Papers IV and V. This diversity clarifies that the municipalities work with experiments across multiple domains and organisational settings, which in turn provides a broad foundation for the subsequent analysis of learning and upscaling.

5.2.2 Who learns and what is learnt

Both studies highlight the challenges faced by the studied municipalities in disseminating lessons from their urban experiments. In the interviews conducted for Paper V, questions were explicitly posed about learning generated from previous and ongoing urban experiments. Respondents almost exclusively argued that they had learnt both from their own and others' urban experiments; however, when referring to projects carried out by other departments, this learning mainly involved being aware of what had been done and recognising promising elements. This type of learning, while informative, did not translate into changes in their own practices. Moreover, respondents described learning from urban experiments as largely organic rather than structured. This form of learning was depicted as dependent on individual initiative and personal engagement, rather than on coordinated organisational processes.

To be more concrete, respondents described meaningful learning as highly specific, technical, and closely tied to the context of their own projects (Paper V). They highlighted insights that could be directly replicated in similar future projects, such as how to formulate requirements towards contractors, how to collaborate on mass handling, or how to work with contractors to develop a climate mitigation action plan and appoint a sustainability coordinator in ground preparation projects. Because this type of learning was seen as dependent on the exact characteristics of each project, respondents often judged practices developed in other departments as interesting but not suitable for implementation in their own work. Thus, while they had *learnt about* other projects, this did not lead to *upscaling*, since no practical changes were made. The Water Department summarised this view by stating: “*The PM-function [the department for large projects] has some larger development projects with larger resources, larger project organisation, and longer time and can gain from it [...] You have to scale it [mitigation measures] down in the smaller projects, so it becomes reasonable to take those measures in those projects.*” They did not, however, report any such actions being taken.

Paper IV provides complementary insights into *who learns* and *what is learnt*, but from a more conceptual perspective. Although interviews and participatory sessions did not focus on specific experiments, practitioners repeatedly emphasised that learning and upscaling require the involvement of those who will ultimately need to change their practices if an urban experiment becomes successful. This points to an organisational understanding that *who needs to*

learn extends beyond project teams to include future users and implementers. Paper IV also shows that practitioners often struggled to define *what* from an experiment should be taken forward. When asked to reflect on earlier projects, participants had difficulty articulating which aspects (e.g. technical solutions, processes, or decision-making routines) were relevant to scale. The analysis concluded that different components of an urban experiment can serve as learning outcomes, and that identifying *what is actually learnt* is essential for enabling upscaling.

A concrete example from Paper IV illustrates this. During an early participatory session with the project group, a technical solution for stormwater purification was described as irrelevant to scale due to its site-specific nature. However, after discussion, practitioners concluded that the *process* of analysing site conditions and identifying an appropriate solution was the aspect of the experiment that should be scaled. This demonstrated that when learning is interpreted only as the replication of a technical solution, opportunities for upscaling appear limited. Thus, Paper IV clarifies that both *who learns* (future implementers as well as project teams) and *what is learnt* (processes, routines, and analysis methods, not only technical solutions) need to be more explicitly defined to support municipal upscaling efforts.

Taken together, these patterns reveal not only who learns and what is learnt, but also hint at a more fundamental issue: how practitioners understand what ‘upscaling’ entails. The following section therefore examines the depth of learning, that is, how practitioners conceptualise upscaling and which forms of scaling are seen as meaningful or possible.

5.2.3 Depths of learning

Both Paper IV and Paper V show that the concept of upscaling is interpreted in varied and, at times, limited ways among the practitioners involved in the studies. During the participatory sessions in Paper IV, participants consistently used the term “upscaling”, but referred to different types of processes without clearly distinguishing between them. To analytically clarify these differences, the typology proposed by Lam et al. (2020) is used, see Table 1. From this perspective, the processes described by participants can be understood as encompassing different forms of upscaling, including replication, transfer, and broader forms of spreading. The concept was therefore not used consistently, but rather filled with different meanings depending on context and individual practitioner.

Respondents in Paper V with more strategic roles articulated a somewhat broader understanding of upscaling. They emphasised that urban experiments also serve cultural and symbolic functions: they demonstrate that change is possible, signal that the municipality is willing to experiment, and contribute to an organisational culture that encourages innovation. Some respondents highlighted that urban experiments can generate visibility and legitimacy for climate action, which can strengthen political and administrative support and thereby increase the likelihood of resources being allocated or new approaches being formally endorsed.

In Paper IV, practitioners also reflected on different types of upscaling during the test phase of the supportive tool developed in the project, drawing on the categorisations presented by Lam et al. (2020) and van Doren et al. (2018). These reflections demonstrated that practitioners found it useful to clarify which form of upscaling might be relevant in a given case, and that multiple forms of upscaling can occur in parallel. Practitioners stressed the importance of identifying what has actually been learnt, and how such learning could be scaled. Such clarity was seen as a prerequisite for organising and resourcing upscaling in a more structured manner outside the scope of urban experiments projects, similar to how studied municipalities already have established some routines for how urban experiments should be initiated.

5.2.4 Interaction forms

Paper IV and V highlight interaction forms from different perspectives. Here, interaction forms refer to how actors engage with each other in processes of learning and upscaling, including the organisational practices and arrangements through which experiences from urban experiments are shared, discussed, and taken forward. In this context, Paper IV focuses on the joint development of a supportive tool as a new interaction form for working with upscaling, while Paper V examines how learning from urban experiments currently circulates within a municipal organisation.

