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# Successful scaling of Edible City Solutions to promote food citizenship and sustainability in food system transitions

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Sustainable, productive and biodiversity-friendly urban landscapes are a strategic step in transitioning to future-proof, liveable and healthy cities. Edible nature-based solutions, otherwise known as “Edible City Solutions”, comprise a wide range of different forms of sustainable urban food production, distribution and consumption which use innovative principles of ecological design combined with closed material and energy flows. Edible City Solutions contribute to a local green economy, reduce cities’ overall ecological footprint, enhance social cohesion, human health and wellbeing and contribute to bridging the gap between “farm and fork”. These benefits have been tested and monitored in Living Labs where a wide portfolio of different solutions have been implemented and scaled in order to accelerate their uptake and use in urban landscapes. The study documents and analyses different scaling practices and activities of the co-created Living Labs – together with local actors within the “scaling community” in Andernach, Berlin, Havana, Oslo and Rotterdam. We follow a mixed method approach and analyse data by applying the different scaling pathways of scaling up, scaling deep, scaling wide, scaling across and scaling soft previously identified through a systematic literature review. Results are presented as ongoing scaling stories, experiences and challenges in the Living Labs. The study also highlights examples of scaling practices beyond the Living Labs and suggests strategic plans for future scaling. Scaling processes, strategies and approaches are critically reviewed and discussed. Observations are condensed into eleven recommendations for scaling edible nature-based solutions.

## KEYWORDS

upscaling, urban farming, urban food system, urban agriculture, co-creation, multi-stakeholder approach, small and medium-sized enterprises, social entrepreneurs

## 1. Introduction

Food is not only a popular topic of conversation—it is shared by everyone and connects us all. The global Edible Cities movement has successfully designed, implemented and managed edible green spaces in urban environments around the world (Orsini et al., 2013; Eigenbrod and Gruda, 2015; Russo et al., 2017; Eetbaarrotterdam, 2021). Edible City Solutions (ECS) have been categorized as a special type of nature-based solutions, as products, activities, and services related to the systemic use of urban landscapes for food production (Säumel, 2019). ECS comprise all types of urban food production, distribution, and use, combined with innovative principles of ecological design and closed material and energy flows. They include the growing of edible plants and flowers, urban beekeeping and sheep farming, green facades and high-tech indoor farming, urban cooking and dining events, local city-grown products sold at marketplaces and measures for advocacy, networking and raising awareness about sustainable urban food system transitions. Edible City Solutions provide a wide range of benefits covering all dimensions of sustainability: increasing social wellbeing in cities by enhancing social cohesion, improving environmental conditions, supporting the local green economy and maintaining local material and energy cycles (Säumel, 2019; Castellar et al., 2021). Furthermore, it has been hypothesized that Edible City Solutions, in contrast to traditional nature-based solutions that are planned and implemented by the respective urban authorities, invite citizens to co-create the sustainable development of their communities, enabling them to proactively change their living environment and lifestyle (Säumel, 2019).

However, it remains challenging to strategically apply and mainstream Edible City Solutions as urban food commons (Scharff et al., 2019) and as a strategy for sustainability transformation (Artmann et al., 2020) beyond demonstration sites and showcases in urban planning and city making. Scaling is crucial to increase the impact of these kinds of practices and can affect comprehensive system change. The main idea is that small and medium enterprises, social entrepreneurs or non-profit organizations represent a huge untapped potential: they may be successful in what they currently do, but the social value they create could be far larger if they were to scale (up). A consideration of scaling is however relevant for an even wider range of different actors of the Edible City. Initiatives that are often responsible for initiating, implementing and sustaining Edible City Solutions—ranging from urban gardening organizations and social businesses to educational institutions or community associations—can utilize different forms of scaling to ensure their social and economic sustainability. The approaches discussed here can also be useful for city administrations and policy makers looking for potential solutions for urban challenges. The experiences and recommendations are also relevant for individuals who are involved in the maintenance

and implementation of Edible City Solutions—whether allotment gardeners or urban beekeepers—looking to enhance and expand the impact of their activities.

(Up)scaling has been discussed in academic literature<sup>1</sup> in the context of social entrepreneurs/enterprises (SEs), i.e., organizations that do not have profit as primary objective but instead the creation of social value. It is therefore especially relevant for non-profit organizations and public institutions, but is also becoming increasingly relevant for small-to-medium enterprises (SMEs<sup>2</sup>). Scaling can be understood as the process of adaptation or expansion of activities, with the aim to increase social and/or economic impact (Desa and Koch, 2014). Social impact is defined as the beneficial outcomes—resulting from activities—that are enjoyed by the targeted individuals and/or by the broader community (Rawhouser et al., 2019). Scaling is related to and takes place within the context of collaborative social innovation. Such collaborations aim to address complex social issues across various actors and sectors (public, SE, private, civil society, citizens), entail new ideas (services, models and resource flows) and form new relationships (Kobro, 2018).

The literature mainly deals with scaling strategies and pathways, drivers and barriers to scaling, and the relationship between scaling and social impact measurement. Social impact is central to scaling and many authors actually define scaling by its desired outcomes, i.e., as increased or maximum social impact. The term “scaling social impact” is also widely used (Islam, 2020). It is however important to distinguish between scaling as a process and the outcomes of scaling, e.g., an increased social value (Cunha and Benneworth, 2020). Scaling can have different objectives such as quantitative scaling, strategic expansion, organizational scaling, functional scaling, advocacy/political scaling, relational scaling or dissemination (e.g., Uvin, 1995; Lyon and Fernandez, 2012; Weber et al., 2012; Islam, 2022). In this paper, we focus on processes, including strategies and approaches taken to effectively deal with drivers and barriers to successful scaling, rather than outcomes in the form of quantifiable social or environmental impact.

<sup>1</sup> We performed a systematic literature review using the PRISMA guidelines on Scaling in the SCOPUS database in March 2022 ( $N = 114$ ). Almost all articles were published within the last decade. Over 70 percent of the publications originated from anglophone countries (e.g. USA, UK, Canada, India). The main perspectives can be classified from areas of business and management (33%), social sciences (24%) followed by economy (16%). Only four publications are related to entrepreneurs in the food business but in rural areas (Biggs, 2008; Mosquera Vásquez et al., 2017; Darko et al., 2020; McKague et al., 2021).

<sup>2</sup> The European Commission (EC, 2020) defines small-to-medium sized enterprises as businesses with 250 employees or less, including the family-run corner shops but also technology startups. SMEs are the backbone of the EU economy, essential for creating new jobs.

In this article, we explore how Edible City Solutions are being scaled in Living Labs located in five different cities. The idea of Living Labs transfers the laboratory concept from natural sciences to the analysis of social and political processes (e.g., Hossain et al., 2019; Fuglsang et al., 2021). The Living Labs that form the basis of this research are mostly understood as temporal spaces where local stakeholders develop, test, and optimize Edible City Solutions according to their specific objectives and needs. The Living Labs enable all stakeholders to conduct interventions in the sense of “real experiments” and learn collaboratively about social dynamics and processes in their own environment.

We use the following framework to classify different types of scaling activities: Scaling can take various pathways: scaling-up, scaling-deep, scaling-wide, scaling-across and scaling soft (Bloom and Smith, 2010; André and Pache, 2014; Desa and Koch, 2014; El Ebrashi, 2018; see Figure 1A). We apply these different pathways to showcase the scaling processes in the different Living Labs as temporal spaces, where groups of diverse stakeholders co-create, implement and test different Edible City Solutions (see Figure 1). Scaling-up means to reach more people with the same activities. Scaling-deep refers to the improvement of existing activities for already established target groups. Scaling-wide involves the replication of activities in new geographic areas. Scaling-across occurs when activities are started in new domains. Scaling-soft refers to scaling modes which do not directly involve activities that target participants, but encompass dissemination and knowledge sharing, and increased collaboration with other partners, such as increased networking, alliance building and lobbying (Dees et al., 2004; Lyon and Fernandez, 2012; Weber et al., 2012; EC/OECD, 2016).

Here we explore how, within the EdiCitNet project, Edible City Solutions are being scaled, what plans are in place to continue scaling them in the future, how these activities and plans respond to the Living Lab objectives, and how their experiences can inform other stakeholders who wish to scale Edible City Solutions in their own contexts. We answer the following questions: (1) Which scaling activities have already been implemented and which are planned? (2) How do activities correspond to different forms of scaling and how could other potential scaling pathways be explored in the future? (3) What key learning's can be extracted to guide other stakeholders looking to scale different Edible City Solutions?

