Review of existing approaches to collaboration in research

Deliverable 3.1.

Work Package 3

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869764. The sole responsibility for the content of this document lies with the GoGreenRoutes project and does not necessarily reflect the opinion of the European Union.

Deliverable No.	3.1
Work Package	Work Package 3
Dissemination Level	Public
Author(s)	Vera Noppenberger, ICLEI Eleanor Chapman, ICLEI
Co-author(s)	Julia Gäckle, RWTH Aachen Mari Carmen Garcia, MCG Tiiu Koff, TLU (UniTallinn)
Date	26.02.2021
File Name	GoGreenRoutes_Report on co-creation_D3_1_Final
Status	Final
Revision	-
Reviewed by (if applicable)	Aado Altmets, City of Tallinn Brendan Keegan, Manchester Metropolitan University

Contents

Executive summary

This report has been written for the research project GO GREEN: Resilient Optimal Urban natural, Technological and Environmental Solutions‘ (from this point on referred to as GoGreenRoutes), funded under the European Commission’s Horizon 2020 funding programme. Primarily based on literature review, this report explores the concept of co-creation in practice-based research (including key definitions; benefits and limitations; obstacles and enablers; and supporting tools and methodologies), in connection with the project themes of nature-based solutions, and health and wellbeing. The content of this report is part of a wider process aimed at establishing and maintaining a sound basis for collaboration among the GoGreenRoutes consortium partners.

Our literature review does not conclude with a clear definition for co-creation, but rather finds that several definitions exist (see Chapter 2). However, we identified certain fundamental features that characterise co-creation, as follows:

- It is an iterative, rather than linear, process - with room for adjustment and change
- It is outcome-oriented
- It demands active involvement of parties (consultation is not enough)
- Both the process and outcomes should be mutually rewarding for those involved

Our review finds that co-creation can deliver several benefits, including more targeted, acceptable, valuable and enduring outcomes. However, the concept also has significant limitations, including a tendency to be deployed without clear definition (leaving potential for unclear expectations and disappointment in outcomes), a limited evidence base for its impacts, and difficulties creating a level playing field for all parties (see Chapter 3).

We categorised obstacles and enablers according to three ‘levels’: the individual level, the process (interaction) and the leadership levels. On an individual level, it was seen as most relevant that stakeholders are committed and have trust in the process. It was therefore presented as challenging when people were too fixed in their roles and resistant to change. Existing prejudices towards the process but also towards other stakeholders were likewise seen as problematic. On the process level, the most important enablers were found to be inclusion, diversity (related to equality) and transparency, as well as finding a joint understanding, continuous dialogue, and relationships based on trust and respect. On the other hand, it was shown as challenging to sufficiently arrive at social inclusion, especially reaching out to relevant stakeholders. Furthermore, it can get challenging when conflictive perspectives and mismatched expectations come up within the group or when effective conflict resolution strategies are missing in order to adequately deal with diverging perspectives. Also, insufficient or non-transparent communication, occasionally connected to an existing language barrier or working remotely, can hinder a successful co-creation process. Last but not least the leadership level is of high relevance to implement a successful process and support the

implementation of the enablers on other levels. Most importantly leaders should provide enough room and time to foster trust and commitment and to help merging agendas. They should follow the strategy of clear coordination and communication and continuously reflect on the process to be able to react to arising, context-specific challenges (see Chapter 4).

Our reflection on obstacles and enablers is followed by discussion of examples in practice, including tools and methodologies that can be usefully deployed to implement a process of co-creation. Digital tools are given particular attention in light of the continued impacts of the Covid-19 pandemic on modes of interacting at the time of writing (see Chapter 5).

We conclude with the following recommendations for the GoGreenRoutes consortium (elaborated on in Chapter 6):

1. **Communicate the benefits of co-creation**
2. **Foster a shared understanding of co-creation**
3. **Establish a clear vision (or visions)**
4. **Actively and iteratively define key concepts**
5. **Share and discuss established 'enablers' to underpin the collaboration**
6. **Actively engage team members in defining a basis for working together**
7. **Develop mechanism(s) to make known enablers operational**
8. **Anticipate obstacles (and possible mitigation strategies) before they arise**
9. **Use the core basis for co-creation to foster local teamwork**
10. **Nurture the co-creation process**

1. Introduction

This report has been written for the research project GoGreenRoutes, funded under the European Commission's Horizon 2020 funding programme. Primarily based on literature review, this report aims to explore the concept of co-creation in practice-based research (including key definitions; benefits and limitations; enablers; obstacles and mitigating strategies; and tools and methodologies), in connection with the project themes of nature-based solutions and health and wellbeing - with a view to providing recommendations for the GoGreenRoutes project.

Development of this report is part of a wider process aimed at establishing and maintaining a sound basis for collaboration among the GoGreenRoutes consortium partners. Establishing this common basis is a process that also includes a workshop (held in February 2021) for the benefit of all consortium partners (led by project partner ICLEI, with support from Connect the Dots and RWTH Aachen). Preliminary findings from the literature review were shared with participants at that workshop, as stimulus for discussion of co-creation in general (aims, benefits, limitations, principles/enablers, obstacles and potential ways to address them), and a step towards both identifying linkages between work streams ('Work Packages' – WPs – in project jargon) and defining ways of working together. The content of this report, and the results of the workshop, will together shape an 'action guide' which will define the terms for a good collaboration within the project (Milestone 6 'Terms of reference for project collaboration', to be completed by May 2021).

1.1. Project background

The project GoGreenRoutes, with its large transdisciplinary consortium of 40 partners, is characterised by an innovative approach to rethinking nature-based solutions based on existing knowledge. The focus of the project lies in improving the relationship between people and their urban environment by enhancing their awareness and understanding of the benefits of urban green space, and consequently generating better, healthier communities. The research design is divided into eleven WPs as follows:

- WP1 Coordination and Management
- WP2 FORAGING: Design of Data
- WP3 Cultivating: Re-/Co-Design, Co-Creation, and Co-Ownership
- WP4 GROW: Innovation Training and Development
- WP5 MOVE: Enhancing Sustainable Lifestyles
- WP6 FEEL: Connecting Citizens with Nature-Based and Digital Innovation

- WP7 KNOW: Awareness of Human-Nature Interactions and Sustainability
- WP8 HARVESTING: Monitoring, Assessment and Evaluation
- WP9 Communication and Dissemination
- WP10 Ethics Management
- WP11 Ethics requirements

The task category map below (see Figure 1) gives an overview of the different kinds of (co-creative) research envisaged in tasks within the different thematic research-focused WPs (excluding cross-cutting WPs 9, 10, and 11).

Figure 1: GoGreenRoutes Task Category Map (designed by Connect the Dots, presented at workshop in February 2021)

The concept of co-creation is highly relevant to this project and is mentioned in a significant number of specific tasks (as described within the project Grant Agreement), as well as in relation to general project objectives (see Table 1 below for example extracts from the Grant Agreement).

WP 3 **To establish and maintain a framework for collaboration between academic partners, local government partners, and local stakeholders in each of the Cultivating Cities, in order to generate a well-connected and integrated approach throughout the whole project.**			
WP 4	WP 6	WP 7	WP 8
Co-creation methodologies will be used to help break down internal 'silos' across public sector institutions Interactive workshop will help cities to understand and address barriers and enablers to **co-creation** and co-production. **Co-design** of the first draft of a Healthy Strategy (HS) to be embedded into overall Cultivating City strategic	Development of digital placemaking toolkit in cities. This toolkit will draw upon the results of initial **co-creation** activities with stakeholders (citizens and municipalities) as well as performance data from the various NBS initiatives in Cultivating Cities to draw up a transferable set of parameters to inform future digital placemaking initiatives	A **co-creation** process with citizens, Cultivating Cities (via the Urban Well-Being Lab) and partners will initiate the development of an online psychological resilience programme.	The personal narratives of community champions in the cities will be collated by a 'citizens voice' monitor. It will ensure that this knowledge informs and supports dissemination activities as part of the **co-creation** and engagement strategy to support the work of NBS implementation and impact monitoring A mental health and well-being scorecard will be developed through a series of **co-creation** activities with project stakeholders The promotion of campaigns to de-stigmatize mental health and other factors that result from **co-creation.**

Table 1: Example references to co-creation from the GoGreenRoutes Grant Agreement

However, the concept of co-creation has not so far been defined or made operational for the project. Given that this concept is open to various interpretations and applications, it is useful to reflect on existing definitions. WP3, with an explicit focus on 'co-design, co-creation, and co-ownership', is tasked with the objective 'to define and maintain a framework for collaboration that will be maintained throughout the project among project partners, as well as local groups of stakeholders in each of the "Cultivating Cities"[1]. This report is a first step in that direction.

1 'Cultivating Cities' refers to the six partner cities involved in GoGreenRoutes, where nature-based solutions will be implemented along with supporting innovations, and their impact assessed.

1.2. Structure of this report

This report is structured in six sections. This introductory section (Chapter 1) is followed by a chapter on key concepts underpinning consideration of co-creation in practice-based research, in connection with the GoGreenRoutes project themes 'nature-based solutions' and 'health and well-being'. Chapter 3 provides an overview of the main benefits of co-creation, and – on the other hand – limitations of the concept. Chapter 4 presents obstacles to successful co-creation, and, conversely, enablers. Chapter 5 introduces different tools, methodologies and examples of co-creation in practice, including their strengths and weaknesses. Finally, Chapter 6 draws on the previous chapters to outline recommendations on how to use co-creation within the GoGreenRoutes consortium.

1.3. Objectives

The literature review conducted for this report aims:

- To identify and explore key concepts and definitions underpinning consideration of co-creation in practice-based research, in connection with the GoGreenRoutes project themes of nature-based solutions and health and well-being.
- To identify benefits, limitations, and typical obstacles and enablers (or principles) of relevance to co-creation in practice-based research.
- To identify and review existing co-creation methodologies and tools, including their strengths and weaknesses - with a particular regard for digital options (given the ongoing impact of the Covid-19 pandemic).
- To identify good practices, demonstrating successful co-creation in practice-based research, of relevance for the multi-disciplinary GGR consortium.
- To make recommendations for effective cooperation between all partners in GoGreenRoutes.

1.4. Methodology

In order to achieve the objectives mentioned above, the literature research was guided by the following questions:

- What are co-creation, co design and co-ownership in the context of practice-based research?
- Are these concepts understood differently in the fields of nature-based solutions and urban health and well-being?
- What are the benefits of co-creation for practice-based research?
- What are typical obstacles regarding collaboration in the field of practice-based research?
- What are enablers of successful co-creation?
- What methodologies and tools for co-creation and co-design in research exist already? What are their strengths and weaknesses (withspecial regard to digital options due to the COVID-19 pandemic)?

To address these questions, both academic literature and grey literature (e.g. policy briefs, guidelines etc. from government agencies, consultants, community groups and non-governmental organisations), were consulted. The literature review was conducted in two steps. First, existing literature on co- creation, co-design and co-ownership was sought through internet-based research using engines such as Google Scholar and Science Direct. The search used combinations of the following keywords. For each keyword search, no more than the first 20 entries were considered. Given the timeframe of four weeks to collect and review literature, the goal was to review approximately 50 sources.

The main keywords included in the search were “Co-creation”, “co-design”, “co-ownership”, “collaboration”, "practice-based research and “urban design” combined with the following specific keywords for each chapter: “nature-based solutions”, “health and well-being”, “green infrastructure”, “stakeholders”, “benefits”, “definition”, “collective creativity”, “objectives”, “digital”, “participatory design”, “social innovation”, “principles”, “barriers”, “obstacles”, “enablers”, "interdisciplinarity”, “mobilizing”, “visioning”, methods”, “tools”, “innovative”, “future oriented”, “strengths ” ”weaknesses”, “COVID”, “pandemic”, “best practice”, “examples”, “case study”, “success”, “practice”, “future oriented” “best practice”, “examples”, “case study”, “success”, “practice”, “future oriented”

Second, documents were scanned and selected for further analysis according to:

- The language of publication. Documents written in English, German, Spanish and Estonian were taken into account due to the authors' language skills.
- Geographical scope. Documents selected were either European-focused studies or offered content that could be easily extrapolated or applied to the European context that is with a global perspective.
- Date of publication. Documents published within the last decade were prioritised.
- The sources resulting from the internet-based research were supplemented with additional sources either cited therein, recommended by colleagues knowledgeable on the topic, or located in online repositories hosted by key agencies working in the fields under investigation. All consulted literature was gathered in a matrix and classified according to topic and type of document.

2. What is co-creation?

This chapter introduces the concept of co-creation and related terms in the context of practice-based research, with particular regard to their significance in relation to 'nature-based solutions' and 'health and well-being'. For the purposes of our analysis, a distinction is made between two 'layers' of co-creation, characterised by the parties involved. Firstly, 'in-house' co-creation, among partners within the consortium, and secondly, 'local' co-creation between city partners (in particular, municipal staff) and their local stakeholders. This is a somewhat simplistic distinction, as the reality is likely to be more complex – with non-city consortium partners also interacting with certain local stakeholders as well (e.g. collecting data from different departments, testing apps with end-users...). However, we consider it a useful distinction in the sense of emphasising that co-creation begins within the wider project team, and is something for which all consortium partners have a responsibility.