The supportive tool, described in Paper IV, aimed at structuring reflection and discussion on learning and upscaling of urban experiments among practitioners. The tool took the form of a set of questions guiding practitioners in reflecting on how learnings from urban experiments could be scaled. In this sense, the tool aimed to make learning and upscaling more explicit and discussable within municipal organisations, and to address the observed tendency for these processes to remain implicit and weakly structured. Its

design was grounded in several converging insights from the empirical material and earlier research.

First, the tool included questions addressing what should be scaled and why. This was considered important since, as discussed in relation to *what is learnt*, practitioners often struggled to articulate what from an urban experiment should be taken forward. This challenge relates to research on institutional capacity (Norell Bergendahl, 2016; Isaksson & Heikkinen, 2018; Eneqvist, 2022), which highlights the importance of knowledge resources in order to create change, including recognising how a tested solution contributes to sustainability goals.

Second, the supportive tool included questions addressing what forms of scaling would be relevant. This was included to address the finding, discussed in relation to the *depth of learning*, that upscaling was frequently understood in narrow terms, e.g. as the replication of technical solutions. The tool therefore drew on conceptualisations that distinguish between different forms of upscaling (Lam et al., 2020; van Doren et al., 2018), supporting a broader and more differentiated understanding of how learning may be taken forward.

Third, the supportive tool included questions addressing how upscaling could be realised in practice. This was motivated partly by the empirical finding that earlier cases of successful upscaling had depended on the availability of dedicated resources, such as time, funding, and decision-making authority. More broadly, this aligns with research on institutional capacity (Norell Bergendahl, 2016; Isaksson & Heikkinen, 2018; Eneqvist, 2022), which emphasises that upscaling depends not only on knowledge resources, but also on relational and mobilisation capacities, including access to decision-making arenas, organisational support, and resources to revise or establish routines.

While the supportive tool was considered useful for structuring reflection on these issues, the participatory sessions in which it was evaluated also revealed limitations in approaching upscaling as something that can be addressed through a set of questions at a particular stage. Rather than being confined to a moment following the evaluation of an urban experiment, practitioners increasingly emphasised that upscaling must be understood as a concern that runs throughout the entire experimental trajectory. Participants emphasised that considerations related to upscaling need to be integrated already in the planning of an urban experiment, continue during its implementation, and be addressed in its evaluation. At the same time, they stressed that more structured organisational processes are required once an experiment has

formally ended, including activities to plan for upscaling, formal decisions on what should be taken forward, and formal allocation responsibility and resources for active upscaling work.

This understanding emerged through practitioners' discussions and was synthesised into Figure 1, which represents a simplified articulation of how planning for upscaling is situated in relation to other interconnected phases of experimental work. The figure should therefore be read as an outcome of this collective reflection rather than as a linear or prescriptive model. Within this broader process-oriented understanding, the supportive tool was regarded as useful for structuring reflection in the phase of *planning for upscaling*.

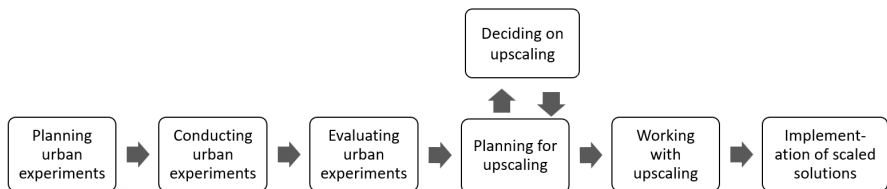


Figure 1. Process chart illustrating an upscaling process, synthesised from practitioners' reflections and understandings of upscaling (Paper IV).

Building on this process-oriented understanding, the following sections outline important considerations for upscaling articulated by practitioners in relation to different phases of an upscaling process. Each bullet point corresponds to a phase in Figure 1 and specifies their view on what needs to be addressed to enable upscaling in practice:

- **Planning urban experiments**

Considerations for upscaling must be integrated into the earliest stages of designing an urban experiment. This includes clarifying the potential future use of 'the solution' being tested, identifying organisational units likely to be involved in later stages, and ensuring that data and insights needed for future decision-making can be generated. These early considerations are crucial for reducing the risk of tensions between the experimental logic of experimentation and the bureaucratic logic of public administration.

- **Conducting urban experiments**

During implementation, the experiment should be carried out in a way that preserves learning potential and supports later transfer. This requires routines for monitoring, documentation and reflexive assessment so that both technical outcomes and organisational lessons are captured.

- **Evaluating urban experiments**

Evaluation must produce the types of information decision-makers need to assess whether ‘the tested solution’ is suitable for broader adoption, such as contribution to sustainability objectives, implementation costs, feasibility, and organisational implications.

- **Planning for upscaling**

Once the evaluation is available, the next step is to articulate what upscaling would entail in the specific context. This involves identifying which components of the experiment should be scaled (technical solutions, processes, collaboration models or routines) as well as clarifying the relevant form(s) of upscaling (e.g. in line with Lam et al. (2020), see Table 1). Assessing the institutional resources required, such as decision-making authority, relational capacity or financial means, is central at this stage.

- **Deciding on upscaling**

A formal decision is often needed to move from analysis to action. This requires identifying the appropriate decision-maker or decision-making body and ensuring that the necessary information, mandates and organisational alignment are in place. Clear definition of what upscaling involves is essential to support informed decisions.

- **Working with upscaling**

Upscaling requires dedicated organisational work that typically spans different departments and professional roles. This can include adjusting existing routines, developing new guidelines, introducing new regulations or procurement templates as well as coordinating with future users, building capacities, and addressing institutional lock-ins that may hinder adoption. Collaboration across organisational boundaries is particularly important in this phase.