## 2. Materials and methods

### 2.1. Co-creation of living labs

We explore how Edible City Solutions are being scaled in 6 Living Labs of the H2020 Edible Cities Network (EdiCitNet)<sup>3</sup>

<sup>3</sup> [www.edicitnet.com](http://www.edicitnet.com)

project. As already mentioned, Living Labs originate from the laboratories in natural sciences but are used for analyzing social and political processes (e.g., Hossain et al., 2019; Fuglsang et al., 2021). In this research, they enable local stakeholders to develop, test, and optimize Edible City Solutions in the form of “real experiments” to learn together. Within this project, the Living Labs have been co-created by so-called City Teams and are currently being co-developed in Andernach, Berlin, Havana, Oslo and Rotterdam. City Teams are open and participatory multi-stakeholder groups which comprise people with shared commonalities but from diverse backgrounds. They function as “Communities of Practice and Knowledge” and include representatives of the local city and/or district administration, social and environmental institutions, businesses, housing associations, schools, kindergartens, and the general public. Working together since the beginning of the project, the City Teams co-created the Living Lab goals, which address a wide range of different challenges in each city. They also co-created the individual Edible City Solutions according to their specific objectives and needs (Table 1; Figure 2) at the start of the project and continue to develop, implement and test them together in an iterative way. This approach opens new knowledge regimes in the Living Labs, where the activities are defined and co-created by the needs and demands identified by the local City Teams. A spectrum of governance arrangements led by non-government actors for the co-creation of nature-based solutions have been used across different European contexts (Wilk et al., 2021).

In a sequence of at least three different participatory workshops at the beginning of the project, the local City Teams in each city co-developed implementation and monitoring plans for their respective Living Labs. This process, including workshops and meetings, was observed by different local actors and by project partners, in order for them to learn from the challenges and successes across the Living Labs. If needed and requested by the local City Team, the observers assisted and gave advice, including reflections on scaling potentials. The City Teams continue to meet regularly to discuss and plan the ongoing implementation and development of both the Living Labs and the Edible City Solutions developed within them.

### 2.2. Living lab case studies

For the past decade, Andernach (Germany, 30,000 inhabitants) has been transforming its public green spaces—moving from traditional to edible greenery, supporting biodiversity and developing innovative ways to reduce the cost of maintaining green spaces in their city (e.g., Artmann and Sartison, 2020). The Living Lab aims to expand Edible City Solutions within the city and shift the dynamics of the local Edible City movement from a primarily top-down to a more bottom-up approach (Table 1).

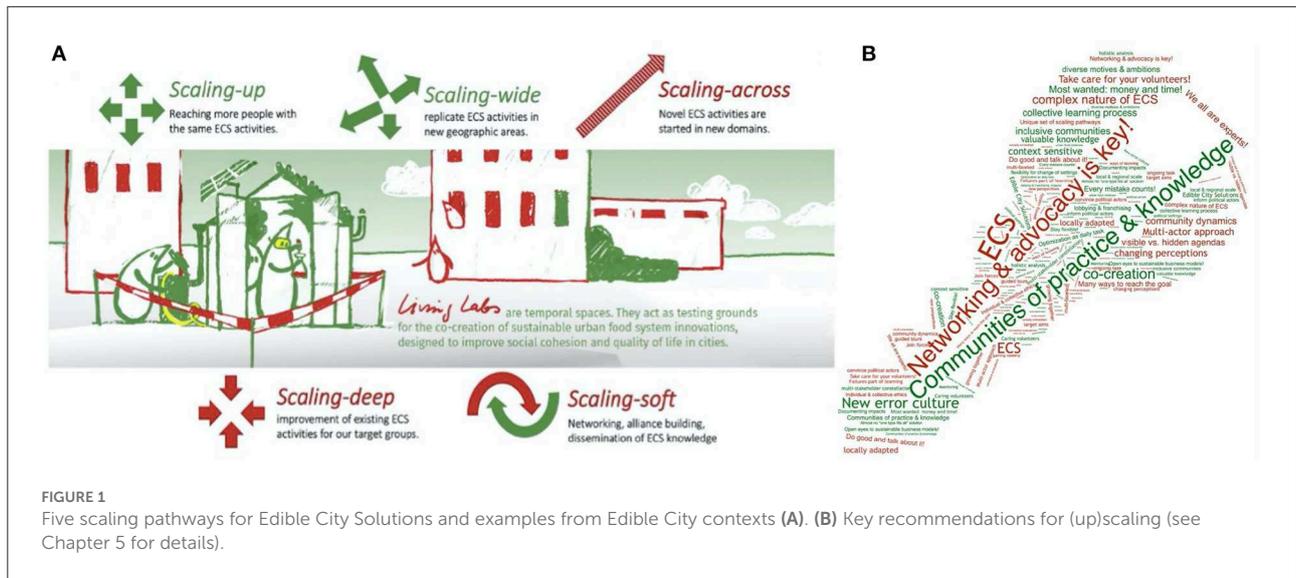


FIGURE 1 Five scaling pathways for Edible City Solutions and examples from Edible City contexts (A). (B) Key recommendations for (up)scaling (see Chapter 5 for details).

TABLE 1 Objectives and implemented or planned (\*) Edible City Solutions (ECS) of the Living Labs [for detailed information on the Living Labs see (Plassnig et al., 2022)].

Living lab objectives	Edible City Solutions
Andernach: Spread ECS across the city and shift from top-down to bottom-up Prolong close cooperation with SE “Perspektive gGmbH” through open access Edible City Solutions for public use; Explore potential national and international co-funding possibilities; Upscale communication measures; Optimize procedures in the municipality	Workshops to foster biodiversity in urban food production for kindergartens and schools; Raised beds in the city centre and for kindergartens and schools; Permaculture-based raised beds; Plots in the community garden; Insect hotels and digital beehive; Fair trade breakfast; Fertilizer experiment; Production of pea seeds; Open action days; Cookbook; Food sharing stations
Berlin: Connect new and old neighbors Further develop existing green spaces; Explore new approaches that support the long-term economic sustainability of community gardens; Foster social outcomes of community gardens (education, integration, networking, health, nutrition); Create an open space where the neighborhood can meet and be creative; Explore integration of ECS in areas of urban regeneration to discover and exploit potential synergies; Provide a best practice example of intelligent green densification	Hellersdorf: Edible Landscaping; Gutsgarten Hellersdorf in transition Neukölln: Cultural and Culinary Action Days; Environmental Research Centre; Cemetery Conversation and Mourning Culture Both locations: Product development
Havana: Exchange with international movement Increase vegetable production; Development of fruit planting and production program (guava and papaya); Assurance of production cycles through the construction of <i>mini-industrias</i> ; Consolidate the farmhouse construction program; Lease and set up markets to ensure the commercialization of agricultural products; Aquaculture development; Link with scientific and educational institutions	Modular aquaponics system*; Modular water reuse system*; Fruit tree planting programme*; <i>Mini-industria</i> programme; International exchange with the ECS community
Oslo: Opportunities for social entrepreneurs Pilot ECS that provide social and economic value; Run experiments that create opportunities for citizens and entrepreneurs; Facilitate knowledge transfer, networking and infrastructure to empower local citizens and use undervalued resources; Build on the work of Oslo’s Urban Renewal Programme; Use synergies emerging from Oslo’s involvement in a green transformation	Linderud Community Garden (LCG); Linderud Community Supported Agriculture; 11 testbeds at LCG for business- or socially oriented ideas; Soil improvement; Educational farm by Nature Upper Secondary School; Market days; Nature Path; Wildflower meadow; Meeting place
Rotterdam: Powerful network of green food initiatives Develop the organizational power of the evolving network of green food initiatives; Develop structures for lobbying/interest advocacy; Share knowledge among participants and the green initiatives in the city; Enhance the visibility of the value or “message” of green food initiatives as well as their products and services; Develop an umbrella organization to coordinate and organize a network of initiatives	Workgroup “Knowledge and Expertise” on strengthening knowledge and expertise related with ECS; Workgroup “Lobby and Interest Advocacy” on strategies for effective lobbying and promoting advocacy for ECS; Workgroup “Coordination and Organization” on effective umbrella organization



FIGURE 2  
Images from the EdiCitNet Living Labs in Oslo (A), Havana (B), Rotterdam (C), Andernach (D), and Berlin (E). Source: EdiCitNet.