2.1. Definitions

The existing literature reveals different definitions for co-creation in the context of practice-based research. In reference to urban research involving community members, Franz et al. (2015) note that

> *"although the starting point of co-creation can be traced back to precise scopes in architecture or participatory design projects (see Sanders & Stappers, 2008), the definition [...] became fuzzy over time (Franz et al, 2015, p .49)." For the purposes of their analysis, they define co-creation as „a collaborative new outcome between two or more groups of actors that include residents as a prerequisite [...] based on an explorative environment (Franz et al, 2015, p.49)."*

As is clear from this definition, their analysis is focused on a particular kind of co-creation, and indeed their main interest is to compare the success of a particular methodology, namely 'living labs', which they define as "an established tool for testing and developing new products or services with users in real-life environments (Franz et al, 2015, p. 48)." Living labs are discussed in more detail in Chapter 5.

Some authors have reflected on the significance of co-creation specifically for the field of 'nature-based solutions' (NBS)[2], with Kabisch et al. (2016) commenting that a process of co-creation can engage diverse actors with different knowledge and backgrounds to strengthen and support the implementation of NBS. Key elements are the involvement of multiple actors (Raymond, 2017), diversity among actors, and an aim to make social innovations [3] (Frantzeskaki, 2019).

Looking at co-creation in the context of community-based health services, Greenhalgh et al. (2016) define it as "collaborative knowledge generation by academics working alongside other stakeholders [with a view] to aligning research and service development" (Greenhalgh et al., 2016, p.392). Dijk-de Vries (2017) defines co-creation in the context of the provincial health system as "an open, active, and creative process in which all relevant stakeholders are engaged in an innovation process" (Dijk-de Vries, 2017, p.2). It further concerns "active and committed decision-making about a meaningful problem through respectful interactions and dialogue where everyone's voice is considered" (Norris et al, 2017, p.9). Leask et al. (2019) define co-creation as "collaborative public health intervention development by academics working alongside other stakeholders" (Leask et al., 2019, p.2). The complexity of public health issues is difficult to address with 'one size fits all' interventions which is why the involvement of end-users and other non-academic stakeholders is crucial to arrive at successful, tailored interventions (Leask et al, 2019).

Aside from academic literature on the subject, there has been a general push from the level of the European Commission towards encouraging co-creation in research programmes such as Horizon 2020, as a shift away from traditional top-down approaches, and consistent with an overall aim to increase the impact of research. Several previous or ongoing research projects operating in the same European Commission-funded territory as GoGreenRoutes have either

2 Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions (EASME, n.d.).

3 A social innovation can be defined as "the creation of long-lasting outcomes that aim to address societal needs by fundamentally changing the relationships, positions and rules between the involved stakeholders, through an open process of participation, exchange and collaboration with relevant stakeholders," (Voorberg et al, 2014)

actively or implicitly employed the concept of co-creation, and some have also reflected on its meaning. The project Clever Cities, also dealing with nature-based interventions in urban settings, describes co-creation as “a collaborative approach to engagement which allows stakeholders to collectively design and build more inclusive and sustainable mechanisms for change” (Morello et al, 2018).

Within the UNaLab project, co-creation is described as an “act of working together. It means that a final product [...] is created by multiple people from different backgrounds who are involved in its development.” (UNaLab, n.d.). The project aims to bring together a wide range of people to jointly discuss nature-based solutions that can be implemented in their cities. to the project team defines five distinct phases for a process of co-creation: Co-Explore, Co-Design, Co-Experiment, Co-Implement and Co-Manage (DeLosRios-White et al., 2020).

Agusti et al. (2014) define co-creation as “the active flow of information and ideas among five sectors of society: government, academia, business, non-profits and citizens - the Quintuple Helix - which allows for participation, engagement, and empowerment in, developing policy, creating programs, improving services, and tackling systemic change with each dimension of society represented from the beginning (Agusti et al., 2014, p.3).“

An aligned, but broader definition is offered by the team from the ACCOMPLISSH project (an EU-funded project that sought to create an innovative valorisation concept to strengthen the impact of research in the social sciences and humanities, with a particular focus on co-creation and innovation for a variety of ‘lead-users’ and end-users). They note “co-creation is a form of collaborative creativity that is initiated to enable innovation with rather than for the involved stakeholders. Co-creation brings different parties together in order to jointly produce a mutually valued outcome”. (ACCOMPLISSH project, 2017).

Despite the multiple definitions in existence, the co-creation processes described in the literature share certain key features. For example, they are typically characterised by a cyclical, iterative approach – rather than a rigid, linear one – that allows for ongoing learning and adjustment. Figures 2 and 3 below both describe co-creation processes that include a stage to initially engage stakeholders, as well as the use of platforms and tools to foster active participation. The process is not linear, but repeats itself, whereby each 'iteration' is a starting point for the next one, with an overall aim of approaching a goal through learning and reflection (Leask et al., 2019). The ACCOMPLISSH project adopts this approach, rejecting a "predefined and linear pathway starting from academic knowledge production and extending through knowledge application to uptake and commercialisation" (Følsgaard Grønvad et al, 2017, p.69). According to this approach, 'value-adding interactions' (e.g. user engagement, dissemination, consultation) should be included throughout the entire research process.

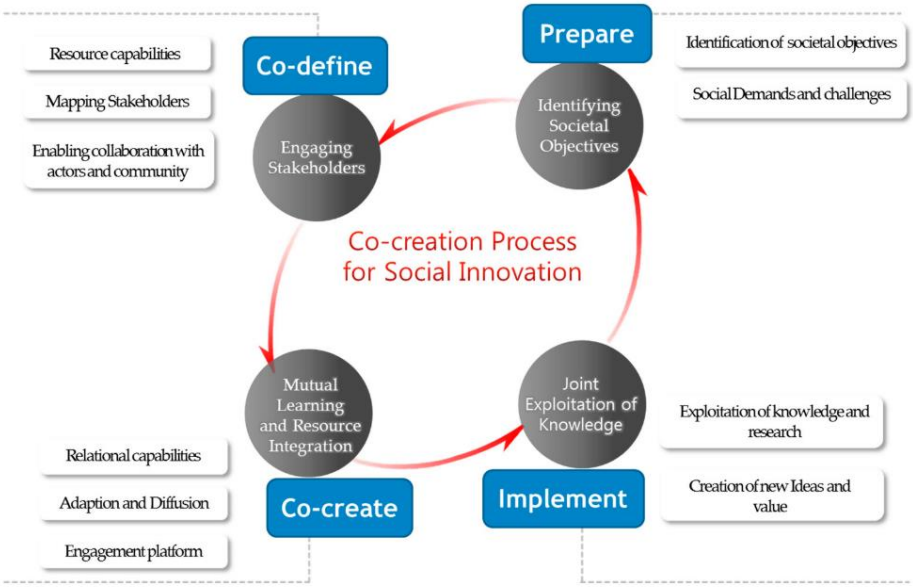

Figure 2: Co-creation process for social innovation (Kumari et al., 2020)

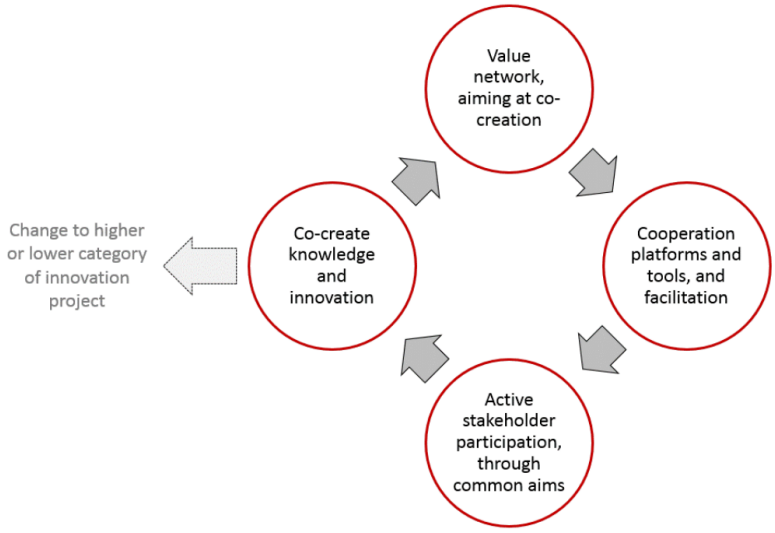

Figure 3: The cyclical connections in co-creation projects (Ruoslahti, 2020)

2.2. Co-creation vs. participation

In the interest of defining what we mean by co-creation, some reflection is warranted on 'participation', which is a closely-related – - but distinct – concept (Voorberg, 2015). A participatory approach can also enable stakeholders to meet each other, share their knowledge, perceive a challenge and determine appropriate solutions. (DeLosRios--White et al., 2020). However, unlike participation, which covers a wide spectrum of different possible levels of engagement, the lower end of which is in fact very passive (as per Arnstein's famous ladder; Arnstein, 1969; or the more recent Spectrum of Public Participation; IAP2, 2014 – see Figure 4), co-creation refers to "the active involvement of end-users in various stages of the production process" (Voorberg, 2015, p.1335). Compared to conventional participative approaches, co-creation aims to go well beyond simple information-giving or consultation, where there may be only a given set of pre-selected answers possible.

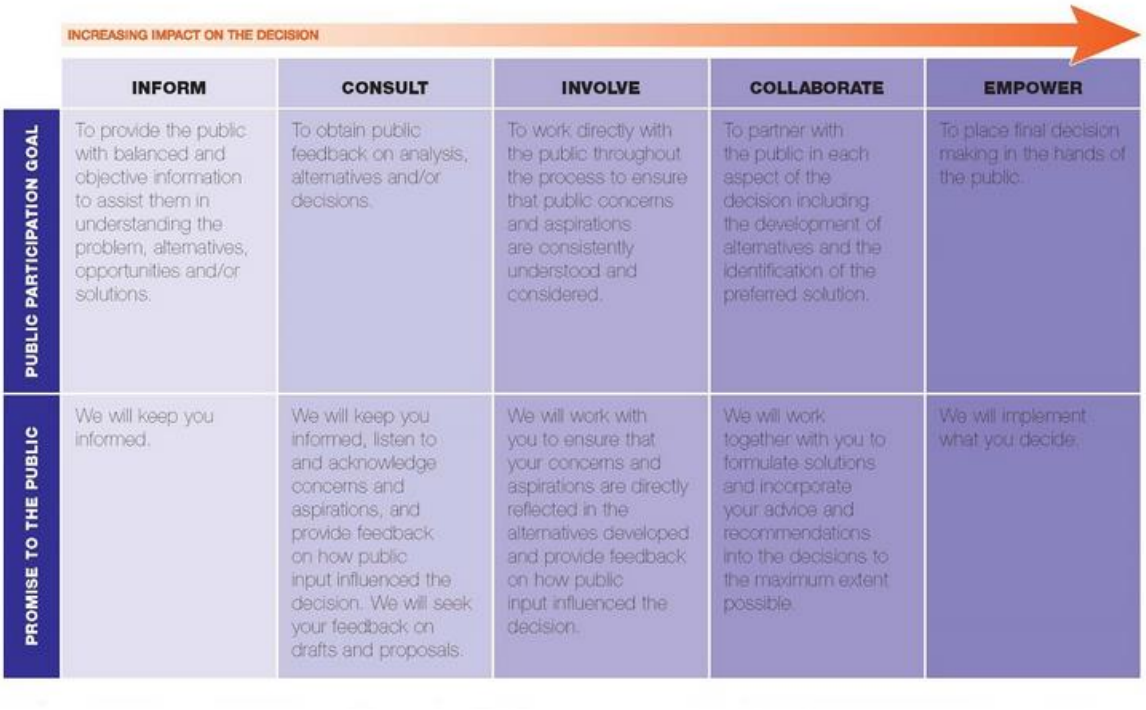

Figure 4: Spectrum of Public Participation (IAP2, 2014)

Prager (2016) goes further in distinguishing between the concepts of participation and co-creation, asserting that, aside from the active involvement of stakeholders that is necessary to characterise a process of co-creation, the main difference lies in the outcomes: co-creation "does not stop at actionable knowledge" but "requires practical outcomes", which is not necessarily foreseen in a typical participatory process (Prager, 2016). Wiek (2016) notes that practical outcomes can be "emotional, behavioural, physical and other changes in the real world". This definition would see that co-creation results in not just development of a joint action plan,, but also its implementation. Participation can therefore be described as a precondition for co-creation, while co-creation is "a further step in producing practical outcomes (Prager, 2016).

2.3. Co-creation and related concepts

After looking at co-creation and how it differs from participation, some related terms will now be examined in more detail, including 'co-production', 'co-design' and 'co-ownership'. Both co-creation – and the related concept of co-production – are considered capable of boosting social innovation and democratic participation in urban development and decision-making, and both go beyond simple participation (Lund, 2018). However, Bason (2010) sees a key difference

between the two in the way citizen involvement is approached. According to Bason, in literature on co-creation, citizens can be seen as co-designers. Here, public organizations are initiating the process while citizens are involved in designing the services. In literature on co-production, on the other hand, citizens are described as co-implementers, with less of a strategic design role, and rather a more limited role in performing certain implementation tasks. Conversely, after a systematic review of 122 articles and books on co-creation and co-production with citizens in the field of public innovation, Voorberg (2015) comes to the conclusion that there is no such clear distinction between co-production and co-creation. Instead, he sees them as linked closely enough that the terms are essentially interchangeable. The divergent conclusions of these authors illustrate some of the challenges that arise when seeking conceptual clarity for co-creation and related terms.