- **Implementation of scaled solutions**

The final stage involves integrating the scaled solution into new contexts, projects or organisational practices. This often requires contextual adaptation, confirming that upscaling is seldom a simple replication but a process of translation, negotiation and institutionalisation.

Paper V documents a plurality of interaction forms through which learning from urban experiments circulates within the studied municipality. At the interdepartmental level, respondents highlighted the municipal sustainability strategist as a key intermediary, facilitating dialogue and knowledge exchange across departments through formal cross-sectoral platforms. At the departmental level, some units, such as the real estate department, had established structured forums, including a sustainability council, where directors discussed lessons from projects and broader organisational change. Other departments, such as the PM-function and Land Use Development, relied more on routine operational meetings and collaborative project environments as arenas for continuous learning between projects. Respondents also described private companies as important intermediaries, transferring experience and practices across departments through repeated involvement in municipal projects.

Alongside these more formalised arrangements, respondents across departments emphasised that learning from urban experiments most often develops organically through personal networks and individual initiative. Project managers were described as “bumble bees” who move between projects and departments, informally exchanging experiences and working methods. This form of learning was valued for enabling continuous improvement, but was also characterised as unguided and weakly structured, reinforcing that the circulation of lessons from urban experiments largely depends on motivated individuals rather than coordinated organisational processes.

To sum up, the results presented in this chapter demonstrates how certification systems can be developed through transparent and reflexive design processes, and how learning from urban experiments can be actively managed and upscaled within and between municipal organisations rather than assumed to occur automatically. By focusing on these processes, the results address the research gaps identified in the introduction and provide an empirically grounded basis for the discussion that follows.

6 Discussion

This chapter discusses the results of the thesis in relation to existing research and the research questions guiding the work. The discussion is structured in five parts. First, the findings related to certification systems are discussed in relation to previous research, with a focus on how design processes and trade-offs shape their function as governance instruments. Second, the findings on urban experiments are discussed, focusing on how upscaling can be organised within municipal organisations. Third, the methodological approach of the thesis is critically reflected upon in relation to knowledge production and generalisability. Fourth, the results from both empirical strands are synthesised to examine what they imply for understanding certification systems and urban experiments as governance instruments for sustainable urban development. Finally, avenues for future research are outlined.

6.1 Certification systems: Design choices and governance implications

This section discusses the results concerning the development of certification systems for urban areas in relation to the research gaps identified in previous research. While earlier critiques have primarily focused on the content, structure, or outcomes of certification systems, this discussion instead centres on what the findings reveal about the processes through which such systems are designed, and how specific design choices and trade-offs shape their function as instruments of urban governance. In particular, the discussion elaborates on how making key considerations in the development process

more explicit provides insight into the underlying logics, tensions, and compromises involved in certification system design. This perspective helps illuminate how different priorities are balanced and negotiated, and how these dynamics relate to recurring debates in the literature regarding both the potential and the limitations of certification systems as tools for advancing sustainable urban development.

6.1.1 Navigating trade-offs through key considerations

One central insight from the results concerns how the development of certification systems is shaped by ongoing negotiations between competing design considerations. The findings in this thesis reveal that several of the key considerations (Table 7), for instance the balance between being *comprehensive* and *simple*, were in constant tension with one another. Rather than prioritising one of these aspects at an early stage, the development of Citylab was characterised by an ongoing negotiation between competing considerations in search of a balanced outcome. A central contribution of this work lies in demonstrating how such trade-offs can be made explicit and handled transparently. If proposed key considerations or similar concepts were adopted more widely, they could enhance understanding of why different certification systems have taken the forms they have and enable more informed debate about how they might be redesigned to better reflect specific purposes or values. Such transparency might also increase understanding of certification systems in relation to recurring critiques in the literature concerning methodological robustness, the overemphasis on environmental aspects, or the limited number of mandatory indicators (Gouda & Masoumi, 2018; Sharifi & Murayama, 2013; Ameen et al., 2015; Haapio, 2012; Wangel et al., 2016).

In the development of Citylab Post-Construction, one of the earliest and most decisive choices concerned what type of indicators the certification should focus on. In response to earlier criticism that certification systems tend to rely on process or feature indicators rather than outcome (Wallhagen et al., 2013), and in line with an explicit prioritisation of *validity* as a key consideration, it was decided that Citylab Post-Construction would focus on performance-based indicators. As different certification systems tend to emphasise different types of indicators, key considerations could potentially serve as a shared vocabulary for explaining and justifying such choices, thereby creating a more transparent foundation for comparison and discussion between systems.

Since the system's launch in 2019, only one urban area has been certified. This low uptake should not necessarily be interpreted as a failure of the *key considerations* framework, which was intended to structure reflection rather than to guarantee a good balance between considerations. Nor should it be taken as evidence that the balance achieved within Citylab was poorly calibrated. Instead, the limited uptake raises more fundamental questions about whether a true equilibrium among key considerations can always be found. Some trade-offs may simply be irreconcilable: making a system simple enough to encourage participation may require sacrificing comprehensiveness to a degree that undermines credibility, while prioritising comprehensiveness can make the system too complex or resource-intensive to use.

