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From pilot to practice: navigating pre-requisites for up-scaling sustainable urban solutions

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Abstract

Municipalities employ pilot projects, tests, living labs and similar initiatives to explore novel sustainable solutions for urban development. Nevertheless, civil servants often encounter challenges when attempting to scale up tested solutions, both within their own city and to other cities. To address this and increase knowledge on how theory can be utilised by practitioners, this research project has created a supportive tool aimed at facilitating the upscaling process. The development took place in co-creation with civil servants from the three largest cities in Sweden. The paper confirms earlier research on the need of institutional capacity as well as appropriate navigation between institutional logics as pre-requisites for upscaling. More specifically, institutional capacity plays a vital role for securing sufficient resources and mandates for upscaling, extending beyond mere dissemination of results. The supportive tool aims at enhancing this institutional capacity and translating between institutional logics. In addition, the paper contributes to the scientific debate on civil servants' understanding of different forms of upscaling and, consequently, the need to articulate these differences when facilitating upscaling. The paper emphasizes that upscaling should be conceptualised not as a discrete event but rather an ongoing process starting already when planning a pilot project.

Science highlights

- It is pertinent for civil servants to elucidate institutional capacity as basis for upscaling
- Civil servants working with upscaling, work in the tension between institutional logic.
- Civil servants should employ a nuanced vocabulary, defining upscaling in each contex.
- Upscaling is not a discrete event but rather an ongoing proces

Policy and practice recommendation

- Defining upscaling for each sustainable solution is a central part of an upscaling process
- Municipalities have to secure resources and mandate in order to make dedicated upscaling efforts
- Possible future upscaling should be considered already when planning a pilot project

Keywords Upscaling, Urban development, Institutional capacity, Urban experiments

Introduction

Municipalities governing cities are often identified as key actors in the transformation towards a more sustainable urban development (e.g., UN (2015; 2017)). To find new, more sustainable solutions for urban development (including new processes, working methods, collaborations, technical solutions, etc.), municipalities use experimental projects, pilots, tests, living labs, urban experiments, etc. (Eneqvist 2022; Torrens et al. 2019; van Doren et al. 2018; van den Heiligenberg et al. 2017; Sengers et al. 2019; Potjer 2020; van den Bosch and Rotmans 2008; Adams et al. 2023). Such initiatives can either be performed as independent projects or as part of larger urban development processes (Eneqvist 2022), and either in collaboration with non-municipal actors such as academia (Rigolot 2020; Lang et al. 2012) or without such collaboration. In addition, they can focus on institutional change or technical change, they can be more or less transformative, more data driven or design led etc. (Evans et al. 2016). However, regardless the type of pilot project, if such a project is to contribute to sustainable development at a larger scale, it needs to result in changes outside the single project or urban area and have a societal impact after the finalised project beyond the mere dissemination of results. This is discussed in academic litterature using different terms such as upscaling. How to be successful in upscaling is, however, not obvious, with no evident, easy approach or process that can suit all contexts (Neij and Heiskanen 2021; Evans et al. 2016). The emphasis is frequently placed on initiating and conducting experiments, tests, and innovative projects; comparatively less effort is directed towards determining how to effectively utilize their outcomes.

The Swedish cities of Stockholm, Malmö and Gothenburg have conducted several pilot projects as part of larger urban development projects, such as the Stockholm Royal Seaport, Älvsstaden in Gothenburg, and BO01 in Malmö, as well as smaller projects, e.g., testing the use of an electric vehicle to clean pathways in parks. They commonly observe that successful outcomes from these projects seldom permeate the market or are implemented on a broader scale in subsequent urban development initiatives. Some solutions may be introduced in various new development projects but fail to transition to refurbishment projects. Alternatively, solutions are introduced in subsequent projects, but without sufficient collaboration necessary to realise potential for increased efficiency and synergies. This aligns with previous research on Swedish municipalities (Eneqvist 2022), indicating a lack of sufficient processes and tools to facilitate upscaling as a standard practice.

Against this background, a research project harbouring the present study was initiated with the aim to develop a supportive tool for upscaling of sustainable solutions in municipalities. In this project, representatives from the cities of Stockholm, Gothenburg and Malmö, as well as Sweden's national real estate association, worked collaboratively with researchers from IVL, KTH and Uppsala University.

Research aim

The overall aim of this paper is to develop knowledge and experience on how municipalities can enhance their performance in upscaling sustainable solutions tested in pilot projects, thereby accelerate a transition towards sustainable urban development.

The specific aim is (i) to identify important prerequisites of upscaling and (ii) to investigate the role of municipal civil servants in navigating these prerequisites to enhance upscaling capacity.