Berlin (Germany, 3.6 million inhabitants) is developing an overall masterplan for anchoring Edible City Solutions in urban planning and has co-created two Living Labs in two structurally different socially disadvantaged neighborhoods, both of which are undergoing a process of profound transformation. One Living Lab is in Neukölln, a district with dense residential buildings of the Wilhelminian era, and the other in Hellersdorf with large housing estates with high-rise buildings from the 1970s and 80s. Both Living Labs address issues connected to social, health and educational inequality and the growing pressure on green spaces due to densification within a growing city with a very tight housing market (Wilk et al., 2021; Table 1).

Havana (Cuba, 2.1 million inhabitants) is an example of large-scale systematic integration of urban agriculture, with about 50% of the horticultural products needed by the population being produced within the country itself (Companioni et al., 2016). The Living Lab is situated in the Boyeros neighborhood—a suburban area south of the city. For decades, urban agriculture has been a local tradition in Boyeros. As such, agriculture is one of the main socio-economic sectors. The aim of the Living Lab is to combine science, technology and innovation with the traditional knowledge of local farmers to adapt urban, suburban, and family agriculture to meet the current demands of food production (Table 1).

Oslo (Norway, 660,000 inhabitants) has a rapidly increasing population with a high degree of socioeconomic segregation. Oslo's Living Lab is located on a historic farm in an area in the east of the city where household incomes are lower than average. It is organized as a community garden, also known as Linderud

Nærmiljøhage (8,000 m<sup>2</sup>; owned by a private foundation and run by the museum Museene i Akershus). It is surrounded by residential areas consisting of high apartment blocks in an area that faces numerous social and health problems linked to inequality, poverty, social exclusion, social welfare dependency, and environmental degradation. The Living Lab aims to act as a green lung and provide a meeting place for the residents. Its social entrepreneurs use urban agriculture as a tool for achieving social cohesion. Linderud builds on Oslo's Urban Renewal Program (URP) which has focused on community development for the past 5 years and is supported by the Bjerke city district and the municipality of Oslo.

In contrast to the physical Living Labs in Andernach, Berlin, Havana or Oslo, Rotterdam is taking a different approach, and exploring the potential of developing a network of grassroots (edible) green initiatives in their city. Organized into four different working groups, the overarching aim is to connect and build coalitions between the city's more than 200 existing initiatives (Table 1). While some initiatives are involved in commercial activities, most of them depend on voluntary work, private funding and subsidies. The Living Lab is steered by the initiatives in a bottom-up process. The working groups are the four Edible City Solutions of the Living Lab and follow a shared goal, which is to develop a network that strengthens the organizational power of the (edible) green initiatives in Rotterdam, facilitates the sharing of knowledge, raises their visibility, highlights their value and empowers them to collectively lobby for more power and recognition within the city government.

## 2.3. Mixed method approach

In this study, we used qualitative and quantitative methods of data collection. In autumn 2021, we used questionnaires, informal interviews, participant observation, field visits, digital and physical meetings to collect information related to scaling in the Living Labs. Due to the pandemic, most data collection had to take place digitally. We developed, distributed and analyzed three questionnaire surveys (Plassnig et al., 2022). In the questionnaires (see [Supplementary material 1](#)) we asked for examples of best practice and successful scaling, these were qualitative assessments from both City Team members and Living Lab actors responsible for implementing the Edible City Solutions. Meetings and informal interviews were subsequently carried out with City Team members, mostly online, to ask follow-up questions that arose from the questionnaires (Plassnig et al., 2022). We were also able to visit the Living Labs in Oslo and Berlin on several occasions such as workshops, events and meetings held in autumn 2021. During these field visits, we gathered data through participant observation and informal interviews and took photographs. Data was analyzed according to the scaling framework.

In spring 2022, a second round of informal interviews were held with City Team members *via* online meetings, telephone and email to capture the most up-to-date information on the scaling activities and how they had developed over the past 6 months, and clarify any issues that had not been addressed before. At the same time, we carried out a workshop on scaling together with EdiCitNet's H2020 sister projects URBiNAT, proGReg and CLEVER Cities,<sup>4</sup> who are all working on the topic of scaling of nature based solutions. The workshop and reflections from the working groups have been uploaded to the EdiCitNet YouTube channel and website as a webinar with shared experiences and findings (see details in [Plassnig et al., 2022](#)).

## 3. Results

### 3.1. Scaling stories of the living labs

In this section, we briefly summarize which scaling activities took place during the project and which are planned.<sup>5</sup> Details are reported in the descriptions of each cities' Living Lab(s) in [Plassnig et al. \(2022\)](#). Due

<sup>4</sup> Project websites of sister projects: [www.urbinat.eu](http://www.urbinat.eu); [www.progireg.eu](http://www.progireg.eu) and [www.clevercities.eu](http://www.clevercities.eu).

<sup>5</sup> Details are reported in the descriptions of each cities' Living Lab(s) in [Plassnig et al. \(2022\)](#). Due to the restrictions caused by the pandemic in all cities and staff changes in many, both the implementation and the refinement of the Edible City Solutions have been delayed or hindered and therefore some scaling activities are not as developed as would have been possible under other circumstances.

to the restrictions caused by the pandemic in all cities and staff changes in many, both the implementation and the refinement of the Edible City Solutions have been delayed or hindered and therefore some scaling activities are not as developed as would have been possible under other circumstances.

With a long tradition as an edible city, Andernach has already successfully implemented and maintained edible green in its town centre. The overarching aim of the Living Labs in Andernach is to expand and develop Edible City Solutions beyond the inner city. Thus, many scaling activities focus on improving, expanding, and enhancing elements of the Edible City on new sites (scaling wide). Another key goal is to shift from a top-down to a more bottom-up Edible City approach. The involvement of schools, kindergartens and a youth centre in many of the Edible City activities is crucial for this. One important step has been to set up a community garden on the outskirts of the city, located close to a youth centre and to invite local youth, schoolchildren and kindergartners to take part in gardening and cooking activities at the plot. Another approach has been to develop a workshop series about permaculture and biodiversity for educators and other multipliers. These kinds of activities act to create a flow of ECS knowledge in the city and across generations. In addition, the Living Lab in Andernach has developed new ECS by exploring innovative water recycling approaches for the garden's irrigation system, as well as food saving activities and collaborations with local NGOs and businesses who want to use the land for their own activities (scaling across).

The Living Labs in Berlin aim to grow and process organic products at consumers' doorsteps as well as to amplify the product and service portfolio of the initiatives involved (scaling across). Moreover, the Living Lab explores and demonstrates the effectiveness and functionality of new forms and new locations for community-supported urban greening in densely built cities (scaling deep and scaling soft). Although the first round of commercial food production for sale—packs of organic tea made from herbs grown in the community gardens—was far from cost effective, it was a valuable learning process for the urban farmers involved who concluded that they had learned about organic and sustainable products, the complexity of production in the food sector and the challenge of creating a profit-making organic food product on a small scale. Many of their activities are forms of scaling deep and up, focusing on enhancing and amplifying positive social and cultural impact and exchange through the installation of new infrastructure for community events, planning and organizing new formats as well as offering open spaces for co-creation among neighbors. The latter helps to maintain and increase levels of community participation and expands the profile of the garden, turning it into a wellknown community meeting place that connects people and increases social sustainability. An important aspect for scaling soft is also the self-confidence they display in functioning as a role model for others. Having integrated a community garden into

a still-active cemetery, they have created a new multifunctional and inclusive space which showcases to other cemetery owners and housing companies how the multifunctionality of urban green spaces can be enhanced strategically to the benefit of all.

For three decades, a governmental strategy has made Havana one of the most successful examples of urban agriculture worldwide (FAO, 2014). Edible City Solutions are widespread and a crucial set of scaling strategies are in place and exemplify how sustainable food production can be implemented in cities. Havana was forced to come up with a production model that produces “more with less,” today commonly known as sustainable agriculture. Due to the lack of agrochemicals from the global market, organic agriculture was implemented and organic and agro-ecological horticulture with high yields was mainstreamed across the country. The scaling-across innovations of the Living Lab focus on modular systems of aquaponics by using water-saving technologies and rainwater harvesting, that will enhance the sustainability of ECS in Havana and also promote circular economy and ecological design in urban development. In addition, the portfolio of products is continuously expanded e.g., by fruit trees to enhance the consumption of the wide variety of existing tropical fruits and promote healthier dietary habits.