6.1.2 Reworking the logic of certification towards network governance in Citylab

Building on these insights, the development of Citylab Post-Construction offers a basis for reflecting on how certification systems might be reoriented as governance instruments. A central reflection concerns the attempt to shift the logic of certification from individual accountability towards more collective and network-oriented forms of governance, and the tensions that emerge when such an ambition is pursued within a certification context. Traditionally, certification systems have been designed to measure and verify the performance of individual actors. Their purpose has been to provide assurance, to demonstrate that a specific organisation, building, urban areas, or products has achieved a defined standard. In this sense, they operate as *de jure* and *de facto* standards in the terms of Lascoumes and Le Galès (2007), setting norms for what is considered acceptable or exemplary practice.

Citylab Post-Construction, however, sought to reorient certification toward network governance. Earlier research (e.g. Wangel et al., 2016; Lind, 2014) has already noted that certification systems can help structure collaboration among actors. Citylab Post-Construction extends this function further by attempting to measure sustainability outcomes that result from the combined actions of multiple actors, municipalities, property owners, developers, and residents, many of whom may not have shared a common project or even been aware of the certification process. Their individual behaviours, such as travel choices, waste management, or the ability to foster social trust among neighbours, collectively contribute to whether an area meets certification criteria.

Yet in shifting from clear accountability toward shared governance, a paradox emerges. The more a certification system emphasises collective responsibility, the less clear the incentive becomes for any single organisation to engage in the process. This was a recurring issue in discussions during the Citylab development process, particularly when identifying potential users of the system and the value it might offer them. For municipalities or developers, certifying an entire urban area post-construction posed uncertain benefits, as the collective nature of the system meant that results could not easily be attributed to a single actor. In other words, when certification is reframed to serve collaborative governance rather than accountability, it risks losing the motivational force that has traditionally driven its use.

This raises a broader question regarding the future role of certification systems in sustainable urban development. As governance increasingly relies on collaboration and shared responsibility, it remains uncertain whether certification systems can function as meaningful structures for such forms of collaboration, or whether their underlying logic limits their relevance for practitioners. Reflecting on the discussions during the development of Citylab Post-Construction, and considering its limited uptake to date, this tension appears to be more than theoretical. It suggests that the paradox identified here may constrain the practical use of certification systems in contexts characterised by shared responsibility for sustainability performance. This, in turn, brings the discussion to other forms of governance for sustainable urban development, where collaboration is a more inherent part of the process, such as urban experiments.

6.2 Urban Experiments: Learning, upscaling, and governance practice

This section discusses the results concerning urban experiments in relation to previous research and to the identified research gap regarding how municipalities can organise learning and upscaling from urban experiments in a more structured way. The findings of this thesis confirm earlier research on urban experimentation (Eneqvist, 2022; Grin, 2020; Ehnert, 2023) and transition management (Dóci et al., 2022; Loorbach et al., 2015), which highlights the persistent difficulties of ensuring that insights and innovations generated through experimental projects influence broader governance practices. Urban experiments can function as meaningful governance instruments only when municipalities strengthen their capacity for process

learning (Evans et al., 2021). This need is closely related to concepts such as learn-to-learn (Neij and Heiskanen, 2021) and meta-learning (Wolfram et al., 2019), all of which point to the importance of intentionally cultivating reflexive, iterative and cross-organisational learning processes.

The analysis presented in this section draws together theoretical perspectives from governance learning, organisational learning, institutional capacity, transition studies, institutional logics and research on the upscaling of urban experiments to deepen understanding of these persistent challenges and to analyse the empirical material. Combining various theoretical perspectives provides a broad analytical foundation for interpreting the empirical findings and makes it possible to highlight different aspects of how learning unfolds in municipal practice and how it can influence municipal governance of sustainable urban development.

This part of the discussion is organised according to Wolfram et al.'s (2019) distinctions for analysing governance learning: who learns, what is learnt, the depth of learning, and the interaction forms through which learning occurs. While following this structure, the analysis also draws on additional theoretical perspectives to deepen the interpretation of the empirical material.

6.2.1 Organising learning from urban experiments

Concerning who learns from urban experiments, this thesis focuses on experiments initiated by incumbents rather than those driven by radical innovators or grassroot movements. This delimitation places analytical attention on the types of experiments that have become increasingly common in municipal governance, as noted by Grin (2020). Drawing on the metaphor of ripples proposed by Dóci et al. (2022), the findings confirm that learning from urban experiments frequently remains within the inner ripples, that is, within the project teams or departments directly involved. Some learning between departments did occur in the studied municipalities, although civil servants often explained that differences in responsibilities and working practices made it difficult to apply learning outcomes generated elsewhere. At the same time, respondents recognised the importance of reaching beyond the inner ripples in order to support more transformative forms of change, which links back to the broader need for process learning and systematic approaches to upscaling.

To understand what is learnt from urban experiments, several conceptual categorisations can be applied, as presented in the chapter 2. The empirical

material shows that respondents frequently highlighted practical outcomes, in line with the definition proposed by Van Poeck et al. (2020). If the learning is interpreted using the framework developed by Wolfram et al. (2019), the outcomes identified in this thesis correspond primarily to the policy dimension (the substantive tools and interventions through which collective goals are pursued) rather than to polity (institutional structures) or politics (processes of negotiation and decision-making). However, such visible and easily articulated learning outcomes may not capture the full range of knowledge generated through urban experiments. Organisational learning theory suggests that experiments can also produce tacit knowledge, as discussed by Basten and Haamann (2018). Paper IV illustrates this notion by showing that practitioners often found it difficult to define what they had learnt and, consequently, to determine what should be scaled into new contexts. Being asked to specify what elements of an experiment should be scaled was consequently perceived as valuable by participating practitioners. In terms of organisational learning theory, the supportive tool developed in Paper IV facilitated externalisation because it encouraged practitioners to articulate their knowledge and make it more explicit, in line with the conceptualisation proposed by Basten and Haamann (2018).