Previous research

Different perspectives on and definitions of upscaling

One way of understanding upscaling is to use multilevel perspective (MLP) theories. According to MLP theories (Geels 2002; Smith et al. 2005; van den Heiligenberg et al. 2017), novel ideas can be developed in protective 'niches' with, e.g., external funding and low requirements for profitability. To be upscaled, such innovations need to level these niches and face 'regimes', a second level. Regimes consist of national laws, habits, working methods etc. If an innovation entails changing these regimes, i.e., laws or working methods, upscaling will face obstacles. On a third level, upscaling may be hindered by a 'landscape', which consists of the aspects of society that are harder to impact, e.g., the building structures in a city, international migration, oil prices, etc. (Geels 2002; Smith et al. 2005; van den Heiligenberg et al. 2017).

There is no common definition or harmonised terminology concerning upscaling. The term itself, 'upscaling', is used by some scholars (van Doren et al. 2018; Hughes et al. 2020; van den Heiligenberg et al. 2017) while others use embedding (Eneqvist 2022), mainstreaming (Adams et al. 2023), rolling out, breaking through (Evans et al. 2016), research implementation (Bammer et al. 2020), amplyfing (Lam et al. 2020) etc. In some litterature the terminology employed reflects varying perspectives on upscaling (in this paper we use upscaling as an umbrella term), and at times, these different terms are used interchangeably.

Some literature present categorisations on different types of upscaling (see, e.g., van den Bosch and Rotmans (2008); Hughes et al. (2020) and Potjer (2020). One such categorisation is presented by van Doren et al. (2018), who differentiate between horizontal and vertical upscaling. Horizontal upscaling means that a solution starts as a local initiative but then grows to include larger parts of a city or region (van Doren et al. 2018). An example might be a sharing service that starts in a single neighbourhood and then grows to enable sharing across the neighbourhood or its entire city. This sharing service can be upscaled via local initiative, growing into a larger organisation, or the initiative can be replicated in all neighbourhoods, creating their own sharing services. Vertical upscaling refers to how a sustainable solution can involve new knowledge, new values, changed norms and more, which affect formal and informal institutions. Vertical upscaling includes new working processes in a municipality, new regulations from national authorities, new norms in society, etc. In practice, horizontal and vertical upscaling are interlinked (van Doren et al. 2018) e.g. the horizontal upscaling of a solution might be dependent on changes in national regulation.

Lam et al. (2020) presents a more detailed categorisation (see Table 1), acknowledging also how an urban sustainability initiative typically corresponds to several approaches and modes of work.

Perspectives on prerequisites for upscaling

Prior research has scrutinized various upscaling initiatives and cities as environments conducive to upscaling. This exploration aims to gain a deeper understanding of what

Table 1 Different kinds of upscaling. From Lam et al. (2020)

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 [and the] initiative works in the same way across a geographical location, organisation, or sector
	Replicating	Copying an initiative to a dissimilar context
Amplifying out—doing a similar initiative in a similar or 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	Impact higher institutional levels by changing the rules or logics of incumbent regimes.
	Scaling deep	Change in values and mindsets

undergoes upscaling and the underlying reasons for such trends (van Doren et al. 2018; van den Heiligenberg et al. 2017). The research highlights some internal factors that a sustainable solution needs to integrate to be able to upscale. A solution needs to be financially advantageous, reliable and simple to use (van Doren et al. 2018). Additionally, a solution needs to be developed in collaboration with end users, have a strong business case and be of high quality (van den Heiligenberg et al. 2017).

Previous research has additionally examined certain external factors of significance. These external factors encompass aspects such as political leadership, the capacity to mobilize resources for upscaling, the availability of capital, and environmental consciousness (van Doren et al. 2018; Hughes et al. 2020) and local visions of sustainability, networks among involved actors and communication dissemination (van den Heiligenberg et al. 2017). To achieve this, individuals or organizations shall act as 'bridging agents' (Hughes et al. 2020) or 'mainstreaming connectors' (Adams et al. 2023) to translate insights and facilitate transformative change.

In certain research, theories on institutional capacity have been employed to gain deeper insights into these dimensions of upscaling (see e.g., Eneqvist (2022). Institutional capacity, rooted in transition theory, pertains to an organization's ability to adapt and fulfil sustainability objectives (Norell Bergendahl 2016; Isaksson and Heikkinen 2018). According to these theories, while all institutions/organisations are based on formal and informal rules that may hinder change, with institutional capacity, an organisation has the ability to overcome such hindrances (Isaksson and Heikkinen 2018). There are three key dimensions of institutional capacity in relation to upscaling sustainable solutions:

- **Knowledge resources** – Including not only knowledge of what needs to be done to create more sustainable development. To effect change, involved actors and people need to have the same frames of reference, as well as an openness to new information.
- **Relational resources** – Actors who are involved in the change that a new sustainable solution entails need to have strong collaboration. There need to be several overlapping networks that create the social capital of trust and experience of reciprocity. These networks can be informal but need to have access to formal

decision-making power (in terms of finances, rules and ideologies) to be able to effect change.

- **Mobilisation capacity** – Where there are knowledge and relational resources, there are opportunities to effect change, but the ability to utilise each opportunity is also needed. Actors need to seize windows of opportunity when they appear and utilise resources in joint actions to institute decisions through and within formal decision-making power (Norell Bergendahl 2016).