The Oslo Living Lab aims to improve the different existing Edible City Solutions and through them manage to reach more members of the local neighborhood (scaling deep and up) by connecting a (nature) path to the garden and the construction of a central meeting place accessible for all. The Living Lab also spreads knowledge about and professionalizes their community supported agriculture initiative with courses and soil improvement. They want to inspire and encourage similar projects and ECS across the city and achieve financial security for the initiatives involved. Some of them want to improve their production processes, as well as develop and test several sales channels, while others prioritize marketing or want to include more people into the food initiatives themselves.

The Living Lab in Rotterdam operates on an inter-personal and inter-organizational level through networking and advocating for more power for (edible) green initiatives. More than 200 initiatives—each with their own history—ranging from small to big community food gardens, urban agricultural projects and food forests have come together to work for a shared cause. The initiatives currently in the network have all been developed in the last 12 years. The working groups strengthen the organizational power of these already existing initiatives, uniting and connecting them to together become even more powerful advocates for (edible) green initiatives in the city. Thus, the Living Lab itself can be seen as a big experiment in scaling-soft by sharing knowledge, building a network of partner organizations, lobbying and building alliances with stakeholders. These activities have brought about many knock-on effects that could be categorized as forms of scaling-deep and scaling-up. The sharing of knowledge, materials, activities and expertise will build up the expertise of (edible) green initiatives, thereby

improving their services (scaling deep). It will further increase the visibility of values of (edible) green initiatives for customers, clients and inhabitants (scaling soft). Improving policies for them will also have a scaling effect as it becomes easier for new (edible) green initiatives to start up, to spread their activities and to maintain them (scaling wide).

## 3.2. Examples of scaling practices

This section provides deeper insights into scaling activities in and around the EdiCitNet Living Labs, offering examples of the varied forms that different scaling processes can take when carried out on the ground.

### 3.2.1. Scaling across in Andernach: Stories about bee rangers and digital beehives

One example of the potential impact of scaling across, starting new ECS activities in new domains, can be seen in Andernach, where a community book initiative started by the bookshop AnkerBuch developed into a bee and weather monitoring project that has the potential to save lives. Against the backdrop of declining visitor numbers to the bookshop and adjoining cafe, it was clear that new forms of interaction with the local community were needed. According to scientific findings, such casual, ‘weak’ relationships cultivated in shops and cafes play a significant role in individuals’ openness, performance, wellbeing and health (Sandstrom and Dunn, 2014). The owners started an ambitious writing project to bring together local writers and local youth, during a period framed by restricted social contact due to the corona pandemic. Under the guidance of a local author and teacher, eight pupils from grades six and eight chose to write “Moss and the Bee Ranger” (Gemmel, 2020; Figure 3A). The story is about a wild bee whose habitat is threatened and who embarks on an adventure to fight against it. While the book was still being written, the bookshop owner began thinking about how to make the life of bees tangible beyond the story—with a beehive fighting against real threats, educating the community and supporting the ideals of the Edible City movement. Together, AnkerBuch, members of the Andernach Beekeepers’ Association, and other local stakeholders developed a system, housed within a beehive, that can measure temperature, humidity, the amount of honey produced, and entry and exit movements in the beehive. These insights make it possible to predict impending extreme weather events, such as the devastating flooding in the Ahr Valley in 2021. The prototype is built from simple, sustainable and inexpensive components and is easy to replicate and maintain. This offers the possibility to collect and link a wide range of data at different locations, spreading the knowledge and benefits. What started as the desire to share stories with the community has evolved into a story of its own: where a small business makes a big impact not only on its own neighborhood, but far beyond.

### 3.2.2. Scaling soft in Berlin: The ups and downs of being a figurehead of the urban gardening movement

Prinzessinnengarten Kollektiv is a pioneer and flagship of the urban gardening movement in Berlin and has made a name for itself even beyond Germany. The social enterprise was founded by two green city enthusiasts, more than a decade after one of the founders became inspired by urban farming in Santa Clara (Cuba). “In the summer of 2009, when we started to transform the wasteland at Moritzplatz into a green kitchen garden, no <150 volunteers joined us in clearing the area from rubbish. Since then, more than 700 articles about the Prinzessinnengarten have been published worldwide including in the New York Times and CNN, TV stations from Sweden, Russia and the Czech Republic, magazines from Argentina, China, Great Britain, France, Italy, Japan or Norway” (Figure 3D; Prinzessinnengarten, 2021). The collective’s popularity with the press and tourists made them a sought-after partner in many local gardening projects in schools, kindergartens and companies, but also in research and innovation projects, which brought funding and political support. However, their popularity also prevented them from gardening in peace, making them feel like ‘zoo animals’. There were many difficulties—wellknown among similar bottom-up initiatives—including a division into two main groups: with one group remaining as urban pioneers with a strong political message at the original location at Moritzplatz (Prinzessinnengarten Kreuzberg) and another group transitioning to the Prinzessinnengarten Collective in Neukölln. The latter runs a not-for-profit organization (Nomadisch Grün gGmbH), provides jobs to more than 20 people and cooperates with several city-owned housing companies aiming to find ways to integrate green, productive and social aspects within urban developments designed to meet the need for affordable accommodation, schools and other facilities. Thanks to their popularity, the continuity and reliability of their work, both groups, coming from a space originally designed for temporary use, have been able to maintain a community garden in the area and have held their own against many multi-million-dollar investors. Moreover, they have been able to expand despite political and economic resistance and headwinds such as in 2019, when the environmental agency of the district imposed a deconstruction order on the community garden including a penalty payment of 30,000 Euro. The argument stated that the gardeners would violate current nature conservation law and a landscape plan that was drawn up for the cemetery in 1993. In March 2022, the cemetery association objected to the order on all points.

### 3.2.3. Scaling deep in Havana: Edible City tools and best practice knowledge when shopping at your local farmers’ market

Agriculture within urban areas was not common until the crisis of the early 1990s and working in agriculture was not attractive to the highly educated Cuban population, especially in the capital, where rural people were often looked down upon. Resources and materials such as seeds or fertilizers were scarce during the crisis and should be used efficiently, without the usual loss that results from “trial and error.” So how did urban dwellers with a professional background beyond horticulture or agriculture become successful and experienced urban gardeners and farmers? In addition to the national programme to provide land for people who wanted to start producing food in the city, the Cuban government developed a network to provide technical and professional support for effective low-input sustainable agriculture. Many people and organizations are involved in this network, including communities, people’s councils and research institutions. The network assists producers in the area by supporting the monitoring of crops, providing veterinary and phytosanitary services and transferring technologies (Gonzalez Novo and Murphy, 1999). A crucial element alongside every citizen turned urban gardener or farmer are the agricultural store consultancies run by the Cuban Ministry of Agriculture, which started in 1995/96 as “shops de semillas” (“seed shops”; Hernández Pérez, 2006). Today, these shops have a broad range of products and services: agronomists offer technical advice and one can purchase seeds, seedlings, saplings, biofertilizers, biopesticides, soil conditioners, veterinary drugs, protective clothing, information leaflets, publications and tools for farming or gardening. At the centre of the support is the producer, those keeping a few chickens in the yard and having a herb patch for their own use, but also the family farmer with 12 hectares who grows vegetables and sells them through a cooperative: “Some people know a lot, but others don’t, and for example they tell you: I want to sow cabbage in July! And you have to tell them that it is not the right time, because it will be very affected by pests. Or they tell you: I want such and such a variety of tomato! And you tell them that it is already outdated, or they bring you a leaf from a plant to see what disease it has and you have to send it to the Consultorio - Tienda Agropecuario and that is a way of passing on what you receive and not keeping your knowledge to yourself” (ACTAF, 1998).