Regarding the depth of learning, the findings of this thesis indicate the value of complementing the concepts of single loop and double loop learning suggested by Wolfram et al. (2019) with the more differentiated terminology of scaling presented by Lam et al. (2020). This terminology helps illuminate that upscaling can take different forms. For example, some outcomes resemble single loop learning that can be replicated within a department, such as procurement requirements. Other outcomes relate to technical innovations that have stabilised or matured in a local market, for example an electric rock crusher. Still other outcomes concern aspects that can be transferred or spread into new contexts if they are adapted or if core principles are translated. These distinctions are important because learning that aims to reach beyond the inner ripples requires an understanding of how specific insights may travel and what kinds of adjustments they may require. The results from Paper IV demonstrate how these challenges can be addressed in practice. When practitioners worked with the supportive tool, they were prompted to specify both what should be scaled and which form of scaling would be appropriate for the specific learning outcome in question. Practitioners described this as a relevant and useful step, since it required them to reflect more explicitly on the character of the learning and its suitability for different dimensions of

upscaling. This work of clarification forms part of the externalisation process (Basten & Haamann, 2018) because it involves articulating and making explicit knowledge that would otherwise remain implicit. While not framed in these terms, similar dynamics have been observed in research on urban experimentation (von Wirth et al., 2019). The results also indicate that the outcomes of a single urban experiment can be scaled in multiple forms at the same time (see Lam et al., 2020), including being anchored in the original site while also being replicated in new contexts and influencing regulations. This highlights the need to better understand both what has been learnt and how that learning can be taken scaled in practice.

In the results concerning interaction forms, both sequential learning and parallel learning, as described by Wolfram et al. (2019), can be identified. Since the learning processes observed in case municipalities were relatively organic and loosely structured, it was difficult to analyse current practice through the lens of the spiral of organisational knowledge creation (Basten and Haamann, 2018). More detailed studies of individual processes or departments might have revealed stronger connections.

A central insight from Paper IV concerns the role of the supportive tool as an interaction form for structuring learning and upscaling. By explicitly addressing what should be scaled and which forms of upscaling are relevant, the tool responds to several challenges identified in both the empirical material and previous research. In particular, it supports processes of externalisation (Basten and Haamann, 2018) and the development of knowledge resources (e.g. Eneqvist, 2022), while also enabling a more differentiated understanding of upscaling in line with typologies proposed by Lam et al. (2020).

Furthermore, by incorporating questions related to how upscaling can be realised, including the need for resources, decision-making authority, and organisational support, the tool aligns with earlier research on institutional capacity (Isaksson and Heikkinen, 2018; Norell Bergendahl, 2016; Eneqvist, 2022; van der Leer, 2025), which emphasises that upscaling depends not only on knowledge resources, but also on relational and mobilisation capacities. In this way, the supportive tool can be understood as a means of making these requirements visible and discussable in practice, thereby contributing to addressing the difficulty of navigating tensions between experimental and bureaucratic logics (Bögel et al., 2019; Berglund-Snodgrass and Mukhtar-Landgren, 2020).

At the same time, the process of developing and testing the supportive tool revealed important limitations in approaching upscaling as something that can be addressed at a single point in time. Through the participatory work, practitioners increasingly problematised the assumption that learning from urban experiments can be mobilised simply through evaluation and dissemination. Instead, they articulated a broader understanding of upscaling as a concern that needs to be addressed throughout the entire experimental trajectory, as illustrated in Figure 1. This process-oriented understanding is also consistent with previous research on urban experimentation and institutional capacity (Isaksson and Heikkinen, 2018; Eneqvist, 2022; van der Leer, 2025; Witzell & Oldbury, 2023), which highlights that the possibility to scale experimental learning depends not only on the capacity of individual projects, but also on the capacity of organisations to receive, interpret, and act upon such learning.

Against this background, the contribution of this thesis lies in showing how urban experiments can be organised in ways that actively strengthen such capacities. More specifically, the findings indicate that engaging with questions of what should be scaled, which forms of upscaling are relevant, and how upscaling can be realised constitutes a practical way of operationalising institutional capacity in relation to upscaling. This implies that upscaling needs to be treated as an integral part of experimental work, rather than as an issue to be addressed at the end of a project when resources are limited and opportunities for organisational alignment are reduced.

6.2.2 Upscaling and projectification

While the findings of Paper IV highlight a set of key questions for urban experiments to address in order to strengthen their contribution to upscaling, this approach may also be open to critique. By emphasising how individual experiments can work more structured with learning and upscaling, it risks reinforcing a project-based logic. This concern aligns with critiques by Torrens and von Wirth (2021) and Raven et al. (2026), who argue that urban change should not be organised around discrete projects but institutionalised within routine governance.

At the same time, project-based experimentation fulfils an important function by creating space for testing novel approaches under conditions that differ from routine administration. As highlighted in transition studies, protected niches remain essential for exploring alternative practices and solutions that

may not emerge within established organisational structures (Köhler et al., 2019). Efforts to fully integrate experimentation into existing governance processes therefore risk reducing the scope for more radical forms of innovation, resulting instead in incremental adjustments rather than transformative change.