Other studies have focused on the tensions between projects (in which pilots are conducted) and general management, or 'line management' (where solutions are to be implemented as a part of upscaling). For example, Berglund-Snodgrass and Mukhtar-Landgren (2020) highlight the differences between experimental and public sector logics as an explanation for such tension. Berglund-Snodgrass and Mukhtar-Landgren (2020) argue that municipalities, as organisations, are governed by public sector logics, i.e., formal structures that value municipalities' traditional and bureaucratic roles. This can be contrasted with the experimental logics that are present in pilot projects and aim to break traditional roles and ways of working to find more sustainable solutions. In other words, an experimental logic values testing, creativity and change, while public sector logic values maintaining order and stability (Berglund-Snodgrass and Mukhtar-Landgren 2020). Thus, conducting tests in pilot projects with an experimental logic becomes problematic when results challenge a traditional management logic to effect change. In this context, Eneqvist (2022) points to the importance of understanding that a municipality consists of different units that not without friction act in different ways based on different logics and have different roles that can conflict with each other. Eneqvist (2022) indicates, for example, that pilots carried out within urban development projects may be upscaled in future stages within the same urban development projects because there is knowledge of the priorities, needs and opportunities to link such pilots to ongoing work. Upscaling outside an urban development project (i.e., replicating, transferring or spreading to other urban development projects) requires other types of organisation and support systems that a single urban development project can rarely constitute (Eneqvist 2022).

The final perspective on upscaling presented here focuses on the projectification of urban change processes, which the pilot projects discussed in this paper may be seen as a part of. Torrens and von Wirth (2021 p. 5) argue that it is *"problematic to overemphasise upscaling or focus on individual experiments"* and that experiments should not be separate projects but institutionalised and part of routine activities. The authors argue for "*harnessing experiments' generative multiplicity*" (Torrens and von Wirth 2021 p. 14). Hence, they argue that new 'hybrid spaces' are needed between experiments and a permanent organisation. Such a space makes room for more reflexive thinking and discussion, which in turn can lead to long-term learning processes based not on one pilot project at a time but on the collective outcomes of a multiplicity thereof.

Methodological approach, research process and methods

Methodological approach

This research project is a transdisciplinary project as defined by Lang et al. (2012), where practitioners and researchers coproduce new solutions to a specific problem. Coproduction is used here in line with Polk and Kain (2015 p. 5) definition: "*nonlinear,*

collaborative approaches to knowledge creation that draw upon interactive and participatory research approaches to societal problem solving". As highlighted by Lang et al. (2012), all parts of such research projects need to take both practitioners' and researchers' perspectives into account. Thus, they need to include joint problem-framing (challenges and opportunities with upscaling), the cocreation of solution-oriented transferable knowledge (how to handle challenges and opportunities in upscaling), and (re) integrating and applying cocreated knowledge. In the last step of integration and application, Lang et al. (2012) suggest that practitioners need output from a project that is usable in practice and that researchers should develop results for the academic community, often resulting in scientific publications.

The research project also uses "Research through Design" (RtD) as a methodological approach. Zimmerman et al. (2010 p. 311) describe RtD as a process where a researcher is engaged in the "*making of an artifact with the intended goal of societal change*", i.e., in the focal context, developing a supportive tool to be used by civil servants to facilitate upscaling sustainable solutions. The motive for engaging in the design of a supportive tool is not only to support change but also to create a deeper and new understanding of the issue at hand. As stated by Koskinen et al. (2011 p. 2), *"When researchers actually construct something, they find problems and discover things that would otherwise go unnoticed. These observations unleash wisdom, countering a typical academic tendency to value thinking and discourse over doing."* Thus, this research is not focused on the best possible supportive tool; instead, it uses the process of developing a supportive tool as a methodological approach for *"find[ing] problems and discover[ing] things"* with regards to upscaling sustainable solutions for urban development "*that would otherwise go unnoticed"* (Koskinen et al. 2011 p. 2).

In line with these two methodological approaches, the research project included practitioners in several ways. As a foundation for collaboration between practice and academia, the research project group consisted of seven civil servants and three researchers. The seven civil servants (4 male and 3 women) were all senior project managers in environmental administrations in Stockholm, Gothenburg and Malmö with experience in several pilot projects of different sizes and in different contexts. These civil servants were, together with us three researchers, involved in all parts of the project and are referred to below as *civil servant project members*. In addition to this group, other civil servants were involved through interviews and workshops to gain more perspectives and greater knowledge when needed. These additional civil servants were mainly working in the environmental administration, land development administration or urban planning administration in Stockholm, Gothenburg or Malmö municipalities; some also represented the Swedish property owner association and Swedish Association of Local Authorities and Regions (see 'Research process and methods used' for more details). This group of practitioners was not specifically investigated but a part of the collective inquiry (Brown 2010); their needs were in focus (from a design perspective) and they were a part of developing the solutions to fulfil this need through a transdisciplinary, coproducing research process.