### 3.2.4. Scaling wide through Oslo’s strategy for urban agriculture

Urban farming has been on Oslo’s political agenda since 2010. The city adopted the Strategy for Urban Agriculture

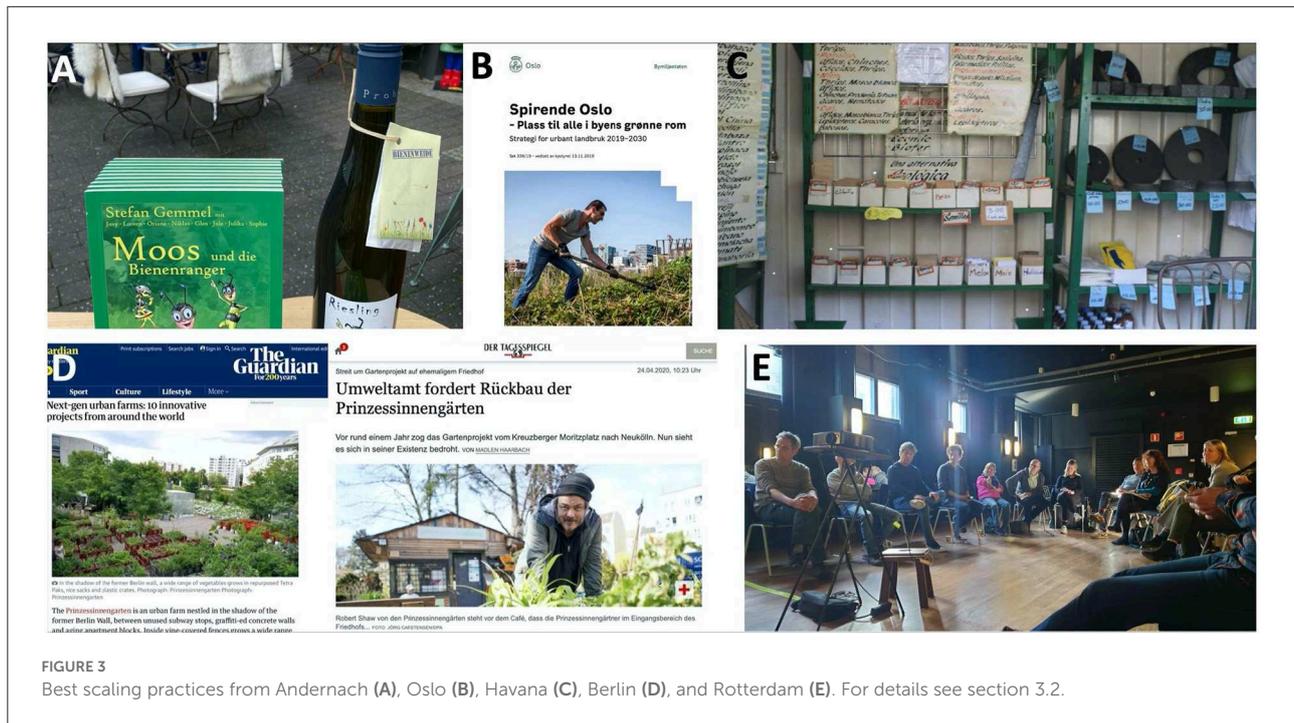


FIGURE 3  
Best scaling practices from Andernach (A), Oslo (B), Havana (C), Berlin (D), and Rotterdam (E). For details see section 3.2.

“Sprouting Oslo” in 2019 (Kommune Oslo, 2019; Figure 3B), which was in place before the city’s Living Lab was implemented. It is a political document that all agencies in the municipality must work according to. The Urban Environment Agency is primarily responsible for coordinating measures toward the city council department, with some agencies more and some less active in implementing urban agriculture. This is probably more dependent on individual engagement than it should be and the municipality does not have many financial instruments or resources to initiate activities beyond its own service provision. Nevertheless, Sprouting Oslo has inspired the scaling of Edible City Solutions across various districts. Thus, it is an example of best practice when it comes to scaling wide, as its five main goals foster the replication of ECS activities in new geographic areas in a structural and systematic way: *More green* areas have been developed by transforming gray or unused surfaces to places where all citizens can cultivate together. The city has facilitated the planting of pollinator friendly and edible plants such as berry bushes, fruit trees and flower meadows—including in graveyards. Habitats for insects, temporary growing boxes, allotments, “colony gardens,”<sup>6</sup> school gardens, meadows and pastures have been established at several locations. Long-term allotments are included in

6 The Norwegian colony gardens (kolonihager) are little parcels of land made available for non-commercial gardening. The plots are subdivided into small pieces of land assigned to individuals or families to cultivate food plants for a small membership fee.

planning processes of new housing projects. *Space-efficient food production* based on cultivation in water (hydroponics and aquaponics) being fostered at different locations, especially as a solution for supplying restaurants. Producing food such as urban seafood in and by the seashore is being investigated as a possibility for the future. In addition, the city assesses potential areas for more community supported agriculture and makes unused areas available. The use of peri-urban areas for grazing livestock increased as well. Unused areas were made available as *green meeting places*, some of them connected to institutions. Larger housing areas as well as indoor facilities have been identified for urban agriculture activities. As such, the number of housing development projects where it is possible to carry out plant-growing activities increased. Green spaces are more frequently used for vocational and work experience for young neighbors as well as for activities and events connected to food. The amount of school gardens increased and plans for the future construction of schools in various districts will take integrated gardens into consideration. Vegetation with edible plants are components of school gardens and extended yards. Kindergartens also continuously increase their gardening activities on vegetable patches. Other green educational areas were created by installing information signs about urban agriculture projects. Oslo as a *collaborative city of knowledge* has helped initiatives with its subsidy scheme (200,000 Euro per year to initiatives) to foster and professionalize urban agriculture. Additionally, more outdoor summer jobs for young people have been established.

### 3.2.5. Scaling soft: Persuasion and ongoing communication—how to build strong alliances for greener cities

An impressive example of scaling soft is pursued in an inspiring way in the Living Lab of Rotterdam. Although many cities worldwide are committed to sustainable lifestyles and economies and have been integrating them into their planning for years, the exchange and cooperation between official authorities and practitioners often remains challenging. Groen010, official Living Lab coordinator in Rotterdam and advocacy body for local green initiatives, knows these difficulties all too well. Since 2016, Groen010 has therefore been working to establish a Green Office in the municipality of Rotterdam in order to achieve the following three functions: (1) to install an entry point for (edible) green initiatives into the municipality in the form of a civil servant who supports the green initiatives; (2) to bring transparency into the maze of municipal departments, regulations, and services where initiatives have often encountered a lot of arbitrariness and opaqueness; (3) to set up structures that enable the participation of green initiatives in the formulation of new green policies. By constantly asking, communicating, giving advice and support and if necessary, expressing displeasure over the years, Groen010 has managed to keep the pressure high for the creation of a Green Office with a Green Broker. Finally, in February 2020, a Green Broker was officially appointed by the municipality. At the moment, the Green Broker is working with Groen010 to generate a website and thus ensure more transparency. What is still missing, however, is the structural involvement of the green food initiatives in the formulation of new policies. The idea of a Green Table was not taken up until Groen010 initiated a joint meeting, to bring together crucial stakeholders to explore how the network of (edible) green initiatives can come together with other large organizations in Rotterdam, such as the municipality, funds, companies and NGOs, and how the Rotterdam City Team can support. Groen010 recently presented a program that was addressed to the new city councilors after the council elections—a short manifesto calling for more cooperation between government and green initiatives, more green spaces in the city, more open knowledge sharing about urban greening and more regular, long-term financing opportunities for (edible) green initiatives.

## 3.3. Strategic plans for different scaling pathways

The scaling activities already implemented in the Living Labs and the examples identified above demonstrate that there are a wide range of different types of scaling currently being carried out across all cities, representing all of the different scaling pathways of our theoretical framework. As

participant-observers, we have been able to highlight a number of additional, untapped scaling potentials for each city. In this next section we present some of these potentials in more detail, separated out into the different scaling pathways, explaining what could be done to ensure continued development along the scaling trajectory identified. These examples have been chosen either due to their accessibility and low cost, and therefore practicability, or to their potential for replicability and therefore usefulness for others. More detailed guidelines on different scaling pathways can be found in the [Supplementary material 2](#) of this paper and in [Plassnig et al. \(2022\)](#).

### 3.3.1. Scaling deep: Improving existing edible city solutions

While both Andernach and Havana are in many respects pioneers when it comes to the Edible City approach, in both places there exists the potential to enhance the cities' already implemented Edible City Solutions (scaling deep).

Questionnaires with local residents in Andernach have demonstrated that the edible public greenery in the city centre managed by Perspective gGmbH is perceived as a “nice to have” and a cost-effective alternative for green space maintenance (e.g., [Artmann, 2020](#)). The community garden and Living Lab strives to be inclusive by among other things hiring the long-term unemployed to carry out a lot of the work but it remains challenging to directly involve a wider public ([Artmann and Sartison, 2020](#)). The socioeconomic effect of this approach to reintegrating people into the labor market has also been seen as controversial in literature as participants have less time to seek a job (lock-in effect) and might be viewed as disadvantaged (stigmatization) (e.g., [Harrer and Stockinger, 2022](#)). Another challenge in Andernach is that many citizens have their own gardens and thus the motivation to do gardening in public areas is limited. The current strategy implemented in the Living Lab to involve children and their families will have to run for a longer period to achieve sustainable change from a passive to an active attitude among residents. In Andernach there is therefore the potential to improve the anchoring of Edible City Solutions within the wider population and there are many simple and cost-effective possibilities for doing this, given the already existing raised beds with edible plants in the city centre and the city's status as an Edible City: starting a “Sponsor a Bed” campaign or “Most Beautiful” bed contest and press initiative to encourage a sense of ownership among the local population, for example, and organizing street festivals and workshops in the city centre where gardening skills are shared.