Rather than positioning projects and permanent governance structures as mutually exclusive, the findings point to the need to understand how they can be more effectively connected. This challenge is also highlighted in previous research on urban experimentation and institutional capacity (see e.g. Fred, 2019; van der Leer, 2025; Witzell & Oldbury, 2023). In the empirical material, current practices of learning and upscaling were often dependent on motivated individuals who actively exchanged experiences across projects. Such bridging agents (Hughes et al., 2020) play an important role in circulating knowledge within municipal organisations. However, even when urban experiments become more explicit in articulating learning and potential pathways for upscaling, learning that depends on personal initiative remains uneven and fragile. It cannot, by itself, secure systematic organisational change, because it is not embedded in formal mandates, routines, or resource structures.

From this perspective, the central challenge lies in establishing a more balanced relationship between the production of learning within experiments and the organisational capacity and willingness to receive and act upon such learning. This requires municipalities not only to support experimentation, often through external funding and dedicated resources, but also to ensure that corresponding organisational structures exist to actively capture, assess, and act upon the knowledge generated. Without such structures, there is a risk that the outcomes of experimentation remain underutilised. Seen in this light, the process developed in Paper IV should not be read as focusing only on projects, but as highlighting organisational functions that are otherwise weakly institutionalised. The steps labelled ‘planning for upscaling’, ‘deciding on upscaling’, and ‘working with upscaling’ do not prescribe how a project should evolve. Rather, they articulate missing organisational capacities for prioritisation, coordination, and implementation. These steps correspond closely to what Torrens and von Wirth (2021) describe as the need to create hybrid spaces that connect experimental practices with permanent administrative structures.

From this perspective, an important avenue for further research lies in examining how municipal organisations can organise themselves to not only

respond to individual urban experiments, but to proactively initiate, steer, and scale sustainability efforts based on portfolios of experiments.

6.3 Methodological reflections on knowledge production and generalizability

Building on the results discussed above, concerning both the development of certification systems and upscaling related to urban experiments, this section reflects on these results in relation to the methodological approaches that characterise the thesis. As the results of this thesis have largely emerged through transdisciplinary (Lang et al., 2012), and design-oriented processes (Zimmerman et al., 2010; Koskinen et al., 2011), methodological choices are closely intertwined with both the nature of the results and their generalisability.

The knowledge developed within the thesis can, in one sense, be described as situated, in that some results are closely tied to the specific contexts in which the research was conducted. This applies in particular to the practice-oriented results that took the form of concrete artefacts and solutions, such as the design of Citylab Post-Construction and the supportive tool for working with upscaling. These results are closely linked to the specific certification system, its institutional context, and the actors involved in the development process, as well as to the particular municipal contexts and organisational conditions examined. In line with Lang et al. (2012), such outcomes can therefore be understood as results for practice rather than as the primary scientific contribution of the thesis.

The scientific contribution, and thus the analytical generalisability of the thesis, lies in the conceptual insights developed through these processes. Within a transdisciplinary and design-oriented research approach, knowledge is produced in close interaction with practice and in relation to concrete problems. This implies that practice-oriented artefacts function as means rather than ends in the research process. Generalisability therefore does not lie in the specific design of the certification system or in the exact wording of the supportive tool for upscaling, but in the analytical perspectives, considerations, and understandings that these processes have enabled (Lawrence et al., 2022).

With regard to the certification system, generalisability primarily concerns the identified key considerations and inherent trade-offs between different goals and logics that must be addressed regardless of how a system is designed or

which priorities are chosen. These trade-offs do not constitute solutions in themselves, but rather analytical insights that may be relevant to the development of other certification systems in different contexts. For the studies of urban experiments and upscaling, generalisability instead lies in the theoretical understanding of recurring processual patterns, assumptions, and organisational challenges that characterise work with upscaling in practice.

The analytical generalisability of the results therefore ultimately rests on their connection to theory. By applying established theoretical perspectives from several relevant research fields to interpret, structure, and inform work in strongly situated contexts, the relevance and explanatory capacity of the theories were tested in practice. It is this testing of theory in context, rather than the concrete design of artefacts, that constitutes the generalisable core of the scientific contribution. These analytical insights are further strengthened by the combined results of Papers IV and V, which draw on similar theoretical perspectives but apply different methodological approaches. While Paper V employs a more conventional case study design, Paper IV is based on a transdisciplinary and intervention-oriented research process. Despite these differences, both studies arrive at similar understandings of key processes and challenges related to learning and upscaling. This convergence strengthens the robustness of the findings. At the same time, Paper IV extends these insights by translating them into a practically applicable supportive tool grounded in theory, thereby demonstrating how analytical concepts can inform action in practice.

This form of knowledge production is closely connected to the methodological choices presented in Chapter 4. Methods in the thesis were selected and combined in a context-sensitive manner, in relation to the research questions, the phases of the respective research projects, and the practical settings in which the research was conducted. This meant that the methods did not follow a fixed or standardised sequence, but were developed iteratively through interaction between empirical material, theory, and practice, in line with transdisciplinary and design-oriented research approaches (Lang et al., 2012; Sanders & Stappers, 2014; Wittmayer & Schöpke, 2014). Taken together, this means that the methods should not be understood as neutral techniques for data collection, but as integrated components of a research process in which knowledge develops through iterative interaction between theory, empirical material, and practice.

That said, situated research also relies on similar studies being conducted across multiple contexts in order to assess the robustness and transferability of its findings. To further test and develop the analytical insights identified in this thesis, future research should therefore continue to examine the identified key considerations and deepen the understanding of more structured approaches to upscaling in other organisational and institutional settings.