Research process and methods used

Working with RtD implies using a design process as a foundation in the research process. Thus, the research process used the double diamond design process presented by Davies

and Wilson (2013), depicted in Fig. 1. The double diamond entails a design process starting with a Discover phase to gain understanding of the focal issue from multiple angles, embracing its complexity and empathising with users. In the Define phase, designers make use of this broad and deep understanding to formulate a focused problem definition. In the Develop and Test phases, new solutions are ideated, prototyped and tested to gain a better understanding of both the problem and the suggested solutions. The process ends with the Deliver phase, where the design is finalised and launched (Davies and Wilson 2013). A central part of any design process is to understand that these phases include iterations within and between themselves, as, e.g., testing prototypes leads to new discoveries that might affect problem definition (Davies and Wilson 2013; d.school 2010; Maher et al. 2018).

However, defining the research process as a double diamond design process as well as a transdisciplinary process based on coproduction does not lead to a certain set of prescribed methods to be used in a certain order. On the contrary, the methods used need to be based on the specific needs of the research project and problems at hand (Brown 2010; Lang et al. 2012; Zimmerman et al. 2010). Thus, the different phases of the research/design process in this study included the use of several methods, as described below. For all interviews and workshops, respondents have been informed about the research project and approved to be a part of it (i.e., made an informed consent), all respondents are anonymised.

Discovering phase

The Discovering phase focused on understanding the problem at hand from the perspective of civil servants frustrated when upscaling does not occur. This part of the process was explorative, applying a broad scope on the relevant aspects of the problem. Interviews and workshops were both used as methods; a summary is provided in Table 2.

Interview Study 1 and Workshop A focused on the experiences of the civil servant project members. Questions posted in interview Study 1 and Workshop A focused on the respondents' views on why upscaling had not taken place and what they thought was

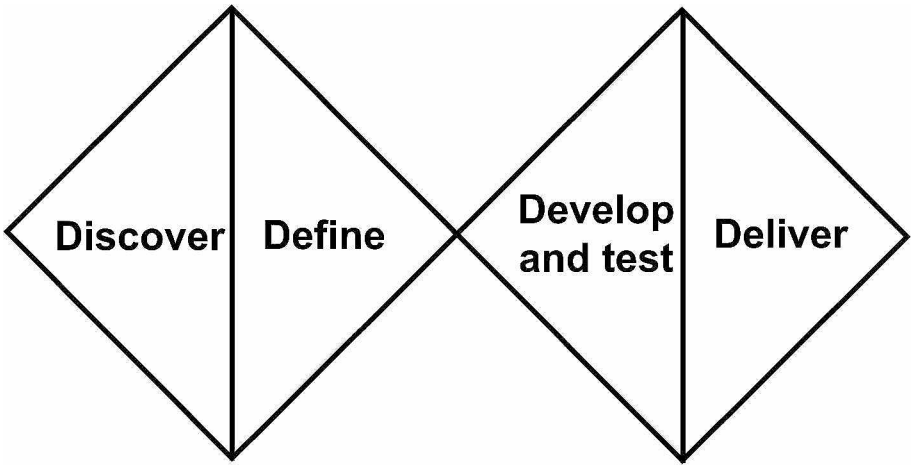

Fig. 1 The double diamond model. Illustration of the phases of the design process used in the research project. The shape illustrates the diverging and converging natures and the differences among the phases. Modified from Davies and Wilson (2013)

Table 2 Summary of methods used during the Discovering phase

When	Method	How many and who was involved
Spring 2020	Interview Study 1—why does not upscaling happen?	Seven civil servants (project members)
2022-06-10	Workshop A—why does not upscaling happen?	Seven civil servants (project members)
2020-10-19	Workshop B—examples of sustainable solutions being upscaled in Stockholm	Eight representatives from and land development administration, environmental administration and urban planning administration in Stockholm municipality. One person representing the Swedish property owner association and one person representing Swedish Association of Local Authorities and Regions.
2020-11-02	Workshop C—examples of sustainable solutions being upscaled in Gothenburg and Malmö	Six representatives from land development administration, environmental administration and urban planning administration in Gothenburg and Malmö municipality
Fall 2020	Interview Study 2—Experiences of concrete examples of sustainable solutions being upscaled.	Stockholm—Four representatives from environmental administration and land development administration. Malmö—one person from environmental administration.

needed to succeed. Workshop A was also used to obtain responses to statements made in interviews to see if respondents agreed on central ideas and perspectives.

Workshops B and C were conducted with the aim of listing examples of sustainable solutions that have been upscaled from each city involved in the project. The persons involved were partly the same as in interview Study 1 and Workshop A; in addition, persons with similar experiences in other administrations were invited. Based on Workshops B and C, five examples of sustainable solutions were selected as the focus in interview Study 2. These interviews were held with key persons who were deeply involved in the upscaling process for each example. The aim was to gain a deeper understanding of the process of upscaling in each case, including how each pilot project was evaluated, who made the decisions on upscaling and what had hindered or enabled it.