In Havana, in comparison, due to the fact that urban agriculture in Havana is mostly based on traditional low-tech solutions, there is a huge, untapped potential to reduce the ecological footprint of urban agricultural products through the integration of circular economy approaches (i.e., water and nutrient reuse), efficient and removable energy use and new

technological aspects of ecological design. In Berlin Hellersdorf for example, a greywater recycling system which recycles washing up water into water for irrigation, has been installed in the Living Lab in a cooperation between two City Team members, an urban gardening collective and a water engineering firm. By involving Instituto de Investigaciones Fundamentales en Agricultura Tropical “Alejandro de Humboldt” (INIFAT), Ministry of Agriculture (MinAg), the district administration and local farmers’ cooperatives, circular economy and ecological design technologies could be better integrated into Havana’s Edible City Strategy too, through different types of ECS, including solar food dryers, and cooperatives supported through the showcasing of technologies in public buildings.

### 3.3.2. Scaling up: Reaching more people with Edible City Solutions

When aiming to reach more people, inclusiveness and the adequate involvement of specific target groups beyond those that are often involved in such initiatives, including those that are considered to be “voiceless” or not reachable, remains a major challenge. This is a shared challenge in almost all EdiCitNet Living Labs which requires a lot of resources and carefully designed offers to tackle. Some specific but also more general plans are outlined in the following paragraphs.

One crucial strategy for driving the transformation of urban food systems, and reaching a large number of people in doing so, is the implementation of changes in public canteens that offer locally and regionally produced, healthy meals—with one meal per month or week made up of entirely regional ingredients during the summer and autumn. This demonstrates that entirely regional meals are possible and can foster local green economic growth, as well as raising awareness among consumers about local food production and seasonality. Smaller cities in particular, such as Andernach, have the ability to act as pioneers and best practice examples when it comes to demonstrating such a shift in public procurement. In Andernach, this could be achieved by extending the already existing collaboration between the city administration, schools and kindergartens, food saving initiatives and the Perspective gGmbH. This strategy is in line with European policies and actions on sustainable and healthy public procurement of food and can feed from existing innovator labs in other European cities (Swensson et al., 2021).

Both Living Labs in Berlin are testing out different ways of reaching more people. In Neukölln there has been a focus in particular on trying to reach people who come from diverse backgrounds, representative of the neighborhood in which the Living Lab is located. One approach which has worked particularly well has been the setting up of the Environmental Research Centre, a small space for workshops and activities with the community.<sup>7</sup> The space has a glass front and is located on

<sup>7</sup> Source: <https://prinzessinnengarten-kollektiv.net/studio-nagelneu/>

a busy street. Rented and coordinated by the urban gardening collective Prinzessinnengarten, the events are organized by members of the wider community. Anyone is welcome to hold an event in the space, for free, and encouraged to carry out their own publicity for the event and invite their networks. The result has been amazingly diverse, with mushroom-growing workshops, North African community dinners and food saver meetings being held. Similarly in Hellersdorf, small grants offered by the local district administration have allowed City Team members to organize and hold their own workshops on food-related activities such as fermentation, that were free for local residents to attend. The same approach—giving space for locals to design and plan their own events, rather than organizing events on their behalf and hoping to attract certain target groups—could be used by the other Edible City initiatives in cities in the project and beyond.

### 3.3.3. Scaling wide: Replicating Edible City Solutions in new geographic areas

Both Andernach and Berlin have the potential to replicate some of their activities at new locations (scaling wide).

The thinking and envisioning of the Edible City are often limited to public and semi-public spaces. Especially in small towns, however, ECS scaling strategies should also promote vegetable and fruit tree gardening practices in private gardens and leased allotments. In many smaller cities (see Andernach but also the Slovenian municipality of Šempeter-Vrtojba; Pachova et al., 2019), a high percentage of people are house-owners and have private gardens. Thus, producing one’s own fruits and vegetables is often a traditional way of life. As an example, the majority of houses in Andernach have gardens where food is cultivated. In addition, there are several small farmers producing local food in Andernach. In a next step, the city administration in Andernach, could organize public workshops on fruit tree pruning, juice and jam conservation in order to facilitate and pool knowledge on food production in private gardens, and invite local urban food initiatives to collaborate with them on this. They could also support the distribution of garden-grown products from cooperations with small public canteens. This could be started in a handful of gardens in Andernach and if successful be replicated across the city and other cities.

Berlin, like many German cities, is a “tenant city,” with more renters than owners. Two thirds of its population live in housing complexes with landscaped residential greenery like those found in Hellersdorf, mostly owned by municipal housing companies that manage a huge part of semi-public green spaces within the city. Right next to the community garden of the Hellersdorf Living Lab, one of these housing companies is developing a new residential area with 1,500 new apartments, and regenerating a former historical estate into a new commercial area with a revived heritage garden. A member of the City Team, the housing company has been involved in discussions with locals

about the possibility of integrating “edible landscaping” into the areas under development. While housing companies can be averse to the installation of edible greenery, due to the perceived higher costs of care that it requires, the approach here has been to integrate the new residents into the caretaking thus reducing the burden on the housing companies and strengthening social cohesion and a sense of ownership among residents at the same time. To support this gardeners-in-residence approach, training courses could also be carried out for local residents, i.e., fruit tree pruning, gardening in collaboration with local edible green initiatives. The concept of “edible greenery at your doorstep” could at the same time be integrated as a marketing tool into the promotion of the apartments, making it more appealing to potential tenants. The edible residential greenery proposed for the regenerated area in Hellersdorf has great potential to be replicated not only in other buildings owned and developed by the housing company, which comprises more than 20,000 apartments in the city, but also by other housing companies in Berlin and beyond.

### 3.3.4. Scaling across: Starting novel Edible City activities in new domains

Due to the involvement of large numbers of social entrepreneurs, working on individual plots in the historical community garden in Linderud, Oslo, is probably home to the Living Lab with the most active participants in EdiCitNet. Due to this diverse set of actors, many activities are started in new domains on a regular basis (scaling across) with some of them are described below.

Urban foodscapes can provide habitat services (van Heezik et al., 2012; Krasny et al., 2013). The Oslo Living Lab could increase their efforts to build habitats for small animals that live at Linderud farm such as squirrels and salamanders. The Living Labs started this endeavor by building Salamander-“houses” made of twigs in autumn 2022, after they had a meeting with the environment coordinator at Linderud school. Target groups that are involved are pupils and kindergarten kids. The community garden also strives to produce seed meadows that will turn into habitats for pollinators. The coordinators already agreed on this with Jobben Oslo (Salvation Army) who could start to produce meadow seeds at Linderud. What remains is to choose the type of seeds. The target group in this scaling activity are persons struggling with substance abuse who will be involved through Jobben Oslo.

Combining nature and garden heritage, the Living Lab Oslo is already planning to re-establish the kitchen garden in the historic part of Linderud farm for which they might use funding from the district and the Norwegian Museum Association. As a next step, the Living Lab coordinators will cooperate with initiatives and actors at Linderud, in particular with pupils from Nature Upper Secondary School who already run a kitchen garden. This particular form of scaling, where a “novel” ECS

activity is inspired by Edible City approaches from history can also be seen in the Living Lab in Berlin-Hellersdorf, where the regeneration of the historical garden and the planting plan—including ancient varieties of fruit trees and edible berry bushes—is inspired by the garden’s former state and marks a unique break from tradition for the developers of the property and the city’s environmental administration authorities, who do not usually choose edible plants in their replacement planting plans.

### 3.3.5. Scaling soft: Networking, alliance building and dissemination of knowledge on Edible City Solutions

The Living Lab in Andernach and especially in Rotterdam are engaged in several activities on dissemination and knowledge sharing as well as networking, alliance building and lobbying (scaling soft). However, some of the activities are in an early phase and could be expanded further.