Mauser (2013) follows a different approach in the context of the co-creation of knowledge in transdisciplinary research on global change: here, co-production (and co-design) are described as integral steps of co-creation. (See Figure 5)

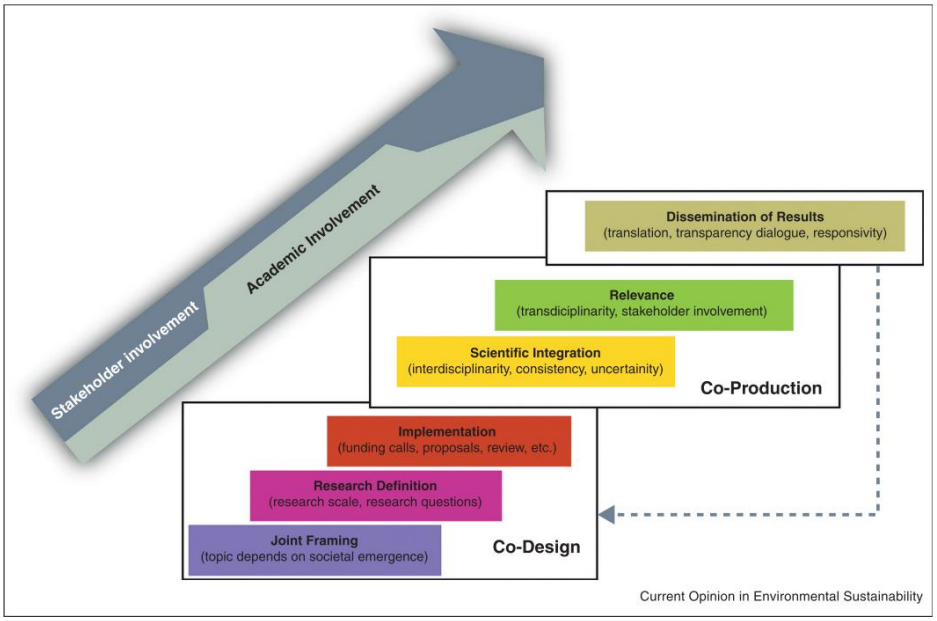

Figure 5: Framework for interdisciplinary and transdisciplinary co-creation of the knowledge castle. (Mauser, 2013)

The concept of co-design is often described as one phase of an overall co-creation process (see Figure 6) with some authors defining it as in particular the phase that allows stakeholders to identify solutions and bold opportunities together, creating an idea and prototype of possible solutions to be tested later (DeLosRios-White et al., 2020). In the context of public health, Jessup et al. (2018) defines co-design as “a participatory approach to the development of interventions that brings together staff and patients to design local solutions to local problems”

(Jessup et al., 2018, p.2). In the context of NBS, on the other hand, Szebeko and Tan (2010) describe co-design as a "creative approach that enables bringing together real-life experiences, views and skills of many different perspectives to address a specific problem" (Szebeko and Tan, 2010). Basnou (2020) further highlights the potential of the 'co-design' phase to jointly define challenges as well as the objectives for the solution.

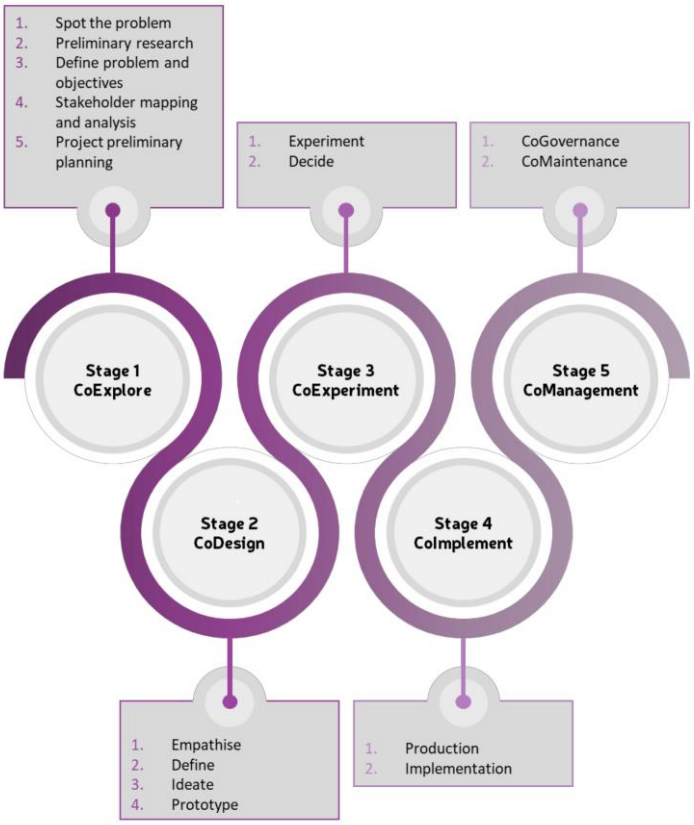

Figure 6: LCCCP with stages and substages (DeLosRios-White et al.,2020)

Zamenopoulos & Alexiou (2018) explain more generally the use of the prefix 'co-' as an acronym of 'com' (i.e. 'with') to emphasise the focus on design 'with' users rather than 'for' or 'by' users. They refer to the complexity of designing healthcare services, community gardens or other public services which cannot be fully understood and solved by one person alone. They focus on co-design characterised solely by involvement (potential or actual) users of services, not necessarily other stakeholders with potentially conflicting agendas or interests.

The term co-ownership is discussed by some scholars as a desirable outcome of a co-creation process. Van Dijk de Vries et al (2020) define co-ownership as "equal distribution of power between the research team and other, non-academic, stakeholders" (Van Dijk de Vries et al, 2020, p.2). Leask (2019) defines co-ownership in a similar manner as "to ensure equal contribution and sharing of expertise between groups of actors." In the co-creation process there Writing about collaborative urban planning processes, AlWaer et al. also point out that ownership transfer can be a desirable objective of a collaborative urban planning process, where stakeholder ownership is actively fostered as part of the process, including development of a governance structure in partnership with the community, and corresponding future responsibilities (AlWaer et al., 2020).

In summary, co-creation has been approached in different fields in academic literature as well as in EU-funded projects related to the topics urban health and wellbeing as well as implementing NBS. In both contexts, the definition of co-creation highlighted the active involvement of stakeholders and the focus on innovative outcomes. While the literature review showed that the concept is often used, it also unveiled the necessity to accurately describe co-creation especially in contrast to related terms such as participation in general. Our literature review does not conclude with a clear definition for co-creation. In fact, it is clear that several definitions exist, and some conceptual confusion exists, particularly with regard to related terms such as 'co-production'. However, we can identify certain fundamental features that characterise co-creation, as follows:

- It is an iterative, rather than linear, process - with room for adjustment and change
- It is outcome-oriented
- It demands active involvement of parties (consultation is not enough)
- Both the process and outcomes should be mutually rewarding for those involved

This lack of conclusiveness does not mean that defining co-creation is not important, (as we will see later in Chapter 4 concerning obstacles to successful co-creation). Rather, it points to the breadth of the concept, its wide scope for interpretation, and a corresponding imperative to reflect on and define each co-creation process according to the context in which it plays out. Importantly, this demands, the active input of those who are parties to the process, which we return to in Chapter 6, where recommendations are outlined.

3. Benefits and limitations

Having reflected on what co-creation is in the context of practice-based research, we now look at why it might be worth doing in the first place. There are several possible benefits of working collaboratively across disciplines and with different kinds of actors. However, given that successful co-creation also comes with additional burdens and obstacles to overcome (which will be explored in Chapter 4), it is worth identifying the rewards that make this investment valuable.

3.1. Benefits

Recent research shows that co-creation in the field of nature-based solutions can be instrumental in improving health and well-being in cities (Ferreira V. et al., 2020). Such processes, through in-depth participation of a variety of different stakeholders from e.g. society, academia, economy and public entities, have the potential to create more usable and user-friendly outputs (Brink et al., 2018). As a response to the complexity of public health issues, co-creation also opens up new avenues for innovative potential, which can lead to more beneficial outcomes in health and wellbeing in an urban context. Different authors highlight the underlying empowerment of stakeholders, and therefore the democratisation of the process, when developing NBS or public services such as specific health interventions (European Commission, 2009; Greenhalgh et al., 2016; Hölscher & Reil, 2019; Zamenopoulos & Alexiou, 2018). Through active participation, co-creation allows stakeholders to be in 'the driver's seat'. This can increase everybody's motivation which in turn creates outcomes with a higher participation rate, since everybody is welcome to speak up (Retegi, n.d.; Schneider et al., 2019). Learning about specific user needs can also help to create more targeted, acceptable, valuable and enduring outcomes, improving the credibility of the results and the chance that new innovations will be adopted in practice. (Retegi, A., n.d., Dijk de Vries, 2020).

The Connecting Nature project participants came to the conclusion that there is a need to "step away from pre-defined issues and solutions towards reframing problems that open up the view on what interventions are needed" (Hölscher & Reil, 2019). Compared to conventional engagement processes, co-creation allows to engage stakeholders who are often left out, but highly needed, to provide solutions which are innovative and in line with end user needs. It can also further empower local communities by sharing responsibilities within the framework of co-ownership. But it also comes with more practical advantages, such as potentially more sources for financial input and a better allocation of funds (Scholl et al., 2017). Lund (2018) agrees on the value of arising opportunities for other citizens to participate in addition to experts.

Most importantly, co-creation aims to share ownership of the knowledge produced (Schneider et al., 2019) which can be seen itself as a source of new knowledge that is translatable into

new solutions (Zamenopoulos, T. and Alexiou, 2018). The European Commission (2009) further refers to the value of developing, validating and integrating new ideas which can be scaled up to new market solutions. Ruoslahti (2020) especially identifies the long-term relationships developed through a co-creation process as the reason for its ability to generate innovative outcomes, due to the trust built.

Torfing et al. (2016) conclude that the most recognisable benefits are "strengthening democratic participation, the production of more efficient and effective (public) solutions, and the enhancement of social cohesion and local resilience" (Torfing et al., 2016, p. 25).

3.2. Limitations

However, despite these benefits, co-creation is by no means free from problems, e.g. power imbalances and inequalities (Leino & Puumala, 2020) and limitations.

As mentioned earlier, various definitions of 'co-creation' exist, and this can be a problem if multiple parties to the process bring to it disparate understandings (without efforts being made to reconcile them, leaving much open to interpretation and creating the potential for unclear expectations and disappointment in outcomes. This frequent lack of a clear understanding of the concept is compounded by a lack of empirical strategies for implementation. (Djenontin & Meadow, 2018; Thompson et al., 2017, Torfling et al, 2019). Torfling et al (2019) point out that despite its popularity, the concept "remains an underdeveloped practice". Itten et al. (2020) go even further, raising a "lack of evidence on how to monitor and evaluate co-creation processes and outcomes as well as a lack of evidence on the impact of co-creation" as critical limitations (Itten et al., 2020, p.25).

Researchers and practitioners keep struggling with the complexities involved within collaborative research (Kirchhoff et al. 2013), "with some recently describing the approach as vague and ambiguous in practice and lacking empirical implementation strategies" (Djenontin & Meadow, 2018, p.886). Aiming to involve all relevant stakeholders often significantly slows down the process and can lead to potentially unexpected outcomes (Itten, 2020), both of which are not easy to accommodate in a research setting which is typically characterised by time and funding constraints, and an expectation to deliver results. Multi-stakeholder partnerships also require an on-going investment in project management and in the involved partners (Ruoslahti, 2018). A lack of resources, in particular time and financial coverage is therefore a widely-recognised barrier to successful co-creation (Djenontin & Meadow, 2018; Potter et al., 2006). While the inequalities in resource availability can be addressed to some extent (also see obstacles and mitigation strategies in Chapter 4), it is very challenging to fully address power imbalances.

In reality, it remains difficult to fully legitimise the process. Legitimacy demands a fair process of feeding in all relevant ideas. However, this is where the concept of co-creation reaches its limits. Is it realistic to involve all relevant parties? Inevitably it will not be possible, so who decides which to exclude? Further, even among those who are included, it may not be possible to create an entirely level playing field: inequalities are likely to remain due to different sets of resources and competences (Lund, 2018). For instance, funded researchers may have significant time to dedicate to a co-creation process while community members contributing on a voluntary basis can hardly be expected to invest the same amount. Power imbalances and inequalities therefore remain as limitations (Leino, 2020). This is not to discount the importance of making efforts to address them – see further discussion in Chapter 4 – but rather to acknowledge an inherent imperfection of co-creation as an approach. Additionally, the question arises to which extent citizens can – or should – take responsibility for solving complex issues such as implementing public health interventions in combination with the development with new, innovative approaches. As Bentzen (2020) point out, in the case of public staff under increasing pressure to deliver services with decreasing budget and capacity, there is a risk that the concept of co-creation is deployed as a tool to supplement essential services that should be publicly supplied with resources from the community.