All interviews were conducted as semi-structured interviews, in line with what (Gustavsson 2004) calls conversations ["samtal"]. Thus, the intent was not to obtain specific, objective facts but to allow the respondents to share their personal experiences, thoughts, and opinions. This aim was fulfilled by using design-influenced interview methods such as "interview for empathy" and "why-how laddering", (d.school 2010). In general, workshops lasted approximately 2 h and used a "beehive setting", a part from participating practitioners (Table 2) two-three researchers participated as facilitators and contributed to discussions.

Defining phase

Defining the problem is done iteratively throughout the whole research and design process. This is an important part of the design process, where any knowledge gained in the Discovering phase is condensed into "problem formulations", i.e., statements that are used as the basis for the work in the Developing and Test phase. Thus, in parallel with conducting interviews and workshops, specific problem formulations were defined and discussed with respondents. Defining the problem formulations included methods such as "why-how laddering" and "point-of-view", following d.school (2010). Since this process was iterative, various problem formulations were defined and discussed with interviewees and workshop participants.

Developing and test phase

In the Developing and Test phase, a draft version of the supportive tool, consisting of 84 questions for use as part of the evaluation of a pilot project, was developed (see results section). This part of the research process was desktop work to ensure that the supportive tool addressed the problem formulations properly, as well as the relevant aspects of the theory presented in 'Earlier research'.

The draft version of the supportive tool was tested in eight workshops (Workshops D-K, Table 3) by the three participating municipalities. In each workshop, the supportive tool was used to evaluate a specific case of a sustainable solution not yet upscaled (cases are listed in Table 3). The cases were chosen by the civil servants engaged in the research project based on the cases they saw as relevant to upscaling. In this part of the process, researchers played a coaching role to explain the idea behind the newly developed tool before any tests were executed. However, the researchers were not actively engaged in the tests. Each test generated a list of comments on the tool regarding both its relevance and usability in general, as well as details such as formulations of specific questions. To compile a joint evaluation from all tests, all engaged partners worked together in Workshop L to cluster and se comments, see Table 3.This was followed by Workshop M to discuss what changes were needed based on questions regarding how the tool could be used in the future, in which processes, by whom, etc.

Iterating before delivering

Based on the results of Workshop M, the research project included an iteration to restructure and reformulate the content of the supportive tool. The supportive tool was also complemented by a description of a generic upscaling process. These new deliverables were sent to and commented upon by civil servant project members before the final version was delivered.

Results

The result part is structured thematically, into three sections, based on the three main results identified from the research process. For each section, references are made to the phases explained in the method part, to show how the respective results were obtained.

Table 3 Summary of methods used during the test phase

When	What	Involved
Fall 2021	Workshops D-K to test the supportive tool, using real-life examples of sustainable solutions from the various cities involved.	One or two of the civil servant project members as well as 2–3 people who had been working with each solution: • Multifunctional mobility hubs • Mobility stations • Raingarden with biochar • Electric waste vehicle • Solar panels on rooves of existing buildings • Collected city deliveries • Sustainable handling of soil masses • Pop-up reuse, recycling and upcycling center
2022-01-27	Workshop L: Cluster and priorities comments on prototype	Civil servant project members One person representing the Swedish property owner association and one person representing Swedish Association of Local Authorities and Regions
2022-03-07	Workshop M: Putting comments on the prototype into context	Civil servant project members One person representing the Swedish property owner association and one person representing Swedish Association of Local Authorities and Regions.

Fostering a comprehensive understanding: the recognized necessity for diversifying perspectives on upscaling sustainable solutions

One of the main results from this research project is that upscaling of sustainable solutions could benefit from civil servants comprehending distinctions among various upscaling forms, enabling them to articulate these differences effectively during the facilitation of upscaling processes.

In the beginning of the project, practitioners participating in interview study 1 and 2, as well as workshop A-C used the term *"upscaling"* ["*uppskalning*" in Swedish] differently, resulting in misunderstandings. Instead of using different terms for different kinds of upscaling (see Table 1), 'upscaling' was used regardless of the context. For example, during workshop A, one civil servant who interpreted upscaling as 'replication' (see Table 1) argued that upscaling is irrelevant in most cases, as each context requires its own solutions, while another civil servant did not agree, using 'upscaling' as term for 'transferring' or 'spreading'. Additionally, several participants used the term 'upscaling' differently on different occasions, i.e., one person could use it as term for e.g. 'replication' in one discussion but also as a term for 'spreading' in another.

Related to this, also the term 'sustainable solutions', was used to refer to a diversity of measures, tests, pilots, processes, documents, etc. This included e.g. solutions for stormwater purification, consequence analysis for social sustainability, procurement criteria, public dialogue methods, demands on energy efficiency, green space index, etc. This in turn resulted in confusions concerning what aspects of a sustainable solution should be upscaled. A discussion in Workshop A regarding storm water purification was one example of such a misunderstanding, as it was not evident that the technical solution developed in a pilot project would be relevant to use in other places, i.e., to 'replicate' or 'transfer' the technical solution. Instead, *the process* for identifying the best solution for a particular context might be relevant to upscale, i.e., to 'replicate' or 'transfer' the working process. However, just stating *upscale the tested storm water purification solution* does not reveal if the focus will be on the technical or process aspect of this solution.