A crucial task for the Living Lab in Andernach is the focus on ECS lobbying and building up consensus beyond political parties and strands. This is of particular importance in smaller cities, where administration staff are often more closely connected with political actors. The Living Lab activities have already taken some key steps to convince political opponents of the positive impact and efficiency of ECS. The joint development of a common Andernach nutrition strategy, to which the different political parties commit themselves, would be a worthwhile goal for the next 5 years. For this purpose, a nutrition council<sup>8</sup> (Mooney, 2022) could be established, following the example of other German cities (e.g., Berlin, Dresden, Kassel; Scharff et al., 2019). This could be initiated by the Andernach City Team and the numerous existing Edible City Initiatives by inviting citizens to form a bottom-up nutrition council and facilitate organization (e.g., office, meeting rooms, secretary paid by the city). As a next step, participants could envision a holistic Edible City Masterplan (Edible Andernach, 2050) and develop an action plan in line with the Masterplan agreed on the council level, involving the city council and administration, all political parties, strands and citizens.

The Living Lab in Rotterdam could continue to develop the existing Edible Rotterdam Manifesto (Eetbaarrotterdam, 2021)<sup>9</sup> with all relevant stakeholders including the Green Broker in order to co-create an “Edible Rotterdam Regional Masterplan” based on a consensus beyond political parties and attitudes and including the city’s geographical surroundings,

<sup>8</sup> Food or Nutrition Councils are platforms for local and regional actors who are active in the food system transformation toward sustainability (e.g. consumers, producers, gardeners, food rescuers, representatives of different food economies). Councils develop their common goals and strategies and turn them into political activities and actions.

<sup>9</sup> [http://www.eetbaarrotterdam.nl/Downloads/manifest\\_EETBAAR-ROTTERDAM.pdf](http://www.eetbaarrotterdam.nl/Downloads/manifest_EETBAAR-ROTTERDAM.pdf)

which is dominated by industrial agriculture. As a starting point, we recommend the masterplan be drafted with the existing manifesto before working on an extended version together with all stakeholders using participatory and co-creative approaches (e.g., forum discussions on website; open workshops; radio discussions), before setting the masterplan on the political agenda and developing an action plan for its implementation to make sure the latter will get approved by the City Council.

When it comes to scaling soft however, it's important to bear in mind that advocacy approaches such as these that involve a large number of different stakeholders can be very time-consuming. Earlier in the project, in the run-up to an election in Berlin, task forces were set up to use the opportunity for Edible City Solution advocacy, as this is often a period where many parties and candidates of representative bodies such as parliaments, councils etc. are open to citizens' suggestions. Statements were sent out to the parties asking them how they will support ECS once elected. To develop this paper, other initiatives were asked to join and this process took longer than expected ending in a document that was too long to be read by the addressees. In addition, the initiative was captured by a certain party producing conflicts with the party in power. To conclude, lobbying should be prepared with more time available.

## 4. Discussion

Edible City Solutions offer innovative solutions for local problems and express the need for systemic change, but similarly to many social enterprises, there is a failure to scale (Westley et al., 2014). Successful scaling processes, that are often challenging and time-consuming, can only be achieved with an exchange of experiences and lessons learned in a multi-stakeholder approach. In this article, we have showcased a range of different scaling activities, categorized them in terms of their intended impact, as well as provided detailed examples of specific scaling activities and strategic plans for future scaling processes.

Living Labs, as spaces for learning, testing and experimenting, have an exploratory and dynamic nature. Despite having clear objectives, co-created Living Labs involve processes that have no conclusion and remain open-ended. Due to the continuous changes within the Living Labs, particularly regarding the impact of the Covid-19 pandemic in all cities and the fluctuation of City Team membership, it has not yet been possible to reliably monitor long-term quantitative impacts of the innovations developed in the Living Labs. Moreover, the EdiCitNet project follows a co-creative approach throughout every stage of the process, including when it comes to decisions regarding if, how and when to scale. While these Living Lab characteristics limit quantitative comparisons or sophisticated statistical analyses, they provide a fruitful basis for a qualitative assessment of the complex processes inherent in the scaling of

edible nature-based solutions. Based on this, in the discussion we reflect on open questions and limitations of scaling experiences identified within the EdiCitNet communities of knowledge and practice.

It is important to highlight here that considering the lived practice of "learning by doing," the iterative "trial and error" development processes and the multifunctionality and complexity of Edible City Solutions, we are in a way aiming to "scale the unscalable." Not to mention the challenges faced when it comes to deciding how to evaluate and judge the success of different solutions and the related scaling processes. At what stage and with which indicators can success be measured? In an ECS that explores developing an edible product for sale in an urban garden, is it the number of packets of tea sold at an event, or the collective learning process that comes from the iterative discussions about how to best dry the herbs? In such dynamic environments, it is more significant to measure the success of processes, rather than outcomes. A more qualitative assessment of scaling is therefore arguably more valuable and insightful than the quantitative measurement of complex and interrelated indicators.

Scaling pathways are overlapping, interdependent and part of a continuum of activities that can be grouped and labeled in various ways (e.g., Uvin, 1995; Lyon and Fernandez, 2012; Smith et al., 2016; van Winden et al., 2016; Islam, 2022). Thus, the same activities can be assigned to various different scaling pathways. This became very obvious in our discussions with Living Lab actors when it came to categorizing scaling activities within certain scaling pathways. For example, if raised beds are installed in other neighborhoods of a city (scaling across), more citizens will be reached (scaling up), the solution will achieve increased visibility (scaling soft) and the raised beds will ideally be optimized based on learning's from previous installations (scaling deep). Replicating or rolling out an Edible City Solution without modifying it (scaling wide), can only happen under certain circumstances (van Winden et al., 2016), which is when an ECS is replicated more or less directly.<sup>10</sup>

Despite the contradictions and challenges around labeling, the different scaling pathways showcased here can help to *open minds*, to develop new ideas and to find temporary solutions. One example from the EdiCitNet Living Labs is the ongoing work being done to develop and apply sustainable business models (e.g., the EdiCitNet playbook "Growing Jobs in Urban

<sup>10</sup> For example, the "SME Efficient City Farming" in Berlin combines fish farming with vegetable cultivation and produces regional "capital city perch" and fresh "capital city basil." The aquaponic facilities use resource-saving recirculation systems where the fish fertilise the plants. This system has been replicated in other cities by the farm construction branch of the SME. For more information see <https://www.ecf-farm.de>.

Agriculture<sup>11</sup> and the EdiCitNet Diamond Model tool for urban food initiatives<sup>12</sup> The aim of this work is to reduce the economic fragility and self-exploitation often experienced by urban food initiatives. However, it was met with strong resistance at the beginning, as concepts like business models for many people still continue to be associated with traditional capitalist profiteering. This often leads to a duality of logic between commercial and social interests, as very individual *ethical considerations influence scaling decisions* (Desa and Koch, 2014; Blundel and Lyon, 2015; Bocken et al., 2016; Smith et al., 2016) and the perception of the scaling process. As an example, the efforts, as described above, to develop a product for sale in the Living Labs in Berlin, to generate additional income (a form of scaling across, as this was a new activity) was seen more as an exercise in learning how complicated and complex this process is, rather than as a viable option for financial growth (see 3.1 Scaling Stories of the Living Labs). The actors concluded that there is no way to make it financially profitable without switching to more intensive production methods and risking losing the focus on community engagement and participation that is central to their goals.

However, the ability to overcome fragility and self-exploitation that scaling can provide—moving from a caring entrepreneur to a caring enterprise (André and Pache, 2014)—is a crucial argument that can be used to counter existing prejudices regarding business models and scaling in terms of growing or expanding in a de-growth atmosphere.<sup>13</sup>

In general, success often depends on the ability to adapt scaling activities to different settings and varying challenges. This is discussed in literature as *management competence* including goal setting, monitoring, evaluating, reporting, and budgeting (Bull and Crompton, 2006). Our efforts share this experience with different scaling concepts that have been discussed in academia predominately from scientific perspectives but might be only of minor use for practitioners. At the present, literature on this topic is almost always based on qualitative, primarily comparative, case study analyses, whereas practical guidelines to scale impact are missing (Weber et al., 2012).

As observed in almost all Living Labs, it remains crucial, through different forms of soft scaling, to establish *strategic partnerships with win-win outcomes*. The breaking down of silos between institutions (e.g., collaboration between city and district administrations, non-profit organizations, businesses, educational institutions, etc.) was a challenging process in all

cities but proved crucial for many decisions around scaling thanks to the vast pool of knowledge and expertise that was brought together. The discussions around edible landscaping in Berlin Hellersdorf for example, would never have been possible without key stakeholders all sitting around the same table: the housing company, local residents, the city department for housing and urban development and a landscape architecture company responsible for designing the area and choosing the plants. Similarly, in Rotterdam, the bringing together of representatives of diverse environmental organizations has led to an intense exchange of knowledge and the establishment of a powerful lobby group for urban nature. The multi-stakeholder approach and the co-creation work carried out in the City Teams as communities of knowledge and practice has proven decisive, although the open-endedness, time consuming and complex decision-making processes inherent to such settings has been recognized as explained above.