In order to design and implement co-creative processes in a way that enables its full beneficial potential, effort and time from all participants is required. Even though the process can be difficult and is time-consuming, the full innovative potential can unfold when participants find the process meaningful, even if there are delays and uncertainty that is beyond their control.

4. Obstacles & Enablers

Having explored different definitions, benefits and limitations of co-creation, this chapter examines the questions of how to successfully co-create: outlining the main obstacles and, conversely, ways to enable successful co-creation.[4] Both obstacles and enablers are grouped into three sub-categories based on their mentions in the respective literature:

1. Meta level: Leadership and reflection
2. Individual level: Personal behaviour and responsibility
3. Process level: Interaction between stakeholders

In reality the distinctions between categories are somewhat fluid, as will be seen from the discussion below. For example, some enablers can be seen as a product of both individual and managerial factors, e.g. trust can be earned by individuals demonstrating that they are reliable, but also by a leader setting up a process that is transparent and consistent. They are nonetheless useful for structuring our discussion.

4.1. Obstacles

The road towards successful co-creation is full of obstacles which those involved should be aware of. What are these barriers and how can they be overcome?

4.1.2. Individual level

Several barriers can arise at the level of individuals engaging in co-creation, in relation to their knowledge, their expectations and their behaviour. A first barrier on an individual level mentioned by Ruoslahti (2018) is a lack of awareness regarding the advantages of co-creation. If research partners do not acknowledge the added value of a co-creation process, or if the incentives to participate are too low, it can easily lead to a lack of commitment, which is itself a barrier (Pirinen, 2016) and a shift away from trying to co-create, in favour of the easier route of doing things independently. Another barrier is different understandings of the same terminology within a group, especially in one with a large, complex team structure consisting

4 For our purposes, “enabler” is used as an interchangeable synonym for “principle”- both terms are commonly used in literature to describe beneficial propositions. For Instance, the ACCOMPLISSH project uses the term ‘enabler’ in the context of co-production of research; Kleinsmann & Valkenburg (2008) use the term when discussing the importance of a shared understanding in co-design projects and Pirinen (2016) use it in the context of the co-design of public services. On the other hand, Leask et al. (2019) use the term ‘principle’ in their discussion of co-creating public health interventions, and Norström et al. (2020) in relation to the co-production in sustainable research.

of many disciplinary backgrounds, which can hinder the group from effectively communicating with one another.

Several authors highlight mismatched or unrealistic expectations within a multi-stakeholder group as a barrier which needs to be addressed at an early stage of the process (Djenontin & Meadow, 2018; Potter et al., 2006; Pirinen, 2016; Chapman et al., 2018). Defining early on objectives, roles (who is responsible for what and accountable to whom), and using a variety of formal and informal communication channels are therefore of great importance (Pirinen, 2016; Ruoslahti, 2018). While role definition is crucial, it can also be obstructive when partners are too fixed in their roles and not prepared to adapt (Chapman et al., 2018, after Pohl et al., 2010; Torfing et al., 2016) or when individuals resist change because of reluctance to abandon long-established habits or to leave their comfort zone. This is often connected to rigid hierarchies, the existing power distribution, prejudices or mistrust. A distinctive tendency for top-down thinking or missing support for building new networks within cross- organisational collaboration are further characteristics of resistance of change (Pirinen, 2016). But sometimes the issue also lies simply in uncertainty from participants about their own role in the project (Brink et al., 2020).

Trust and respect cannot be automatically assumed and need initial an investment to be established and built over time (Potter et al., 2006). Pirinen (2016) describes a need to overcome existing prejudices at the beginning of co-designing public health services. In this case, while some stakeholders were suspicious about the co-design approach itself (as described on the individual level), others lacked trust in the abilities of a certain group of people involved. Initial mistrust can also result from a past negative experience with a similar process, as described by Djenontin (2018) after Foley (2017): the difficulty was to establish a co-production process including local residents and external researchers where they had been previously been involved in previous unsuccessful collaborative research projects. Here, the basis for mistrust was not uncertainty, but rather pre-existing personal and professional relationships due to power asymmetries, poor information flow and perceived unwillingness of the researchers to understand the arguments raised by the community, leading to poor community involvement..

Schmalzbauer (2018) refers to another barrier on an individual level: a lack of skills and knowledge, e.g. when it comes to a specific topic such as nature-based solutions and their implementation. As a limited knowledge base can hinder the successful implementation of innovative solutions, the “unwillingness or inability of people to seek input and learn from others or to transfer knowledge” (Pirinen 2016, p.28) is described as problematic.

4.1.2. Process level: interaction between stakeholders

A second group of barriers concerns the process of interaction among the different parties to a co-creation process. When many different stakeholders interact, a number of process-based barriers can inhibit their successful collaboration. First, it is a challenge to engage relevant stakeholders in the first place, especially community members (Schmalzbauer, 2018). It is crucial to reflect on the question of who is participating and who is not – and why. Some citizens have more resources such as money, time or knowledge which might be advantageous for participating in a co-creation process. In contrast, certain groups, e.g. women, ethnic minorities, low income earners or disabled people might not have the same access, and could easily be excluded if efforts are not made to involve them. This can also lead to a psychological barrier as some people may perceive that their input is considered less relevant than others. Consequently, some potentially highly relevant stakeholders might exclude themselves from the process not only due to a lack of capacity but also due to a sense that they do not have a genuine claim to be involved, or that their contributions are not likely to make any difference (Leino, 2020).

After this initial challenge to include and engage all relevant stakeholders, there are several other challenges during the collaborative process. In order to establish trust and confidence in other stakeholders' abilities (see earlier discussion of trust at an individual level under part 4.1.1), it is essential to have an ongoing communication flow. Insufficient or non-transparent communication can be a major issue, often connected to an existing language barrier or cultural differences (Djenontin & Meadow, 2018). Pirinen (2016) gives the example of unfamiliar words and terms which might create misunderstandings and leads to delays in finding common ground. For example, the language used in a city administration often differs from the language used in academia or in communities, all using their own terms (or sometimes the same terms, but meaning different things). Also, a need to rely on remote communication, which has become the norm during the current global Covid-19 pandemic, can negatively influence communication. Djenontin & Meadow (2018) relate their experience of conducting research in a remote location that lacked internet access, which made it difficult to share resources with fellow scientists and, conversely, for the local community to access research outputs. Face-to-face meetings are recommended where possible to ensure sufficient communication and active learning.

Conflictive perspectives and priorities (Schneider et al., 2019), different interests (Pirinen, 2016) and a lack of clarity about common goals within a group (Schmalzbauer, 2018) can be further obstacles. If not resolved, these can lead to conflict during the process, which can easily escalate if there is no conflict resolution mechanism in place (Chapman et al., 2018, after Pohl et al., 2010). Circular discussions around values and priorities can lead to frustration, or even

stop the group's progress entirely. Schneider et al. (2019) analysed 31 transdisciplinary projects conceptualising the link between transdisciplinary co-production of knowledge and sustainability transformations and gathered shared experiences while implementing their theories of change. They describe how participants felt stuck and got the feeling that they could not learn from each other because their thinking seemed to be too far away from others. Overcoming these obstacles can be a challenge, but some projects have succeeded in using the frustration as a 'learning edge'. Tailored knowledge input and investment in trust-building activities can help to stimulate a further productive debate and restore motivation.

4.1.3. Meta level: leadership and reflection

Failures in leadership can exacerbate or in themselves trigger some of the individual level or process level obstacles described above. Different authors discuss key obstacles at the leadership level, including a general lack of integration (Chapman et al., 2018, after Crosby et al., 2010), unclear or poor allocation of responsibilities (Pirinen, 2016) or insufficient adaptation to the needs of stakeholders (Schneider et al., 2019). Potter et al. (2006) refer to inappropriate or inequitable distribution of power and control. Having power means "the ability and the resources to negotiate and adapt interests during the process of knowledge co-production" (Pohl, 2010, p.271). Imbalances arise when specific disciplines or actors are privileged over others in contributing to the process.

In their *Guidelines for urban labs*, Scholl et al. (2017) raise another issue in the context of their 'urban labs' methodology (further described in Chapter 5). According to the authors, 'solutism' can be a problem, i.e. focusing solely on practical outcomes rather than on the inherent value of experimentation and learning. However, this is a difficult obstacle to overcome, given that it can be difficult to gain political and financial support for processes that are not results-oriented, especially in the context of implementing nature-based solutions (Schmalzbauer, 2018; also see Box 1 below). Lack of political support is also occasionally connected to the resistance of public sector actors to adopt a bottom-up engagement model that might challenge well-embedded administrational structures (Leino, 2020).

BOX 1: R-URBAN

Petrescu et al. (2016) address contemporary processes of resilient co-production within the city, focusing on the case study of a project called **R-urban**, a bottom-up project initiated in a suburban town near Paris in order to catalyse creation of local production-distribution cycles, including sharing knowledge about recycling, self-construction, urban agriculture and collective housing. Unlike other top-down regeneration strategies facilitated by external managerial structures, in r-urban the researchers, architects, designers and planners acted as initiators, facilitators, mediators and consultants within a 'pluralist' approach that provides a platform for wider participation. The r-urban hubs generated local 'ecosystems' of services and products that connected existing and emerging civic projects and practices. Residents were encouraged to both buy and create local products. In the end, the r-urban experiment was not accepted by politicians, however the people involved don't consider it as failure but take away the lesson to not underestimate the importance of political agency. "a commons-based resilience project is a political project too and skills for negotiation with mainstream political institutions are needed (Petrescu, 2016, p. 733)." While not every project seeking to deploy co-creation (or co-production) may have such ambitious and long-term aspirations as described in this study, the prospect of potential new roles for architects and planners (linked to the enabler 'flexibility'), as well as the imperative of engaging with existing governance structures in the interest of gaining support and longevity (lack of political will as a barrier with the potential to derail the whole endeavour), are both relevant also to shorter-term processes of co-creation.

4.2. Enablers

After summarising recognised obstacles from the literature, this sub-chapter focuses on typical enablers (some of which could also be described as principles or values) for a successful co-creation process – though it should be noted it is not an exhaustive list. As Anton et al. point out, in the context of the proGireg project on co-designing nature-based solutions, using enablers (or principles) to define the process, instead of a more prescriptive 'step-wise' approach, can help to keep the procedure adaptable to different contexts (Anton et al., 2019).

Baker et al. (1999) assert, however, that it is not sufficient to just adopt a set of principles, as these are highly interrelated and therefore work synergistically. As an example, they describe 'respect' as a core principle which is likely to provide a basis for 'honouring each other's different agendas'. Depending on the stage of the process, some enabling principles might be more important than others.

4.2.1. Individual level

Looking at an individual level, three elements are particularly relevant: trust, commitment and co-ownership. Schneider et al. (2019) call 'trust' a success factor for the transdisciplinary co-production of knowledge "e.g. regarding sustainability assessments, joint future visions, or identification of best practices" (Schneider et al, 2019, p. 32). Djenontin & Meadow (2018) discuss the significance of trust and relationship-building in particular at the beginning of a project. This gains even more weight when dealing with problematic pre-existing personal and professional relationships as mistrust and prejudices need to be resolved. Pirinen (2015) provides one of the few studies on research projects with a focus on higher education, finding that trust-based interactions are crucial in knowledge co-creation. He underlines the necessity of trust for learning and as a requirement to stimulate creative innovation. Ruoslahti (2020) points out that trust is an essential precondition for individuals to feel comfortable sharing their own experience. Hägele (2019) describes trust as social capital which is an important ingredient for the development of robust commitment (also see Box 2 below).

To foster trust and commitment, Schneider et al. (2019) discuss the integration of knowledge promotion strategies in collaboration processes e.g. training or the attractive visualisation of latest scientific insights of high interest for participants. Those knowledge promotion strategies can again become an entry point to discussions, and catalysts for joint learning. Hansson & Polk (2017) evaluated knowledge co-production for sustainable urban development gathering experiences from project leaders and participants at the 'Gothenburg Local Interaction Platform 2012–2015'. They concluded that people who participated in co-production projects experienced stronger learning processes and were able to change perspectives much easier. They further point out that "participants in the projects with a higher degree of collaboration have been more committed (and) therefore been more open to learning. Individual commitment to the projects is thus central to the learning that occurs" (Hansson & Polk, 2017, p.8).

While Brink et al. (2018) focus on enhancing capabilities for, and interest in, participation, Hägele (2019) points out that not only willingness to participate must be present, but also a sense of responsibility. Scholl et al. (2017) and Leask et al. (2019) go even further and consider how participants can initiate and operate their own processes within a living lab (see Chapter 5 below for more on living labs). This process of 'manifesting (co-)ownership' includes figuring out where and how responsibilities and control can be shared within the group, and supporting participants in articulating and discussing their different interests. Scholl et al. (2017) consider

co-ownership as important to ensure long-term sustainability of the process and its results, as stakeholders are more likely to then feel responsible for continuing the work when they are owners of the process themselves.