Because of these initial confusions, the draft version of the supportive tool included questions on defining upscaling for each solution used as case in the tests. This was done referring to guidance given by Lam et al. (2020) and van Doren et al. (2018). In addition, questions regarding what aspect of the sustainable solution to be upscaled was also included. In workshop L and M, the notion of defining upscaling was deemed relevant by the participating practitioners as it was noted that such questions supported a common understanding of upscaling for the specific sustainable solution. Hence, these questions were included also in the final version of the supportive tool.

Exploring the role of institutional capacity in understanding the mechanisms of upscaling

Another significant outcome of the research project is recognizing the relevance of institutional capacity. This extends beyond its role in understanding upscaling mechanisms, as previously discussed in research by Norell Bergendahl (2016) and Eneqvist (2022). Moreover, institutional capacity proves valuable in developing practical guidance for civil servants engaged in the implementation of upscaling initiatives.

This result is firstly based on interview study 1–2 and workshops A-C, where civil servants expressed a need of being able to show why something should be upscaled, i.e., to evaluate and communicate how a tested solution contributes to sustainability objectives.

This is in line with earlier research on institutional capacity (Isaksson and Heikkinen 2018; Norell Bergendahl 2016), highlighting the need for *knowledge resources* and *relational resources*. In other words, involved actors, (including civil servants with decision mandate) need to understand that the solution is good and agree on its importance to fulfil joint objectives.

Secondly, a common conducive factor for upscaling (identified in interview study 2) was that earlier upscaling have had allocated resources (by external funding or internal budget) to work with upscaling activities, e.g., developing new or updating existing routines and working instructions. Another common conducive factor was that politicians and civil servants with a decision-making mandate had supported upscaling by making the needed decisions, e.g. decision on implementing new working instructions. In other words, upscaling did not occur spontaneously; rather, it resulted from intentional and proactive efforts. These conducive factors are also in line with theories on institutional capacity (Isaksson and Heikkinen 2018; Norell Bergendahl 2016) considering the need of access to formal decision-making power, i.e., civil servants need to have relational resources and mobilisation capacity to get the opportunity to work dedicatedly with upscaling.

The relevance of theories on institutional capacity in this context was further confirmed through the tests of the draft version of the supportive tool (workshop D-K). The draft version of the supportive tool included questions to identify existing knowledge resources, relational resources and mobilisation capacity, as well as to identify if such resources or capacity could be strengthened. These questions were deemed as relevant by participating civil servants, who argued that the supportive tool highlighted important organisational pre-requisites for up-scaling which are needed but not easy to fulfil. Thus, the evaluation of the supportive tool (workshop L and M) included discussions among civil servants regarding the need of creating new forums within the municipal organisations to make decisions on upscaling. In other words, to strengthen relational resources by increasing access to formal decision-making power.

Redefining upscaling: from anticipated outcome to an integral process from project inception

At the project's outset, participants envisioned upscaling as a natural progression following a successful pilot project. However, a key revelation from the research project is the recognition that upscaling is, in fact, a process that initiates during the planning phase of a pilot project.

Understanding upscaling as a process is primarily a result from evaluating the draft version of the supportive tool in workshop L-M. Thus, it is the most obvious difference between the draft and final version of the supportive tool. Workshop L-M included discussions of when the supportive tool could be used and by whom, and it was identified that the draft version was not explicit on this regard, but rather included several sections that would be relevant to use on different occasions and by different people within a municipal organisation. Thus, Workshop M resulted in understanding upscaling as permeating all steps of a process encompassing planning a pilot project to the implementation of new solutions in new contexts/places, depicted in Fig. 2.

For each part of the upscaling process, recommendations could be formulated based on the results from the research project, including earlier presented results i.e., both

how to work continuously with defining upscaling in the specific context and how to use existing as well as strengthening institutional capacity in each part of the process:
General, for the whole process.

- Upscaling should be considered an integrated part of the process, emphasizing its continual consideration rather than addressing it only on isolated occasions.
- Use collaboration as a mean throughout the process (see further recommendations below).

Planning and conducting pilot projects.

- Formulate an objective with future upscaling, considering it as a potential extension or continuation of an ongoing pilot project.
- Develop a strategy for monitoring the critical aspects that decision-makers require information on to make informed decisions regarding the upscaling process.
- Include future users of the sustainable solution in the pilot project to understand their demands.

Evaluating pilot projects.

- Assess the solution's impact on sustainability objectives and quantify its level of contribution.
- Evaluate implementation costs for the specific project, actor(s) and society at large.

Plan for upscaling.

- Use the supportive tool to compile information about the sustainable solution, to define what upscaling would imply in a specific context, to clarify the conditions for upscaling and to make an action plan for upscaling.