As described above in our reflections on the possibilities of further soft scaling, awareness-raising and advocacy processes take time. Similarly, a modification in public policy and regulations at local, national and international levels including the regulative, normative, and cognitive transformation of existing institutions and processes is a goal that can only be achieved over a longer time period (Jolly et al., 2012). First steps toward this transformation have been laid by the new *urban and action plans, policy briefs and/or guidelines* that have been co-created in Milan, Berlin and Oslo. Berlin is co-developing an Edible City Master Plan focussing on edible neighborhoods, nutrition hubs and a practical nutrition strategy at district level<sup>14</sup> while Milan has co-developed related operative rules and tools to enhance the development of green roofs and walls.<sup>15</sup>

One major challenge, especially when it comes to scaling up, is *inclusiveness* and the adequate involvement of specific target groups beyond those that are often involved in such initiatives or those that are considered to be “voiceless” or not reachable. This is a shared challenge in almost all EdiCitNet Living Labs which requires a lot of resources, dedication and trial and error (see 3.3.2 Scaling Up: Reaching more people) but innovative approaches have proven to be effective: in the Living Labs in Oslo and Andernach for example, where long-term unemployed people work in the community garden or in Berlin where inviting local people to organize their own events on their own terms led to a more diverse group of people being successfully reached. When working in an iterative way and using trial and error, sharing information about mistakes and *lessons learned* is naturally also important.

In addition to all of the above, the scaling strategies reviewed and analyzed in this study were developed under

11 <https://www.edicitnet.com/wp-content/uploads/GJUA-Playbook-190521.pdf>

12 <https://www.edicitnet.com/diamond-model/>

13 There are successful examples of product development in Central European contexts among them the ECF farm systems in Berlin or Rotterzwam in Rotterdam (Source <https://www.ecf-farm.de> or <https://www.rotterzwam.nl>).

14 <https://www.berlin.de/ernaehrungsstrategie/>

15 [https://www.edicitnet.com/wp-content/uploads/EdiCitNet\\_Upscaling\\_Workshop\\_CLEVER-Cities.pdf](https://www.edicitnet.com/wp-content/uploads/EdiCitNet_Upscaling_Workshop_CLEVER-Cities.pdf)

the very special conditions of the *Covid-19 crisis*, which has affected both the co-creation of the Living Labs and their scaling pathways differently. We observed very differing ways to deal with the crisis: some Living Lab activities and actors stopped completely for a period. Some responded with organizational scaling by expanding their services, building new inter-organizational collaborations and serving additional beneficiaries (Loukopoulos and Papadimitriou, 2021).

## 5. (Up)scaling in a nutshell: 11 key recommendations rather than conclusions

There is still a large mismatch between scientific findings and its communication to interested stakeholder groups. We used co-creation as a tool for making transdisciplinary research more inclusive and ground based in terms of assessing diverse forms of knowledge and practice from different actors involved. Based on our observations of the different scaling activities in and around the Living Labs we have drawn up a set of easy to understand take home messages.

*There are rarely “one type fits all” solutions:* Scaling activities are context sensitive and have to be adapted to the local conditions, actors involved and specific aims targeted. There are many ways to reach a goal, and ECS actors need to find their own unique set of pathways for scaling.

*Optimisation is a daily task:* Scaling activities have to be continuously optimized. Edible City Solutions are socially-embedded activities, made up of vivid processes influenced by community dynamics among ECS practitioners, the multi-stakeholder constellation around the ECS, political settings and visible and hidden agendas at the local and regional scale.

*Stay flexible:* The complex nature of ECS must be recognized and analyzed holistically and continuously. Scaling is an ongoing task; what works today may not work tomorrow.

*Everything is driven by people:* Scaling is based on people's needs and by individual and collective ethical considerations. Staying flexible as situations change, perceptions and normative evaluations, growing together, co-creating with others. The motives and ambitions of Edible City actors are complex and multi-faceted and at times may be in contradiction to what might objectively be of most benefit to the ECS.

*We are all experts!* ECS are frequently co-created in a collective learning process, which leads to a comprehensive and co-developed knowledge base, with contributions from theoretical and practical contexts. It is crucial to be inclusive, open to new perspectives and ways of knowing, and to explore the expertise of your community.

*Networking and advocacy is key:* Although lobbying (or, more correctly, advocacy) usually has negative connotations, it can help to solve problems and facilitate scaling in all dimensions. Be aware of and connect with the political actors

at a local and regional level, inform them about your goals, achievements and needs. Join forces with other urban food initiatives—there is strength in numbers!

*Open your eyes to sustainable business models:* Economic growth does not always have to be associated with the exploitation of finite resources. Sustainable business models and tools can open up new perspectives for urban food initiatives, strengthen their structures and offer clearer visions of current values and future goals.

*Every mistake counts:* Success stories are willingly shared. However, it is our failures that offer us valuable knowledge and opportunities to learn, analyse what went wrong and adapt our plans before the next try. We have to welcome a culture of error and start to share unintended experiences as a part of the learning process.<sup>16</sup>

*Do good and talk about it!* Document, demonstrate and communicate about all of the great work you are doing with as many people as possible—via guided tours, online media, maps and more. Monitoring the impact of your efforts can be challenging, but statistics, images and videos can be powerful when it comes to convincing key stakeholders of the value of initiatives.

*Most wanted resources are money and time:* These two finite resources were consistently identified as being the most valuable when it came to successfully implementing and scaling ECS—and the least readily available. Be sure to respect your own boundaries, avoid burnout and take good care of your colleagues, employees and/or volunteers!

*Reduce our ecological footprint and foodprint!* Edible City Solutions reduce the ecological footprint of your neighborhood by using innovative principles of ecological design, biodiversity friendliness as well as closed material and energy flows. Urban food production also reconnects people from urban and rural areas by innovating the urban fabric with closed-loop water, waste and nutrition systems, thereby releasing pressure from over-exploited agricultural landscapes.

## 6. Next steps and future research

Experimenting with food system innovation on a small scale, like in the EdiCitNet Living Labs, constitutes a first step toward reducing the ecological footprints of neighborhoods and strengthening social cohesiveness in cities. A social innovation project like EdiCitNet challenges existing structures. It has therefore been important to try out different solutions and see what works best, accepting local adaptations and variations. We have learned the importance of being flexible and responsive to the needs of the people we work with.

To scale Edible City Solutions, networking and advocacy is key. Scaling up implies communicating the value that

<sup>16</sup> <https://edicitnet.typeform.com/to/K9epCKCs>

Edible City Solutions provide society and the local community. Policy and decision makers need help to understand the value of these types of initiatives. In monitoring, qualitative documentation like photos, videos and qualitative interviews are therefore key, as well as documenting the results through numbers, which are often convincing. At the same time the initiatives themselves must stay open to the local community to provide the social and environmental value that they promise.

We have started reflection processes and initiatives internally, carrying out interviews on lessons learned from the project. As part of this we have talked to all members of the City Teams in each of the cities, to discuss perceived successes and failures both on the level of the Living Lab and the development of the ECS and on the level of the City Team and the co-creation process carried out within the project. These findings will feed into further publications both academic and for specific target groups.

Future research should continue to investigate how municipal structures can better support the spread of Edible City Solutions that provide multiple values, including social, environmental and health, as the silo organization and policies of public agencies are still obstacles to finding sustainable solutions locally. More research is therefore needed on sustainable governance and how to operationalize the UN sustainable development goals locally. The initiatives—collectives, non-profit organizations, social enterprises—that are often responsible for implementing Edible City Solutions—pose another topic for potential further research. As they often, as discussed in this paper, suffer from economic fragility and self-exploitation and are reliant on short-term project funding or grants, it would be valuable to explore what financial models and strategies exist, or could be developed, to support the financial sustainability of Edible City initiatives whose focus is on offering social and environmental value.

## Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author/s.

## Author contributions

SP, MP, and IS wrote the manuscript and contributed equally to this work. KR-K contributed to the methods, result section, and reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frsc.2022.1032836/full#supplementary-material>

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