BOX 2: GREENSURGE PROJECT

Researchers in the project **GREENSURGE** analysed the success factors underlying six case studies in the field of communal urban gardening. In addition, results showed the importance of clearly communicated objectives, financial resources or social capital, and municipal support - as well as a willingness for municipal staff to let go of a degree of control (linked to the enabler 'trust') (van der Jagt et al., 2017).

4.2.2. Process level: interaction between stakeholders

The second group of enablers concerns the process of interaction among the different parties.Following an inclusive, equitable and pluralistic approach is recognised as essential. Bringing together diverse actors with different types of knowledge and providing them with equal opportunities to meaningfully contribute helps to gather different ideas and gain mutual understanding (Norström et al., 2020; Wilk, 2020; Latinos et al., 2019). Djenontin & Meadow (2018) highlight the importance to pay attention to gender diversity as well as possible language barriers within an inclusive process of getting together relevant stakeholders. The latter can be the cause of misunderstandings or frustration, while the former can support ideas and knowledge sharing, and may indeed be crucial to the effectiveness of results, since "neglecting the influence of gender issues and norms is often tied to ineffective outcomes" (Djenontin & Meadow, 2018, p.897). As addressed in sub-chapter 4.1.2 on obstacles, a language barrier between researchers and local participants also needs to be taken into account while following an inclusive approach. For this reason, it is favourable when people are aware of the different backgrounds and enough time is given to people to express their position and share ideas.

Related to equality, inclusivity and plurality is the principle 'transparency', which demands that key information is shared openly with all parties to the process. Greenhalgh et al. (2016) discuss the importance of creating ''space for transparency, deliberation, and inclusion of diverse stakeholders'' while Leask et al. (2019) focus on transparency related to sharing information about the aims of the project. In the document *Clever Cities Guidance on co-*

creating nature-based solutions, Schmalzbauer (2018) notes the relevance of transparency in order to generally make relevant information accessible to all stakeholders.

Several authors, such as Wamsler (2017) and Schmalzbauer (2018), point out the importance of fostering participation and ongoing interaction during the process. The degree of interaction is often directly linked to usability and usefulness of the outcomes produced (Djenontin & Meadow, 2018). Ruoslahti (2020) agrees that especially the participation and confidence of practitioners within communities is essential. Due to the importance of ongoing interaction, engagement and communication activities are widely recognised as cornerstones for successful co-creation. Cooperation tools and an easily accessible environment help to foster long term relationships and set a base for knowledge sharing (Ruoslahti, 2018).

To ensure sufficient and transparent communication, Scholl et al. (2017) points out the importance of proactively establishing mechanisms for ongoing dialogue, e.g. setting up regular meetings to discuss different participants' agendas, instead of waiting for individuals to raise an issue. Physical spaces for dialogue give room for interaction and experimentation, but space can also be digital, e.g. online meetings. Whether the space is real or virtual, preparation, facilitation and structure are critical. Both physical or digital spaces can be used to find a joint understanding about an overall vision and common goals. This is widely recognised as another enabler in the respective literature (Scholl et al., 2017; Anton et al., 2019; Kleinsmann & Valkenburg, 2008; Pirinen, 2016; Ruoslahti, 2018, 2020; Schneider et al., 2019). As a first step, it is important to understand the different values and individual goals that exist in the group. Then, to look for common objectives from which all stakeholders benefit from and agree on (Ruoslahti, 2020). For Scholl et al. (2017), shared purposes within a living lab are "key starting points for defining and building the organizational structure of the lab". As a lesson learnt from the ProGIreg project, Anton et al. (2019) also identify a new 'common identity' within a lab as a recurring element which helps to develop a collective responsibility for arising tasks (Ruoslahti, 2020). In order to keep the common vision alive, Wamsler (2017) points out the relevance of consistency in project participation as a change of participants can be counter-productive.

Finally, although an element of common ground is essential, it is worth noting that different, including conflictive, viewpoints within a diverse group is also advantageous to the process, as it increases the potential for innovative outcomes – also known as the 'collaborative advantage' (Pirinen, 2016).

4.2.3. Metalevel: leadership and reflection

Effective leadership is essential to successful co-creation. Leaders have a fundamental role in creating an enabling environment that supports the individual and process levels: steering the process, setting priorities and making short-term and long-term decisions. Conversely, poor leadership can exacerbate or even itself trigger the obstacles outlined in earlier sub-chapters. Besides the reflection on the meta level, enablers which are connected to setting up a supportive enabling environment for co-creation are elaborated in this subchapter.

Scholl et al. (2017) first refer to the long-term orientation of the co-creation process, in relation to living labs. They explore the question of what leaders should focus on. In doing so, they recommend avoiding 'solutism' (as described under obstacles in sub-chapter 4.1.3 above)and instead focusing on the inherent value of experimentation and learning as an important success factor. Remaining open to unexpected outcomes and seeing the value in the collaborative process itself requires courage and the necessary resources. The unpredictability that accompanies this process can be challenging to accept and deal with. However, Hansson & Polk (2017) highlight unpredictably as an essential precondition for creative processes. They also mention the ability to adapt to ongoing societal processes as a driving factor. The related importance of flexibility is also mentioned in different project contexts such as the ARCH and ProGIreg projects, both with a focus on co-creation in local government contexts(e.g. Anton et al., 2019).

The leadership level is supposed to provide space and time to foster trust and commitment, strong participation and a joint understanding within the group. Potter et al. (2006) highlight the importance of allowing adequate time in all phases, not only to adequately prepare for seminars and workshops, but also to address unexpected developments (Hansson & Polk, 2017). Last but not least 'legitimacy' is another principle to ensure a process which is trusted by participants and includes legitimate and credible knowledge (Hölscher & Reil, 2019). Cash et al. (2002) define legitimacy as "how fair an information-producing process is and whether it considers appropriate values, concerns, and perspectives of different actors" (Cash et al, 2002, p.2). While legitimacy is often considered as something to be addressed once the co-creation process is already underway, Djenontin & Meadow (2018) argue to explicitly consider it already during at the beginning of the process, based on their experience in five case studies where trust and relationship-building as precursors needed greater attention at the start of the project.

The importance of finding common ground was already discussed on a process level, however leadership is critical in supporting this. Scholl et al. (2017) and Hegger et al. (2012) point out the importance of articulating the purpose of co-creation, where different perspectives, backgrounds and knowledge exist, in the context of living labs. Leask et al. (2019) agree that the aim should be jointly shaped and agreed on by the 'co-creators' from the beginning of the process. This should be used as a point of reference throughout the process, to ensure that a

project stays on course, especially when decisions need to be made about key actions or strategies to adopt. Effective leadership is needed in order to structure contributions from all co-creators in a systematic way (Baker et al. 1999). Hegger et al. (2012) argue that the framing of the aim(s) of the co-creation process should not be too broad in order to be successful. Besides a clearly defined overall aim, short term goals should be included within the process as well to identify the timing of relevant milestones towards success on the way (Strecher et al., 1995).

Another dimension that the leadership level can provide is space and time for reflection on the process – critical to the 'iterative' nature of co-creation as described in Chapter 2. Ruoslahti (2018) discusses the general need for facilitation and monitoring and Greenhalgh et al. (2016) describe leaders who advance democratic structures as well as create spaces for transparency, inclusivity and diversity. Many authors point out the importance of reflection and flexibility within the leadership level (Scholl et al., 2017; Hansson & Polk, 2017; Leask et al., 2019; Potter et al., 2006; Regeer, & Bunders-Aelen, 2009; Ruoslahti, 2018; Schneider et al., 2019). Authors phrase it as "initial and continuous reflections" (Hansson & Polk, 2017), or an „on-going cyclical endeavour" (Ruoslahti, 2018, p.8) to „evaluate the co-creation process (Leask et al., 2019)." Continuous reflection and preparedness to learn from mistakes and improve the process are preconditions for success. Hägele (2019) raises another interesting aspect regarding the management of failure. They support a risk-taking administrative culture where, instead of reducing risk to a minimum, conflictive situations and failure are welcomed as opportunities to learn. However, this proposition obviously needs to be handled with extreme care, in order not to derail the process entirely.

For Pirinen (2016), management support is especially important for guaranteeing that temporary multidisciplinary teams remain able to produce. In the framework of their case study, they identify influential factors concerning the creation of a shared understanding on three levels (actors, project and company level). While the first two concern knowledge transfer or the efficiency with which information is processed and communicated (described in sub-chapters 4.2.1. and 4.2.2), the company (or meta/leadership) level looks at the organisation of resources and the allocation of tasks. On this level, they highlight organisational support for building new networks as the main principle for cross-organisational collaboration success, in their specific case in developing services for the elderly in an urban area. Aside from customer-centeredness, they consider it "crucial to develop methods and practices for facilitating actual collaboration between actors in a particular context" (Pirinen, 2016, p.29).

An effective leader should also steer the definition of different roles and contributions, and maintain an overview of who is doing what (along with acceptance that this may change over time). Depending on the role as initiator, funder, coordinator, partner or participant, responsibilities vary significantly and need clear definition, communication and coordination by

leaders (Scholl et al., 2017;). Leask et al., (2019) agree that identifying the status and role of each co-creator is fundamental for the process. At the local level of co-creation, a stakeholder mapping is a crucial initial step (also see sub-chapter 5.3 below) to identify relevant stakeholders (Anton et al. 2019).

The enablers and obstacles described above can be used as support to raise awareness of likely problems before they arise and as guidance (especially for leaders, e.g. coordinator or WP leads). In conclusion, the following can be seen as among the most important enablers and obstacles:

- On an **individual level**, it was seen as most relevant that stakeholders are committed and have trust in the process. It was therefore presented as challenging when people were too fixed in their roles and resistant to change. Existing prejudices towards the process but also towards other stakeholders were likewise seen as problematic.
- On the **process level**, the most important enablers were found to be inclusion, diversity (related to equality) and transparency, as well as finding a joint understanding, continuous dialogue, and relationships based on trust and respect. On the other hand, it was shown as challenging to sufficiently arrive at social inclusion, especially reaching out to relevant stakeholders. Furthermore, it can get challenging when conflictive perspectives and mismatched expectations come up within the group or when effective conflict resolution strategies are missing in order to adequatly deal with diverging perspectives. Also, insuffient or non-transparent communication, occasionally connected to an existing language barrier or working remotely, can hinder a successful co-creation process.
- Last but not least the **leadership level** is of fundamental importance to implement a successful process and support the implementation of the enablers on the other two levels. Leaders should provide enough room and time to foster trust and commitment and to help merging agendas. They should follow a strategy of clear coordination and communication and continuously reflect on the process to be able to react to arising, context-specific challenges, be flexible enough to make changes where needed and establish mechansims for conflict resolution.

4.3. Mitigation strategies

Having explained various obstacles at different levels, the question remains how to overcome them. To this end, the following table provides pointers for possible mitigation strategies. This is not an exhaustive list, but provides a starting point for consortium partners to already consider the kinds of difficulties likely to arise and possible ways to deal with these.

OBSTACLES	MITIGATION STRATEGIES
Individual level	
Lack of awareness and commitment	Invest time in presenting added value and benefits, incentives for stakeholders (Hägele, 2019) Consider how participants can initiate and operate their own processes (co-ownership) (Scholl et al., 2017) Set short term goals (Norström et al., 2020)
Lack of skills, limited knowledge base	Ensure access to relevant information for all actors (Schmalzbauer, 2018) Offer research-based advice and training (Schneider et al, 2019) Enhance knowledge sharing through joint practices between actors with different backgrounds (Schneider et al, 2019)
Process level	
Difficulties engaging relevant stakeholders with a limited set of resources	Use stakeholder mapping to identify relevant stakeholders and their specific roles Targeted engagement programs for less powerful citizens
Insufficient communication, language barrier	Engage knowledge brokers, boundary organizations* or “change agents” who spread the outcomes in the organisation, build co-design skills and connect people (Djenontin & Meadow, 2018) Provide a shared platform or physical location for discussion and experimentation (Scholl et al., 2017) Develop training modules, attractive visualisation of latest scientific insights = entry point to discussions (Schneider et al., 2019) Adjust communication/wording according to context (Pirinen, 2016) *‘boundary organizations’ are defined as belonging neither to the realm of science nor to the realm of politics (Pohl, 2010).