Decide on upscaling.

- Identify the person with mandate to decide on upscaling. A clear definition of what upscaling will imply in a specific context is a prerequisite for finding the right person.

Working with upscaling activities.

- Work actively with upscaling in collaboration with future users and other stakeholders.

Implementation of sustainable solutions.

- Work actively towards the implementation of the solution in collaboration with future users and other stakeholders.

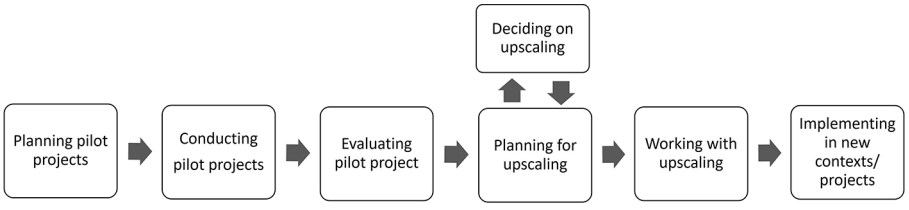

Fig. 2 Simplified illustration of the "upscaling process", from planning a pilot project to implementation.

It should be noted that the process illustrated in Fig. 2 is a simplification and participants in Workshop M highlighted that most pilot projects do not follow such a straightforward process. In Stockholm, for example, some pilot projects had been decided to be upscaled by politicians before they were evaluated.

Within the upscaling process, 'planning for upscaling' was pointed out as most central by participants in workshop M, mostly because the tension between experimental and public sector logics was deemed most prominent in that part of the process. Therefore, the supportive tool was refined to be used in that step of the process, including questions regarding (1) conclusions from the evaluation on benefits and costs; (2) definition of upscaling for the specific solution and context; (3) barriers for upscaling, (4) Develop an action plan for upscaling that includes the allocation of resources. The responses provided in the supportive tool serve as the foundation for both the decision-making process regarding upscaling and the execution of the upscaling efforts.

Concluding discussion

The overall aim of this paper is to develop knowledge and experience on how municipalities can enhance their performance in upscaling sustainable solutions tested in pilot projects, thereby perform better in upscaling sustainable solutions tested in pilot projects and thus accelerate a transition towards sustainable urban development. To address this, the research project has used a transdisciplinary approach (Lang et al. 2012), which has resulted in outcomes for both practitioners (a supportive tool and recommendations for upscaling processes) and academia (academic conclusions in relation to theory). As of the current writing, the involved municipalities have initiated the integration and implementation (Rigolot 2020; Bammer et al. 2020) of the final version of the tool and recommendations. Consequently, it is premature to analyse the effectiveness and challenges associated with integration and implementation at this stage. In this paper, we focus on using the process of developing a supportive tool and recommendations to foster an academic discussion concerning upscaling of sustainable solutions, including the conclusions discussed below in relation to earlier research. We also want to highlight, in this context, how using RtD as a methodological approach, in line with Zimmerman et al. (2010); Koskinen et al. (2011), has contributed to the possibilities of making the conclusions presented below. The iterative process of developing a supportive tool through cocreation and tests (which are characteristic of an RtD process) contributed to more concretisations, clarifications and deep discussions on more details than possible without these parts of the research project.

Examining our results from a comprehensive perspective, we identify the difficulties in achieving successful upscaling as an expression of the tension between experimental and public sector logics (in line with, e.g., Eneqvist (2022); Berglund-Snodgrass and Mukhtar-Landgren (2020). These theoretical frameworks have proven instrumental in elucidating complexities, such as the reasons behind the successful upscaling of sustainable solutions within one urban development project while facing hurdles in other projects within the same municipality, as identified by Eneqvist (2022). Extending this perspective, the supportive tool and the recommendations formulated can be seen as attempts to translate results from an experimental logic to a public sector logic, or as specified by Adams et al. (2023): translate across levels, sectors, and actors. However,

as we argue below, further theoretical understanding is needed to succeed in such translation.

Based on the results of this study, we see a need for a more nuanced and common vocabulary among practitioners concerning the upscaling of sustainable solutions. As reported in the result part of the paper the civil servants did not use a joint terminology when talking about the upscaling of sustainable solutions. This created misunderstandings and made it difficult to discuss and collaborate. In addition, when the civil servants tested the supportive tool and were asked to define upscaling in line with the terminology presented by Lam et al. (2020) and van Doren et al. (2018), they saw it as relevant to make such distinctions to improve communication and thus improve upscaling capacity. In other words, this paper adds to this earlier research with new knowledge concerning the need of civil servants to understand the differences among multiple forms of upscaling and, consequently, be able to articulate these differences when facilitating upscaling.