6.4 Understanding certification systems and urban experiments as governance instruments

This thesis is concerned with two governance instruments for sustainable urban development: certification systems for urban areas and urban experiments. While these discussions so far have been closely tied to the empirical focus of the individual papers, they have primarily examined the instruments separately and in relation to their respective analytical concerns.

As a final step, this section examines what the findings imply for understanding certification systems and urban experiments as forms of governance more broadly. Rather than introducing new empirical material, the section reinterprets the results through a governance instrument perspective to analyse what the observed dynamics of certification systems and urban experimentation reveal about how these instruments function when used in practice. Drawing on the policy instrument framework developed by Lascoumes and Le Galès (2007), the section synthesises insights from the two empirical strands by analysing how certification systems and urban experiments generate inertia effects, shape representations of sustainability, and embed particular problematisations of urban change.

6.4.1 Inertia effects and stabilising dynamics

Both certification systems and urban experiments generate inertia effects (Lascoumes & Le Galès, 2007), meaning that once introduced, they tend to reproduce their underlying logics and stabilise particular ways of working, thereby shaping how sustainability governance unfolds over time. In the case of Citylab Post Construction, inertia effects are not observed over time, but can be analysed through how the certification system connects to existing forms of governance. To fulfil key considerations related to *simplicity*, Citylab Post Construction builds on established building certification systems to address issues such as energy performance and indoor environmental quality. By

relying on existing certifications that were seen as already scientifically credible and widely recognised, the system reinforces prevailing definitions of best practice in building-level sustainability, producing a form of indirect inertia through the sedimentation of existing steering logics at the district level. This alignment supports coherence across certification schemes, but also contributes to the stabilisation of existing governance arrangements by reproducing established standards, procedures, and modes of coordination across different levels of sustainability governance.

Urban experiments generate inertia effects of a different kind than certification systems by stabilising particular modes of governing rather than specific technical standards. In line with critiques of projectification (Torrens and von Wirth, 2021), this thesis is itself based on empirical material from discrete, time-bound projects, through which experimentation is organised and given particular status, resources, and visibility. Through the repeated reliance on such arrangements, project-based forms of organising become stabilised as a dominant mode of governing sustainability work.

6.4.2 Representations of sustainability

Certification systems and urban experiments shape how sustainability is represented and understood in urban development. From a policy instrument perspective, certification systems do not only assess sustainability performance, but also contribute to defining what sustainability becomes in practice. In the development of Citylab Post Construction, this was particularly visible in the work of translating broad sustainability ambitions into assessable indicators. To meet requirements of reliability and validity, indicators had to be formulated in ways that allowed for consistent assessment. This entailed a balancing of sustainability ambitions against what could be operationalised in measurable terms, creating challenges in capturing dimensions that were widely recognised as important but difficult to standardise. Seen through this lens, certification systems can be understood as instruments that stabilise particular representations of sustainability by privileging what can be measured, assessed, and compared.

Urban experiments also shape how sustainability is represented in urban development by influencing which challenges are considered actionable. While many of the experiments examined in this thesis address climate mitigation, this is not a defining feature of urban experiments as governance instruments. Rather, reflecting on the research process and the experiments included in this

thesis, urban experiments can be understood as tending to privilege sustainability challenges that can be addressed through bounded, project-based interventions. This leads to a focus on localised actions, while broader structural or regulatory challenges remain less directly addressed. This, in turn, suggests that approaches aligned with what Lam et al. (2020) describe as “scaling up” into higher institutional levels and “scaling deep” into values and mindsets may help to counterbalance this tendency. At the same time, this interpretation remains tentative and points to a need for further research on how such representations influence the selection and prioritisation of sustainability issues in practice.

6.4.3 Problematisation and assumptions about change

From a governance instrument perspective, certification systems and urban experiments shape sustainability governance by problematising how change is expected to occur. In doing so, these instruments embed assumptions about which pathways of change are considered feasible, legitimate, and actionable in urban areas. In the case of certification systems, change is problematised as something that can be achieved through the measurement, comparison, and communication of performance. By making sustainability performance visible and comparable, certification systems rely on market-oriented dynamics in which informed actors (such as property owners, investors, and users) are expected to make choices that reward higher-performing alternatives. This creates a logic in which responsibility for change is distributed across a chain of actors, where improvements are driven by the need to meet expectations and demonstrate performance. Such a logic depends on the possibility of attributing outcomes to identifiable actors and activities, in line with the principle of influenceability discussed earlier. As discussed in Section 6.1.2, attempts to reorient certification towards more collective and network-oriented forms of governance challenge this underlying logic.

Urban experiments, by contrast, tend to problematise sustainability challenges as issues to be addressed through the development and testing of new solutions. While such arrangements create space for innovation, they also contribute to a governance logic in which the initiation of new ideas and projects is prioritised. In doing so, this understanding of change may overshadow the fact that many of the technologies and working methods required for sustainable transitions are already available, thereby reflecting a tendency for innovation to become a value in itself rather than a means to achieve clearly defined sustainability outcomes (Fred, 2022). This dynamic

also resonates with arguments that experimental approaches are not always critically assessed in relation to the challenges at hand, but may instead be applied as a default mode of action (Grundel and Trygg, 2024).

This analysis shows that certification systems and urban experiments are fundamentally different governance instruments, but that each generates distinct and systematic effects on how sustainability is understood, organised, and pursued in urban development practice. The issue is therefore not to identify an instrument without drawbacks or to determine which instrument is “best” in general. Rather, the findings demonstrate that different instruments shape governance in different ways and entail specific consequences for learning, coordination, and change. Greater awareness of these governing effects creates possibilities to anticipate and manage the limitations of each instrument, and thereby to use them more deliberately in efforts to advance sustainable urban development.