OBSTACLES	MITIGATION STRATEGIES
Conflictive perspectives and priorities	Set up regular meetings for discussing the participants' agendas
Lack of trust and respect	Use a variety of formal and informal interaction channels (Pirinen, 2016) Run trust-building activities from the beginning (Djenontin & Meadow, 2018) Foster Interactions, build on prior positive relationships (Potter et al., 2006)
Leadership	
Insufficient adaptation to needs of stakeholders	Undertake needs assessment
No common goal	Provide enough time to share different ideas and gain mutual understanding (Scholl et al., 2017)
Uneven distribution of power, power imbalances	Foster democratic processes and leadership (Potter et al., 2006) Set up neutral or rotating meeting place (Scholl et al., 2017)
Mismatched, unrealistic expectations	Define early on who is responsible for what and to whom (Djenontin & Meadow, 2018; Potter et al., 2006) Ensure evenly distributed power constellations (Ruoslahti, 2018)

5. Co-creation in practice: tools, methodologies and examples

Awareness of the enablers described above, along with mitigating strategies to address obstacles, goes some way towards establishing a successful co-creation process. However, tools and methodologies are needed to make these operational. As described in Chapter 2, co-creation in urban development has some commonalities with more traditional processes of participation, which seek to engage a pool of stakeholders, including community members, in planning and decision-making - and hence some of the established formats for participatory engagement can support a co-creation process. However, crucially, co-creation foresees an active involvement of participants, i.e. at the 'collaborate' or 'empower' end of the IAP2 spectrum, which is not compatible with more passive forms of participation and their associated tools and methodologies. This chapter begins with a tabular overview of several methodologies and tools, along with their strengths and weaknesses. Three of the more promising methodologies, and several tools, are then described in more detail. Finally, we conclude by looking in particular at digital tools, as their relevance significantly increased with the Covid-19 pandemic but also in the face of a wider, ongoing digitalisation trend.

5.1. Overview of tools and methodologies

Before presenting the overview of tools and methodologies below, it is worth mentioning that some scholars have noted that the effectiveness of such instruments commonly used to support participatory decision-making is often not validated, and that certain formats are in any case only capable of offering limited involvement, e.g. voting (Steltzle et al., 2017). Taking into account that there is a rising demand for digital participation in urban design, Stelzle et al. go on to assert that it is essential to first investigate effective participatory decision making in non-digital formats in order to translate them into digital ones (Steltzle et al., 2017). Given that such an investigation is well beyond the scope of our brief study, our purpose here is rather to highlight a selection of available instruments and approaches, with the cautionary note that this is not an exhaustive overview, and that readers looking to employ any of those listed would do well to explore further their 'fitness for purpose'.

TOOL OR METHODOLOGY	DESCRIPTION	STRENGTHS AND WEAKNESSES	LINK TO EXAMPLE
Design Thinking (DT)	Uses divergent (e.g. a structured brainstorming process) and convergent thinking (focusing on different proposals to select the best choice).	DT helps to go through a process of pattern finding and synthesis to arrive at solutions or opportunities. Some of these prescriptions have been criticised for oversimplifying the design process and trivialising the role of technical knowledge and skills.	https://www.blog.urbact.eu/2018/02/design-thinking-to-co-create-cities-of-the-future/
Living Lab	Research concept defined as a user-centric ecosystem, operating in a territorial context, integrated with society and real-life context concurrent research and innovation processes, using a variety of methods of co-creation with multi-stakeholder participation and generally provided by a scientific or academic institution.	This concept involves user communities, not only as observed subjects The human-centred approach is a strength, but there has to be taken special care to consider the life of other species and how these are affected by changes.	https://www.rotterdaminnovationcity.com/News/south-of-rotterdam-living/
Life Cycle Co-creation Process (LCCCP)	This is a complex method involving various stages and substages, where stakeholders and engagement methods and tools are mapped and defined.	LCCCP thinks beyond the planning and creation phase by specifically including maintenance which is a central factor for sustainable solutions	https://unalab.eu/en

TOOL OR METHODOLOGY	DESCRIPTION	STRENGTHS AND WEAKNESSES	LINK TO EXAMPLE
Dragon Dreaming (DD)	This is a framework for integrating different approaches into a single model where the priorities and values of the individual are important. It is conducted in four stages: dreaming, planning, performing and celebration:	This concept derives from the concept of 'deep listening' to enable more transparent dialogue and establish more empathy. Time consuming, and may not reach a high number of participants.	**https://dragondreaming.org/toolbox/**
World Cafe	Participatory dialogue in groups structured for knowledge sharing in a friendly atmosphere as in a cafe. Pre-defined questions should be agreed upon at the beginning, but outcomes or solutions are not decided in advance.	The collective discussion can shift people's conceptions and encourage collective action. Some degree of formality may be retained to make sure that everyone gets a chance to speak. Practical questions to be considered: important role of moderators, time management, and how to document the results.	**https://urbact.eu/world-caf%C3%A9**

TOOL OR METHODOLOGY	DESCRIPTION	STRENGTHS AND WEAKNESSES	LINK TO EXAMPLE
Public participation geographic information system (PPGIS)	Concept that can help citizens and stakeholders to identify locations on a map of various aspects, often intangible ones, such as perceptions, preferences, or values and associate them with different ecosystem services.	This method has potential to improve the representativeness and accuracy of current expert-based assessments, to highlight provision of difficult-to-map services, and to increase understanding of functional synergies and complementarily. Issues include map-literacy and digital literacy as a pre-requisite that can affect the inclusivity of the method (could e.g. be combined with other methods).	https://www.balticurbanlab.eu/
Citizen assemblies	Informed decisions are made by a randomly-selected group of people with every citizen having equal opportunities to be selected.	Question of decision-making power to be solved and communicated in advance, refers to expectation management. Random selection process in conflict with targeted involvement of underrepresented groups	https://www.involve.org.uk/our-work.
Social media platforms	Social media includes all interactive, digitally-mediated technologies that facilitate the creation or sharing/exchange of information, ideas, and other forms of expression via virtual communities like Facebook, Twitter, TikTok etc.	Digital literacy can be a challenge in terms of inclusion of all relevant stakeholders. For this reason, recommendable to be used in combination with other methods.	http://r-urban.net/en/

TOOL OR METHODOLOGY	DESCRIPTION	STRENGTHS AND WEAKNESSES	LINK TO EXAMPLE
Augmented reality (AR)	An interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities including visual.	Combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects. Not always a user-friendly approach, costly maintenance, potential to results in unequal involvement of different stakeholder groups unless targeted efforts made, language silos between different experts, e.g. planners and software developers.	https://www.augmentedurbans.eu/

5.2. Methodologies

In this section, we describe in more detail three methodologies that can support co-creation. These have been selected for their relevance to the GoGreenRoutes project. The first two deal with a very similar focus area (researchers engaging with municipal staff in the area of NBS), while the third looks at different applications of the popular 'living lab' methodology.

DeLosRios-White et al. (2020) developed a **Life Cycle Co-Creation Process** (LCCCP) for NBS, which is a step-wise approach built on the principle of continuous improvement and the concept of Design Thinking and comprising five stages, i.e., CoExplore, CoDesign, CoExperiment, CoImplement and CoManagement, creating a unique path that can be followed by practitioners for NBS co-creation.

The **CLEVER Cities guidance on co-creating nature-based solutions** presents another stepwise approach to co-creation (Morello et al., 2018), aiming to support cities to better implement NBS, and achieve flexible, open, equitable urban resilience, and to adapt to climate change. The second part of the guidance contains a toolkit for the implementation of the co-creation process, including 16 steps envisioned in a complete co-creation pathway to support cities to achieve successful implementation of nature-based solutions (Morello et al. 2018).

Menny et al. (2018) define (urban) living labs as scenarios where users fruitfully engage in a participatory methodology, facilitating co-creation and enhancement of the transformative potential (Menny et al, 2018). Mulder (2012) describes 'living methodologies' as methodologies

related to the measurement of behavioural dynamics, capturing social experiences of everyday life that can foster innovation in real-life contexts. Mulder (2012) reports on three cases from Rotterdam in the Netherlands, where "living labbing" was used to enable citizens to co-develop their city. These cases utilized visual ethnography as a research method. The cases not only inspire citizen participation, but also inform social innovation and policymaking.

Mačiulienė et al. (2020) applied the **living lab** concept as a way of opening up innovation processes through online and offline collaboration between urban policymakers, non-profit organizations, citizens and other stakeholder groups. Their research presents a systemic approach to digital co-creation by applying a monitoring technique based on a so-called digital co-creation index (DCCI). It offers a systematic understanding of the main factors shaping co-creation processes in living labs while considering an interdisciplinary perspective. With this systematic approach it is possible to identify potential areas of improvement and to compare different cases using common indicators. As another example, the UNaLab project (https://unalab.eu/en) developed demonstration areas through the implementation of living labs in European cities. Their living labs are aimed at involving end-users in the process of developing a product or a service in order to create valuable experiences together.

5.3. Non-digital tools

In this section we look in more detail at (non-digital) tools to support the co-creation process. Ferreira et al. (2020) analysed the current situation regarding citizen and stakeholder participation in projects with a focus on NBS. They concluded that stakeholder and citizen participation or collaboration in NBS is increasingly recognised as promising. However, research in several related domains is still lacking. Their analysis of 142 research papers revealed that questionnaires and surveys have been the most common tools used in participatory processes in the context of implementing NBS, as they are easy to implement for the collection of citizens' perceptions and preferences. But also, GIS- based tools such as PPGIS or 3D visualisation were commonly used tools to involve citizens and stakeholders as participants on NBS (see sub-chapter 5.4 below). In the following paragraphs three examples of implementing co-creation tools are presented in more detail: participatory budgeting, citizen assemblies, and stakeholder analysis.

The **participatory budget** is a tool that has been employed with success in Tallinn (Estonia). Everyone who has registered as a resident of Tallinn can submit their ideas to their district of residence on how to allocate Tallinn's city budget. When submitting an idea, residents must take into consideration that the participatory budget can only be distributed between projects that are for public use or open access facilities. The submitted ideas are evaluated by a committee of experts. Selected ideas go on to a presentation stage, a discussion stage and then to a referendum. In each district, the project that has been proposed by the residents of the district that has received the most votes and that meets the conditions of the participatory budget will be implemented next year. A participatory budget creates a good platform for the emergence of ideas that improve communities; it raises residents' awareness of how local government is managed; gives the local government direct feedback on the wishes and needs of the residents; increases active and collaborative citizenship; and can as a result increase social cohesion and a sense of community. The whole process must be clear and transparent from start to finish. Once the expert committee has assessed the feasibility of the ideas and compliance with the conditions established by the city council, the ideas that have reached this stage are sent to be voted on via a referendum. Each district then implements the idea that receives the most votes. This type of participatory budgeting can be understood as a relatively simple form of democratic innovation. There are however some negative aspects of participatory budgeting in practice, including typically a rather low number of participants. For example, only 5.1% of registered residents in the case of Tallinn. This small proportion suggested that likely not all social groups are represented (Tallinn, n.d.).

In some European cities, urban design problems are worked out by means of **citizen assemblies** (Involve, n.d.). A citizen assembly brings together people from all walks of life – selected randomly, but to be demographically representative – to consider a public issue in

depth over multiple days and meetings. The assembly members hear evidence, question witnesses and deliberate with one another, before reaching recommendations on what they think should be done.

Two EU projects, namely PHUSICOS (PHUSICOS project, n.d.) and RECONECT (RECONECT project, n.d.) reflect upon stakeholder constellations, and the relative methods developed to identify and **analyse stakeholders** and initiate collaborative planning to co-design NBS (Zingraff-Hamed et al. 2020). 16 NBS and 359 stakeholders have been analysed. Real-life constellations are compared to theoretical typologies, and a systematic stakeholder mapping method to support co-creation is presented. Rather than making one-fit-all statements about the "right" stakeholders, the contribution provides insights for those "in charge" to strategically consider who might be involved at each stage of the NBS project.

5.4. Digital tools

Conventional participation events (e.g. workshops, debates, public presentations) often suffer from only involving a small and highly selection-biased participant group. Digital tools promise the possibility of participation on a higher quantitative and qualitative level. First, they may enable participation on a mass scale, by addressing thousands of participants online, thus turning into genuine 'crowdsourcing'. Second, digital tools may reach user groups that are otherwise out of reach for ordinary participation formats, be it for geographic, social, or cultural reasons. Petrescu et al. (2017) suggest that one way of sustaining and scaling local resilience practices is by developing digital tools that could enable connections and knowledge sharing across locations, through 'commoning' in the digital realm. Performative interventions to re-claim, re-define and produce public space in different cultural and political contexts. Stelzle et al. (2017) describe how to create a co-design platform for urban design that allows participation for a large number of (simultaneous) participants.

As a consequence, much effort is currently invested in the development of digital participation tools, the U_CODE platform, a participative platform where citizens can co-create new concepts for the urban environment, being one of them (WISSENSARCHITEKTUR Laboratory of Knowledge Architecture, n.d.). People can become co-designers of their city and are able to share their ideas with a large audience.

Another emerging technology to aid engagement is geographic information systems (GIS) which incorporate socio-spatial information in strategic green space planning. Public participation geographic information system (PPGIS) may help citizens and stakeholders to identify locations on a map of various aspects such as perceptions, preferences, or values and associate them with ecosystem services (Rall et al. 2019). This potential was highlighted through a Berlin case study, where PPGIS helped to identify and protect especially-loved features of parks, to target conflict areas and other spaces needing attention (e.g. redesign),

and to increase functionality and amenity at parks identified as having little value and mono-functional uses. At the city- and district level, this study demonstrated the potential to improve the representativeness and accuracy of conventional expert-based assessments, to correct deficits, to highlight provision of difficult-to-map services and to increase an understanding of functional synergies and complementarity.

Social media platforms are also increasingly used as a tool to facilitate collaboration and interactions among stakeholders. Already in 2012, Dörk and Monteye outlined a use of digital tools in support of urban forms of civic participation. The combination with e-tools can create map-based e-tools to encourage co-creation and offer an easy way to give feedback on different development plans. As an example, the City of Tallinn developed a mobile app for urban planning (Baltic Urban Lab, n.d.).