Civil servants need to utilise existing and increase institutional capacity to be *bridging agents* (Hughes et al. 2020) and act as *connectors* and *implementors* to facilitate upscaling through *translating knowledge* (Adams et al. 2023) and actively realise *transferring* and *spreading* as defined by Lam et al. (2020). As presented in the result part of the paper, the supportive tool was based on earlier research on institutional capacity. Civil servants who tested the supporting tool noted that it heightened their awareness regarding the imperative need to secure decisions on allocated resources, both in terms of time and funding, for the successful realization of upscaling. Thus, the results of this paper confirm earlier research (e.g., Eneqvist (2022) on the need for institutional capacity in the forms of *knowledge resources* and *relational resources* and *mobilisation capacity* to succeed in upscaling, including initiating both formal and informal processes. Knowledge resources and relational resources might need to include also other actors if changes are needed within other organisations or national parliament (to affect legislation). The need of institutional capacity is also in line with previous research identifying the need for the right external factors to succeed in upscaling, e.g., political leadership and networks among involved actors (van Doren et al. 2018; van den Heiligenberg et al. 2017; Hughes et al. 2020). In other words, upscaling activities include using both existing institutional capacity and improving existing capacity.

Based on the result of this paper we argue for an approach, where upscaling is understood as a process, as depicted in Fig. 2. Throughout this process, the tension between logics, the necessity for a more nuanced and shared vocabulary, and the requirement for institutional capacity are present to varying degrees across different components. In other words, upscaling is dependent on the organisational context (where it takes place), and it is not possible to present very detailed conclusions on how to succeed in each part of the upscaling process in various contexts. However, some general recommendations are presented in the result part which give guidance on possible pre-requisites in each step of an upscaling process, to reach for implementation at the end. This perspective on upscaling might be valuable both for practitioners and the academic debate on urban experimentation.

It is, however, possible to problematise the simplified illustration of the upscaling process presented in Fig. 2. In that model of upscaling, pilots are seen as projects to be translated by the supportive tool into routine activities. This is in contrast to the ideas of Torrens and von Wirth (2021), who criticise the projectification of urban change and

experimentation and see a need to institutionalise experimentation and make it a part of routine activities rather than separate projects. However, even if the upscaling process presented in this paper focuses on individual pilot projects, we want to emphasise that it is a *simplified* illustration to clarify that upscaling is not done by single measures but needs to be discussed in all parts of the process of a pilot. In other words, we agree with Torrens and von Wirth (2021) and identifies that the supportive tool and recommendations rely on organisational prerequisites. The parts of the upscaling process called 'planning for upscaling', 'deciding on upscaling' and 'working with upscaling' are about creating the needed *hybrid space* that Torrens and von Wirth (2021) call for within the public sector logic/permanent organisation. We argue, further, that the upscaling process and recommendations imply institutional capacity, as needed, to secure resources and mandate needed for a reflexive learning. Additionally, even if the upscaling process is a simplification and becomes quite (or maybe too) linear, the step 'working with upscaling' does not have to mean working with upscaling from a single project but should include "*harnessing experiments' generative multiplicity*", as Torrens and von Wirth (2021; p.14) suggest. Thus, the main conclusion is that institutional capacity should be used to obtain enough resources and the mandate for work dedicated to upscaling beyond the dissemination of results.

In summary, the results from this research process demonstrate how theories concerning urban experimental governance, experimental and public sector logics, upscaling, mainstreaming, institutional capacity etc. can be made operational for practitioners and through that contribute also to a theoretical understanding of upscaling processes. At the same time we acknowledge there are also other theories to explore in future research concerning both overlaps and differences with theories used in this paper e.g. theory of change (Meharg 2020), VRK-framework (Colloff et al. 2017), different types of learning (van Mierlo and Beers 2020) and institutional change (Harries 2012). As discussed above, the results in this paper confirm the generalisability of the theories used in this paper, and contribute to a deeper understanding of how these theories interconnect and can be applied in the practical context of civil servants facilitating the process of upscaling. However, context dependencies makes it not possible to aim for providing detailed recipes that all should follow.

Lastly, we also want to stress that upscaling might naturally continue to be a challenge. Adopting a multilevel perspective (Geels 2002; Smith et al. 2005; van den Heiligenberg et al. 2017) to understand upscaling, solutions for sustainable urban development will be dependent on regimes and landscapes, even if the former is easier to change than the latter. However, in this context, we argue for not only seeking sustainable solutions that have the best possibilities to be upscaled, i.e., easiest to upscale, just as some civil servants argued should be in focus at the beginning of the research project; and some research have tried to define the distinctive features for (van den Heiligenberg et al. 2017; van Doren et al. 2018). Instead, with great institutional capacity, upscaling is a mean to affect the systemic changes needed for sustainable development, including changes in legislation, business models, traditional roles and responsibilities. Without such efforts, regimes and landscapes might never change.

Abbreviations

MLP Multilevel perspective
RtD Research through Design

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None.

Authors' contributions
J.S. Developed the original idea for the paper, designed the research and wrote first draft. B.B. and A.H. reviewed content and structure of the paper, developing the paper further. A.H. also contributed with theoretical understanding.

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Data availability
The dataset supporting the conclusions of this article is included within the article.

Declarations

Competing interests
The authors report that there are no competing interests to declare.

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