Placed in the broader context outlined in the introduction, these findings underscore the importance of how cities work with governance instruments if they are to fulfil the role increasingly ascribed to them in sustainability transitions. While cities are often highlighted as key arenas for driving change, this thesis shows that the capacity of urban development to contribute to sustainability transitions depends not only on the choice of instruments, but on how their inherent limitations are understood and addressed. Certification systems do not capture all dimensions of sustainability, and urban experiments do not generate change unless their lessons are taken up and translated into sustained practices. In this sense, the challenge is not only to design better instruments, but to develop more reflexive ways of working with them. This involves recognising both their strengths and limitations, and adjusting how they are used and combined in order to better support broader sustainability goals.

6.5 Future research

The findings of this thesis open several avenues for future research. First, future research could further test and refine the analytical insights developed in this thesis by examining certification system development in other institutional and geographical contexts. While the identified trade-offs and key considerations are likely to be relevant beyond the specific setting studied here, their relative importance and practical implications may vary depending on governance structures, market conditions, planning traditions etcetera. Comparative studies could therefore deepen understanding of how certification systems function as governance instruments across different urban contexts.

Second, the analysis of urban experiments shows that upscaling depends on the presence of active recipients within municipal organisations who intentionally seek out experimental insights and are willing and able to use them to change established ways of working. Future research could more explicitly examine how such recipient capacities can be developed and sustained in practice within municipal organisations, and how they can become stabilised as ordinary ways of working rather than occurring only in isolated instances.

In addition, future research could more explicitly examine upscaling in the context of urban experiments with more transitional and system-oriented ambitions. The cases analysed in this thesis primarily concern experiments initiated within existing organisational structures, where upscaling can often be understood in relation to specific solutions or practices. However, in contexts where more fundamental change is required, upscaling may need to be conceptualised and organised differently. Future research could therefore explore how upscaling unfolds when change depends on the coordinated action of multiple actors across organisational and institutional boundaries, and where no single actor has the mandate or capacity to drive change alone. This raises questions about who can take responsibility for initiating and sustaining such processes, and how insights from urban experiments can contribute to broader system change. Such research could deepen understanding of how upscaling relates to more transformative sustainability transitions.

7 Conclusions

The overall aim of this thesis is to advance understanding of governance instruments for sustainable urban development. More specifically, the development certification systems for urban areas and how learnings from urban experiments can be scaled beyond individual projects are in focus. Related to this aim, this chapter presents three main conclusions of the thesis.

Certification systems are shaped through negotiated trade-offs between competing considerations

This thesis shows that the design and content of certification systems for urban areas are shaped by negotiations in the design process between competing considerations rather than by the optimisation of a single set of criteria. In the empirical material, these trade-offs became particularly visible in discussions about how to develop a system that: comprehends the breadth of sustainability issues relevant to urban development, ensures robust and credible assessment, and at the same time remains simple enough to be practical and not overly resource-intensive.

By making these trade-offs explicit, the thesis provides insight into the rationales that underpin certification systems and helps explain why they take the forms they do. Rather than viewing certification systems primarily as fixed assessment tools, the findings highlight their character as negotiated governance arrangements that embed particular priorities, assumptions, and compromises. This perspective moves beyond existing critiques focused solely on the content or outcomes of certification systems by drawing attention to the underlying logics and tensions that shape their development.

Importantly, the findings also suggest that these tensions may not be fully resolvable. A system that is sufficiently credible to be perceived as meaningful may at the same time be too complex or resource-intensive to be considered worthwhile to pursue, while a simpler system risks lacking the credibility needed to motivate actors to seek certification. In this sense, certification systems must be understood not as optimisable tools, but as governance instruments characterised by inherent and persistent trade-offs.

Upscaling from urban experiments requires articulated learning, a differentiated understanding of scaling, and organisational demand

The findings of this thesis demonstrate that urban experiments can contribute to learning in municipal practice, but that such contributions do not automatically scale into broader organisational change. Learning from experiments often remains situational, project-bound, and dependent on individual initiative unless it is supported by more structured organisational processes. As a result, the potential of urban experiments to influence wider governance practices depends less on the number or novelty of experiments conducted, and more on how learning from them is actively identified, articulated, and taken up within municipal organisations.

The contribution of this thesis lies in showing how urban experiments can work more structured with upscaling by clarifying what should be scaled, which forms of upscaling are relevant, and how such processes can be organised in practice. At the same time, the findings show that the effectiveness of such approaches depends on organisational demand for change, as without structures, mandates, and resources to receive and integrate learning, even well-articulated outcomes risk remaining dependent on individual initiative and confined to project-based settings.

Sustainable urban development depends on reflexive use of governance instruments

Lastly, the results show that certification systems and urban experiments function as fundamentally different governance instruments, each producing distinct and systematic effects on how sustainability is understood, organised, and pursued in urban development practice. Certification systems tend to stabilise particular definitions of sustainability and favour interventions where influence can be specified and assessed. Urban experiments, by contrast, emphasise innovation, learning, and temporary arrangements, and frame

change as something that can be initiated through bounded projects operating alongside ordinary governance structures. This orientation risks prioritising the development of new solutions over the scaling of already available ones.

The key insight from this thesis regarding how certification systems and urban experiments function as governance instruments is therefore not to determine which instrument is preferable in general. Rather, it points to the need for greater awareness of their governing effects, in order to better anticipate the strengths and limitations of each instrument.

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