The project Augmented Urbans is another example where new digital technologies in combination with non-digital methods are utilised, focusing on the potentials of extended reality, virtual reality and augmented reality (Augmented Urbans project, n.d.). The idea behind the project is to improve stakeholder participation and link between long-term visions of urban resilience and sustainability and short-term actions in the cities. One of the advantages of this digital approach is the potential of visualisation, in contrast to purely verbal approaches, map-making or simulations. There are challenges however, connected with not only the risk of unequal involvement of different stakeholder groups (as some people are not familiar or comfortable with these digital tools) and the question of what happens to the collected data.

A digital approach can be helpful to further implement conventional participatory methodologies and tools, in support of co-creation. Platforms based on feedback can improve the compliance of public services with people's needs, and diversify the generation of solutions. It is important however to track the fulfilment of the public promises made and increase the role of local governments' responsibility in this process, and it is likely that conventional methods will retain a key complementary role, in order not to exclude certain groups from involvement . Digital tools are not a magic bullet, instead, technology needs to be accompanied by processes, collective wisdom and leadership.

6. Conclusion and recommendations for the GoGreenRoutes project

Having reflected on the concept of co-creation and related terms, we now arrive at an outlook for the GoGreenRoutes consortium. This outlook finds its basis in the available literature and experience from comparable projects described above. As stated in Chapter 1, co-creation is relevant not only for the local urban development planning and decision-making that will play out at city level for the project (in particular in the six Cultivating Cities), it is also fundamental to the ways in which the consortium partners will work together. With the overall project goal in mind of finding new approaches to NBS solutions through a well-implemented process of co-creation, the literature presents various different enablers and obstacles that are relevant for both 'layers' of co-creation, in terms of individual behaviours, the quality of the process and the leadership level (see Chapter 4). The enablers suggested to overcome obstacles need to be made operational and adapted to suit the needs of the consortium. The following recommendations for action draw on the discussion in earlier chapters, as a way forward for the project team.

6.1. Recommendations for ‚how to co-create' in GoGreenRoutes

1. Communicate the benefits of co-creation

Given the additional time and energy demands imposed by engaging in co-creation, it is important to reflect on the reasons for doing so, in order to establish and maintain commitment for the endeavour. It should not be assumed that benefits are self-evident. Rather, they should be identified and communicated both internally to the project team, and externally as part of messaging about the project (see Chapter 2).

2. Foster a shared understanding of co-creation

It should not be assumed that everyone knows how to co-create, or even has the same understanding of what it means! To foster a shared understanding of co-creation, make time to discuss it with consortium partners, sharing findings of this review (especially definitions, potential obstacles, and principles/enablers). See who can work together and how on an internal level.

3. Establish a clear vision (or visions)

Invite consortium partners to openly share their visions. Although there may be a broad ambition defined already for the project (e.g. in the Grant Agreement), there are very likely to be a range of different aims and objectives among the team - whether stated explicitly (e.g. in

Work Package descriptions) or not. There should be time and space made available for sharing visions, and these should be consistently revisited (e.g. when planning tasks in detail and conceptualising key outputs). Consider, for example, inviting participants in each WP to define their expectations and visions in a shared visualisation (note that has been begun already for WP3, with a joint **'map of partners'**), or even facilitating a joint visioning exercise for the whole team early on in the project. As a minimum, open communication about visions should be actively encouraged and structured by the project lead.

4. Actively and iteratively define key concepts

Just like co-creation itself, there may be other key concepts that people understand in different ways, based on their experience and disciplinary background. To assist in building a common understanding of key concepts, a glossary of terms should be established, shared and maintained. All partners should have access and the opportunity to contribute. A glossary manager should be nominated with the role of gathering input, maintaining the glossary and sharing updates as they occur. The glossary can serve as instrument to avoid misunderstandings due to failures in communication that arise from language barriers or disciplinary barriers (see sub-chapter 4.1.1).

5. Share and discuss established 'enablers' to underpin the collaboration

The literature highlights several enabling factors that characterise successful co-creation processes. Enablers include key principles, e.g. equality, inclusivity, plurality and transparency; trust, openness and commitment; legitimacy; and flexibility. These warrant careful attention, and should be shared with consortium partners, with the invitation to reflect on their meaning in practice, and to add their own suggestions.

7. Actively engage team members in defining a basis for working together

To foster a sense of co-creation being a shared undertaking, engage consortium partners in an active discussion of key dimensions of the concept (definitions, principles, enablers). Not only do different members of the project team have valuable experience to contribute here, but this is a useful exercise to gain buy-in to a shared endeavour, and to identify possible mismatches in expectations that need to be addressed.

6. Develop mechanism(s) to make known enablers operational

In connection with the above, the enabling principles need to be not only discussed as a group, but also translated into practical mechanisms in order to usefully guide the process of working together. Such mechanisms might include e.g. a self-assessment checklist, with guiding questions clustered according to each enabling principle; clearly writing down and sharing roles and responsibilities for tasks; and/or setting up mailing lists to facilitate communication with larger teams. We recommend that these kinds of options are defined soon and

incorporated in the Risk and Quality Management Plan (D1.1) that will be delivered in Month 7. General project management guidance may need to be supplemented with additional supporting documents in future, but ideally a sound basis and clear guidelines should be established as early as possible.

8. Anticipate obstacles (and possible mitigation strategies) before they arise

The literature points to a range of possible barriers that may arise, including a lack of integration and leadership; poor or unclear allocation of responsibilities; failure to adapt to the needs of different parties (and related lack of flexibility); mismatched or unrealistic expectations; insufficient or non-transparent communication; and lack of common goal(s). Even before such problems are encountered, they should be actively anticipated and discussed - along with ways to deal with them. For example, to support continuous communication and avoid problems with transparency, consider establishing a monthly newsfeed that all WP leads contribute to, providing an update on 'what happened this month in WPX'. Progress updates should be kept short and to the point, published in an attractive and engaging format (e.g. blog or Wiki post style) and circulated by the project coordinator to all consortium partners.

9.Use the core basis for co-creation to foster local teamwork

After establishing a basis for co-creation within the project consortium, work with city partners to translate this into local efforts. While each local context is unique, many of the general elements defined for the project team may be applicable locally, even if they are made operational in different ways (e.g. the principle 'transparency' might be achieved on a project level through enabling access to a project management intranet, while for a city's local taskforce it may mean enabling open communication through a mailing list). The conceptual basis established for the project team can then be built on usefully by each local team. Use local workshops as opportunities to transfer this knowledge to local stakeholders and make it operational to suit the context.

10. Nurture the co-creation process

Once established, co-creation needs regular monitoring. Create regular opportunities for facilitated discussion to 'check in' on co-creation at project meetings, as well as channels for consortium partners to update each other on task progress. Consider accessible formats like blogs and wikis, as well as traditional formats like meeting minutes.

6.2. Further reading

The following selected sources are recommended for readers seeking further guidance on the next step to improving their own leadership of or participation in co-creation in practice-based research.

- **Connecting Nature co-production guidebook**

  Hölscher, K., Lodder, M., Allaert, K., Sillen, D., Frantzeskaki, N., Dumitru, A., … Osipiuk, A. (2020).

- **CLEVER Cities guidance on co-creating nature-based solutions**

  Morello, E., Mahmoud, I., and Gulyurtlu, S. C. (2018).

- **Guidelines for urban labs**

  Scholl, C., Agger Eriksen, M., Baerten, N., Clark, E., Drage, T., Essebo, M., Hoeflehner, T., de Kraker, J., Rijkens-Klomp, N., Seravalli, A., Wachtmeister, A., & Wlasak, P. (2017).

- **Stakeholder Mapping to Co-Create Nature-Based Solutions: Who Is on Board?**

  Zingraff-Hamed, A., Hüesker, F., Lupp, G., Begg, C., Huang, J., Oen, A., Vojinovic, Z., Kuhlicke, C., and Pauleit, S. (2020). *Sustainability*, *12*(20).

7. Bibliography

ACCOMPLISSH Project. (2017). Co-creation. Retrieved February 26, 2021, from https://www.accomplissh.eu/co-creation

Agusti, C., Bluestone, B., Carvalho, P., & Cudden, J. (2014). *Co-Creating Cities. Defining co-´creation as a means of citizen engagement*. DOI: 10.13140/RG.2.1.3684.5849

AlWaer, H.; Cooper, I. (n.d.). Changing the Focus: Viewing Design-Led Events within Collaborative Planning. *Sustainability 2020*. https://doi.org/https://doi.org/10.3390/su12083365

Anton, B., Latinos, V., Knappe, D., Saraco, R., Vuger, M. and Wilk, B. (2019). *Co-designing Nature- based Solutions in Living Labs. Deliverable 2.3 on Workshop round 1 in Frontrunner Cities (Dortmund, Turin, and Zagreb).* https://progireg.eu/fileadmin/user_upload/Deliverables/D2.4_Report_on_WS_round_2_in_FRC_proGIreg_ICLEI_2019-10-01.pdf

Augmented Urbans project. (n.d.). Augmented Urbans project: Participatory Planning and Integrated Management for Resilient Cities. Retrieved February 26, 2021, from https://www.augmentedurbans.eu/

Baker, E. A., Homan, S., Schonhoff, S. R., & Kreuter, M. (1999). Principles of practice for academic/practice/community research partnership. *American Journal of Preventive Medicine*, *16*(3 SUPPL.), 86–93. https://doi.org/10.1016/s0749-3797(98)00149-4

Baltic Urban Lab. (n.d.). Stakeholder involvement app AvaLinn utilised in Tallinn. Retrieved February 26, 2021, from https://www.balticurbanlab.eu/goodpractices/stakeholder-involvement-app-avalinn-utilised-tallinn

Basnou, C., Pino, J., Davies, C., Winkel, G., & De Vreese, R. (2020). Co-design Processes to Address Nature-Based Solutions and Ecosystem Services Demands: The Long and Winding Road Towards Inclusive Urban Planning. *Frontiers in Sustainable Cities*. https://doi.org/10.3389/frsc.2020.572556

Bason, C. (2010). Leading public sector innovation. Co-creating for a better society. *Policy Press*. https://doi.org/10.2307/j.ctt9qgnsd

Bentzen, T. Ø. (2020). Continuous co-creation: how ongoing involvement impacts outcomes of co-creation. *Public Management Review*, 1–12. DOI: 10.1080/14719037.2020.1786150of_co-tion

Brink, E., Wamsler, C., Adolfsson, M., Axelsson, M., Beery, T., Björn, H., … Thiere, G. (2018). On the road to 'research municipalities': analysing transdisciplinarity in municipal ecosystem services and adaptation planning. *Sustainability Science*, *13*(3), 765–784. https://doi.org/10.1007/s11625-017-0499-0

Chapman, E., Hanania, S., Connelly, A., Carter, J., & Dumonteil, M. (2018). Developing the RESIN tools, advancing local adaptation (D4.2). https://resin-cities.eu/resources/deliverables/

Crosby, B. C., & Bryson, J. M. (2010). Integrative leadership and the creation and maintenance of cross-sector collaborations. *The Leadership Quarterly*, *21*(2), 211–230. https://doi.org/10.1016/j.leaqua.2010.01.003

DeLosRios-White M.I. Roebeling, P., Valente, S., & Vaittinen, I. (2020). Mapping the Life Cycle Co-Creation Process of Change Adaptation. *Resources*, *9*(4), 39. https://doi.org/10.3390/resources9040039

Djenontin, I. N. S., & Meadow, A. M. (2018). The art of co-production of knowledge in environmental sciences and management: lessons from international practice. *Environmental Management*, *61*(6), 885–903. https://doi.org/10.1007/s00267-018-1028-3

Dörk, M. and Monteye, D. (2011). Urban Co-Creation : Envisioning New Digital Tools for Activism and Experimentation in the City, 1–4. https://mariandoerk.de/urbancocreation/hpc2011.pdf

EASME. (n.d.). Nature-based solutions projects tackle the climate and biodiversity crisis. Retrieved February 26, 2021, from https://ec.europa.eu/easme/en/section/horizon-2020-environment-and-resources/nature-based-solutions-projects-tackle-climate-and

European Commission. (2009). Living Labs for user-driven open innovation. *Facilities*, *23*(January), 109–112. https://doi.org/10.2759/34481

Ferreira, V., Barreira, A.P., Loures, L., Antunes, D., and Panagopoulos, T. (2020). Stakeholders' engagement on nature-based solutions: A systematic literature review. *Sustainability*, *12*(2). DOI: 10.3390/su12020640

Foley, R. W., Wiek, A., Kay, B., & Rushforth, R. (2017). Ideal and reality of multi-stakeholder collaboration on sustainability problems: a case study on a large-scale industrial contamination in Phoenix, Arizona. *Sustainability Science*, *12*(1), 123-136. https://doi.org/10.1007/s11625-016-0393-1

Følsgaard Grønvad, J., Hvidtfeldt, R., & Budtz Pedersen, D. (2017). *Analysing co-creation in theory and in practice – A systemic review of the SSH impact*. https://docs.wixstatic.com/ugd/35d470_1d36ad453b884646899f6196b45cac7e.pdf

Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environ Sci Policy*, 101–111. https://doi.org/https://doi.org/10.1016/j.envsci.2018.12.033

Franz, Y., Tausz, K., & Thiel, S. (2015). Contextuality and Co-Creation Matter: A Qualitative Case Study Comparison of Living Lab Concepts in Urban Research. *Technology Innovation Management Review*, *5*(12), 48–55. https://doi.org/http://doi.org/10.22215/timreview/952

Greenhalgh, T., Jackson, C., Shaw, S., & Janamian, T. (2016, June 1). Achieving Research Impact Through Co-creation in Community-Based Health Services: Literature Review and Case Study. *Milbank Quarterly*. Blackwell Publishing Inc. https://doi.org/10.1111/1468-0009.12197

Hägele, H. (2019). Co-creation of services - Thematic Review Workshop on Co-creation of services. *European Commission*. https://ec.europa.eu/social/BlobServlet?docId=22230&langId=en

Hansson, S., & Polk, M. (2017). Evaluation of knowledge co-production for sustainable urban development. Part I: Experiences from project leaders and participants at Gothenburg Local Interaction Platform 2012–2015 https://www.mistraurbanfutures.org/sites/mistraurbanfutures.org/files/hansson-polk-wp-2017-2.pdf

Hölscher, K., & Reil, A. (2019). Co-creating inclusive green cities: European examples and global learning opportunities | Connecting Nature. https://connectingnature.eu/blog/co-creating-inclusive-green-cities-european-examples-and-global-learning-opportunities

IAP2. (2014). What is the Spectrum of Public Participation? Retrieved February 26, 2021, from https://sustainingcommunity.wordpress.com/2017/02/14/spectrum-of-public-participation/

Involve. (n.d.). Citizens' Assembly . Retrieved February 26, 2021, from https://www.involve.org.uk/resources/methods/citizens-assembly

Itten, A. V., Sherry-Brennan, F., Sundaram, A., Hoppe, T., & Devine-Wright, P. (2020). State-of-the-art report for co-creation approaches and practices with a special focus on the sustainable heating transition: Shifft work package 2 deliverable 2.1. 1. DOI: 10.13140/RG.2.2.22835.17440

Jessup, R. L., Osborne, R. H., Buchbinder, R., & Beauchamp, A. (2018). Using co-design to develop interventions to address health literacy needs in a hospitalised population. *BMC Health Services Research*, *18*(1), 1–13. https://doi.org/10.1186/s12913-018-3801-7

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., ... & Bonn, A. (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: Perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*, *21*(2). http://dx.doi.org/10.5751/ES-08373-210239

Kirchhoff, C. J., Lemos, M. C., & Dessai, S. (2013). Actionable knowledge for environmental decision-making: broadening the usability of climate science. *Annual Review of Environment and Resources*, *38*, 393–414. https://doi.org/10.1146/annurev-environ-022112-112828

Kleinsmann, M., & Valkenburg, R. (2008). Barriers and enablers for creating shared understanding in co-design projects. *Design Studies*, *29*(4), 369–386. https://doi.org/10.1016/j.destud.2008.03.003

Kumari, R., Kwon, K. S., Lee, B. H., & Choi, K. (2020). Co-creation for social innovation in the ecosystem context: The role of higher educational institutions. *Sustainability (Switzerland)*, *12*(1), 1–21. https://doi.org/10.3390/su12010307

Leask, C. F., Sandlund, M., Skelton, D. A., Altenburg, T. M., Cardon, G., Chinapaw, M. J. M., … Chastin, S. F. M. (2019). Framework, principles and recommendations for utilising participatory methodologies in the co-creation and evaluation of public health interventions. *Research Involvement and Engagement*, *5*(1), 1–16. https://doi.org/10.1186/s40900-018-0136-9

Leino, H., & Puumala, E. (2020). What can co-creation do for the citizens? Applying co-creation for the promotion of participation in cities. *Environment and Planning C: Politics and Space*. https://doi.org/10.1177/2399654420957337

Lund, D. H. (2018). Co-creation in urban governance: From inclusion to innovation. *Scandinavian Journal of Public Administration*, *22*(2), 3–17. http://ojs.ub.gu.se/ojs/index.php/sjpa/article/view/3741

Mačiulienė, M., & Skaržauskienė, A. (2020). Sustainable urban innovations: digital co-creation in European living labs. *Kybernetes*. DOI: 10.1108/K-07-2019-0514

Mauser, W., Klepper, G., Rice, M., Schmalzbauer, B. S., Hackmann, H., Leemans, R., & Moore, H. (2013, September 1). Transdisciplinary global change research: The co-creation of knowledge for sustainability. *Current Opinion in Environmental Sustainability*. Elsevier. https://doi.org/10.1016/j.cosust.2013.07.001

Menny, M., Palgan, Y. V., & McCormick, K. (2018). Urban living labs and the role of users in co-creation. *GAIA-Ecological Perspectives for Science and Society*, *27*(1), 68–77. http://lup.lub.lu.se/search/ws/files/58101885/Menny_et_al._2018_GAIA_.pdf

Morello, E., Mahmoud, I., and Gulyurtlu, S. C. (2018). *CLEVER Cities guidance on co-creating nature-based solutions. https://clevercities.eu/fileadmin/user_upload/Resources/D1.1_Theme_5_Co-creation_framework_FPM_12.2018.pdf*

Mulder, I. (2012). Living Labbing the Rotterdam Way: Co-Creation as an Enabler for Urban Innovation. *Technology Innovation Management Review*, *2*(9), 39–43. http://doi.org/10.22215/timreview/607

Norris, J. M., White, D. E., Nowell, L., Mrklas, K., & Stelfox, H. T. (2017). How do stakeholders from multiple hierarchical levels of a large provincial health system define engagement? A qualitative study. *Implementation Science*, *12*(1), 1–13. DOI: 10.1186/s13012-017-0625-5

Norström, A. V., Cvitanovic, C., Löf, M. F., West, S., Wyborn, C., Balvanera, P., … Österblom, H. (2020). Principles for knowledge co-production in sustainability research. *Nature Sustainability*, *3*(3), 182–190. https://doi.org/10.1038/s41893-019-0448-2

Petrescu, D., Petcou, C., and Baibarac, C. (2016). Co-producing commons-based resilience: lessons from R-Urban. *Building Research and Information*, *44*(7), 717–736. https://doi.org/10.1080/09613218.2016.1214891

PHUSICOS project. (n.d.). PHUSICOS project. Retrieved February 26, 2021, from https://phusicos.eu/

Pirinen, A. (2016). *The Barriers and Enablers of Co-design for Services*. *International Journal of Design* (Vol. 10). http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/2575

Pohl, C., Rist, S., Zimmermann, A., Fry, P., Gurung, G. S., Schneider, F., ... & Wiesmann, U. (2010). Researchers' roles in knowledge co-production: experience from sustainability research in Kenya, Switzerland, Bolivia and Nepal. *Science and Public Policy*, *37*(4), 267–281. DOI: 10.3152/030234210X496628

Potter, M. A., Quill, B. E., Aglipay, G. S., Anderson, E., Rowitz, L., Smith, L. U., … Whittaker, C. (2006). Demonstrating Excellence in Practice-Based Research for Public Health. *Public Health Reports*, *121*(1), 1–16. https://doi.org/10.1177/003335490612100102

Prager, K. (2016). Is co-creation more than participation? https://i2insights.org/2016/07/28/co-creation-or-participation/

Rall, E., Hansen, R., and Pauleit, S. (2019). The added value of public participation GIS (PPGIS) for urban green infrastructure planning. *Urban Forestry and Urban Greening*, *40*, 264–274. DOI: 10.1016/j.ufug.2018.06.016

Raymond, C. M. (2017). A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environ. Sci. Policy*, 15–24. https://doi.org/10.1016/j.envsci.2017.07.008

RECONECT Project. (n.d.). RECONECT project. Retrieved February 26, 2021, from http://www.reconect.eu/

Ruoslahti, H. (2018). Co-creation of Knowledge for Innovation Requires Multi-Stakeholder Public Relations, *3*, 115–133. https://doi.org/10.1108/s2398-391420180000003007

Ruoslahti, H. (2020). Complexity in project co-creation of knowledge for innovation. *Journal of Innovation and Knowledge*, *5*(4), 228–235. https://doi.org/10.1016/j.jik.2019.12.004

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-Creation and the New Landscapes of Design. *CoDesign*, *4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Schmalzbauer, A. (2018). *Barriers and success factors for effectively co-creating naturebased solutions for urban regeneration. . Deliverable 1.1.1, CLEVER Cities, H2020 grant no. 776604*. https://clevercities.eu/fileadmin/user_upload/Resources/D1.1_Theme_1_Barriers_success_factors_co-creation_HWWI_12.2018.pdf

Schneider, F., Giger, M., Harari, N., Moser, S., Oberlack, C., Providoli, I., … Zimmermann, A. (2019). Transdisciplinary co-production of knowledge and sustainability transformations: Three generic mechanisms of impact generation. *Environmental Science and Policy*, *102*, 26–35. https://doi.org/10.1016/j.envsci.2019.08.017

Scholl, C., Agger Eriksen, M., Baerten, N., Clark, E., Drage, T., Essebo, M., Hoeflehner, T., de Kraker, J., Rijkens-Klomp, N., Seravalli, A., Wachtmeister, A., & Wlasak, P. (2017). Guidelines for Urban Labs. https://adk.elsevierpure.com/ws/portalfiles/portal/61301561/Scholl_et_al_2017_GUIDELINESforURBAN_LABS_URBExp_FINAL.pdf

Stelzle, B., Jannack, A., and Noennig, J. R. (2017). Co-Design and Co-Decision: Decision Making on Collaborative Design Platforms. *Procedia Computer Science*, *112*, 2435–2444. https://doi.org/10.1016/j.procs.2017.08.095

Strecher, V. J., Seijts, G. H., Kok, G. J., Latham, G. P., Glasgow, R., DeVellis, B., ... &, & Bulger, D. W. (1995). Goal setting as a strategy for health behavior change., *22*, 190–200. DOI: 10.1177/109019819502200207

Szebeko, D., & Tan, L. (2010). Co-designing for Society. *Australasian Medical Journal*, *3*(9). https://www.academia.edu/346809/Co_designing_for_Society

Tallinn. (n.d.). Tallinn participatory budget. Retrieved February 26, 2021, from https://www.tallinn.ee/eng/participatorybudget/

Thompson MA, Owen S, Lindsay JM, Leonard GS, C. S. (2017). Scientist and stakeholder perspectives of transdisciplinary research: early attitudes, expectations, and tensions. United Nations (2016) C. *Environ Sci Policy*, *74*, 30–39. DOI: 10.1016/j.envsci.2017.04.006

Torfing, J., Sørensen, E., & Røiseland, A. (2016). Transforming the Public Sector Into an Arena for Co-Creation. *Administration & Society*. https://doi.org/10.1177/0095399716680057

UNaLab. (n.d.). Co-Creation in UNaLab. Retrieved February 26, 2021, from https://unalab.eu/en/co-creation

van der Jagt, A. P., Szaraz, L. R., Delshammar, T., Cvejić, R., Santos, A., Goodness, J., & Buijs, A. (2017). Cultivating nature-based solutions: The governance of communal urban gardens in the European Union. *Environmental Research*, 264–275. DOI: 10.1016/j.envres.2017.08.013

van Dijk-de Vries, A., Stevens, A., van der Weijden, T., & Beurskens, A. J. (2020). How to support a co-creative research approach in order to foster impact. The development of a Co-creation Impact Compass for healthcare researchers. *PloS One*, *15*(10). https://doi.org/10.1371/journal.pone.0240543

Voorberg, W. H., Bekkers, V. J., & Tummers, L. G. (2015). A systematic review of co-creation and co-production: Embarking on the social innovation journey. *Public Management Review*, *17*(9), 1333–1357. https://doi.org/10.1080/14719037.2014.930505

Wamsler, C. (2017). Stakeholder involvement in strategic adaptation planning: Transdisciplinarity and co-production at stake? *Environmental Science and Policy*, *75*, 148–157. https://doi.org/10.1016/j.envsci.2017.03.016

Wiek, A. (2016). Eight strategies for co-creation. https://i2insights.org/2016/05/12/eight-strategies-for-co-creation/

WISSENSARCHITEKTUR Laboratory of Knowledge Architecture. (n.d.). U_CODE - Urban Collective Design Environment. Retrieved February 26, 2021, from https://www.u-code.eu/

Zamenopoulos, T., & Alexiou, K. (2018). Co-Design as Collaborative Research. In *Facer, K and Dunleavy, K. (eds.) Connected Communities Foundation Series. https://connected-communities.org/wp-content/uploads/2018/07/Co-Design_SP.pdf*

Zingraff-Hamed, A., Hüesker, F., Lupp, G., Begg, C., Huang, J., Oen, A., Vojinovic, Z., Kuhlicke, C., and Pauleit, S. (2020). Stakeholder mapping to co-create nature-based solutions: Who is on board? *Sustainability*, *12*(20). https://doi.org/10.3390/su1220862