



D4.5.1: Co-production and public participation in Nature-based Solutions for Cities: a discussion of research literature

VARCITIES | Work Package 4, Task 4.5

Final delivery date: 07-07-2022

Deliverable version	v.01
Dissemination level	Public
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Article 29.5 Disclaimer



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 869505.

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Document History

Project Acronym	VARCITIES
Project Title	VISIONARY NATURE BASED ACTIONS FOR HEALTH, WELL-BEING & RESILIENCE IN CITIES
Project Coordinator	Denia Kolokotsa TELECOMMUNICATION SYSTEMS INSTITUTE
Project Duration	54 M (September 2020- February 2025)
Deliverable Number	D4.5.1
Deliverable Type	Report/Demonstrator/Ethics/ORDP
Dissemination Level	PU-Public
Contractual delivery date	
Delivery date	07-07-2022
Version	v.01
Pages	32
Work package	WP4 – STK engagement and co-creation (T4.5)
Lead Beneficiary	UiB
Contributing beneficiaries	
Keywords	Nature-based solutions, participation, co-production, co-design



Revision History

Date	Version	Author	Description
07-07-2022	v.1	Håvard Haarstad, Lene Drengenes, Devyn Remme	Report finalised



Table of Contents

Table of Contents	5
1 Summary and main conclusions	7
2 Introduction.....	8
2.1. What are nature-based solutions?	8
2.2. Definitions	9
2.3. Goals – what do proponents hope NBS will achieve?	10
2.4. Summary – what is the mainstream understanding of NBS?.....	12
3 Public participation and co-production – evidence from the research literature	14
3.1. What types of participation have been tried, according to the research literature?...	14
3.2. What are the challenges of participation in NBS, according to the literature?	17
3.3. What needs to be improved for participation NBS to work, according to the literature?	19
4 Citizen involvement in NBS – lessons from case studies	23
5 References	26



List of tables

Table 1: illustrates the different government roles in the different possible governance arrangements (Source template: Mattijssen et al., 2018). 15

1 Summary and main conclusions

- NBS has become a key approach for major governance institutions such as the EU, and there are high ambitions for what NBS can achieve in cities. While earlier definitions of the term focused on climate change mitigation and biodiversity, approaches from the European Commission also emphasize economic growth, innovation and job creation.
- There is a danger of oversimplifying and overselling the concept. ‘Solutions’ might imply quick and clear outcomes. In reality, the research literature suggests that NBS implementation is a complicated process that requires continuous learning from past experiences and to evaluate different trade-offs.
- Multiple methods exist to include citizens in the design and implementation of solutions. Co-production and co-design methods, some of which are tested in the VARCITIES project, are considered some of the most inclusive and empowering strategies. Making full use of these methods requires dedication, resources and time.
- Citizen participation is constrained by practical concerns. A key constraint for NBS projects is that the solutions often have to be designed in advance in order to get funding and approval, and that citizens are therefore only included in the final implementation stage. It is also challenging to do justice to the diversity of citizens in cities within the financial and temporal constraints of specific projects.
- Key suggestions for improved participation in NBS are (1) to include citizens as early as possible in the design process, (2) foster good relationship between grassroots organization and the municipality, (3) involve citizens in the long-term care and maintenance of solutions, (4) make the benefits from NBS solutions clear and broadly accessible. The research literature offers a wide range of case studies where these methods are discussed in specific contexts.



2 Introduction

2.1. What are nature-based solutions?

Since the 1970s there have been an increased focus on the relationship between humans and nature in scientific literature, with an emphasis on ecosystem services and biodiversity (Cohen-Shacham et al., 2016; Pauleit et al., 2017:37). With challenges concerning urbanization, biodiversity loss and climate change, policy makers and decision makers are looking to sustainable solutions for a resilient urban development (Eggermont et al., 2015). Various concepts have emerged when trying to find strategies to meet these challenges, with ecosystem-based adaptation and green infrastructure among others (Dorst et al., 2019). In the late 2000s Nature-based Solutions (NBS) started to make an appearance through international organizations. The World Bank (MacKinnon et al, 2008) and IUCN (2009) introduced NBS as part of the strategies for climate change adaptation and mitigation.

In recent years NBS has emerged as a key concept in the research and innovation agenda within the EU (EC, 2015; Faivre et al., 2017). In 2015 The European Commission implemented the concept into Horizon 2020, the EU framework programme for research and innovation (EC, 2015). NBS is also one of the main priorities of the “Urban Agenda for the EU - Pact of Amsterdam” (EU, 2016).

On a global level, the UN recognizes how innovating with nature is necessary to reach the UN Sustainable Development Goals (Faivre et al., 2017). The UN have promoted an implementation of NBS with the release of the World Water Development report in 2018, titled “Nature-Based Solutions for Water” (UN-water, 2018). In the following year a coalition for NBS was created under the UN climate Action Summit, with “The Nature-Based Solutions for Climate” manifesto (UN, 2019). With the launch of the “Decade on Ecosystem Restoration”, UNEP (2021:3) states that ecosystem restoration *“is one of the most important ways of delivering nature-based solutions for societal challenges”*.

Cities are looking to NBS to solve a range of challenges, including health, liveability and sustainability. The VARCITIES project addresses these challenges by implementing ‘visionary solutions’ in eight pilot cities. An important task for cities implementing NBS is to include the population, and to make them meaningful in the everyday lives of citizens, through citizen participation. The purpose of this report is to summarize the research literature on the basic concepts, goals and challenges related to participatory processes for nature-based solutions in cities. It will provide a basis for the empirical work in T4.5 and Deliverable D4.5

2.2. Definitions

NBS has become a primary institutional term that consolidates many similar terms, such as ‘ecosystem services’, ‘green-blue infrastructure’, ‘ecological engineering’, ‘ecosystem-based management’ and ‘natural capital’ (Nesshöver et al., 2017; EC, 2015). Nature-based solutions was first defined by IUCN as:

“Actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits.” (Cohen-Shacham et al, 2016:2).

Within the EU framework, NBS has become a priority for urban areas to tackle future challenges related to climate change and urbanization (EC, 2015; EU, 2016). An early definition from the EC (2015:4) stated that *“nature-based solutions are actions which are inspired by, supported by or copied from nature”*. More recently the EC (2020) define nature-based solutions as:

“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.”

In addition, it is emphasized that such solutions *“must benefit biodiversity and support the delivery of a range of ecosystem services”* (EC, 2020). While the definition from IUCN focuses more on nature, with climate change mitigation and biodiversity, the term has evolved within other institutions with an increased focus on socio-economic aspects (Bridgewater, 2018). The European Commission emphasizes economic growth and job creation, through innovation opportunities found in environmental, social and economic challenges (Nesshöver et al, 2017; Bridgewater, 2018).

While the definitions have different objectives, the emphasis is on the enhancement of natural ecosystems to address societal challenges. According to Cohen-Shacham et al (2016), the emergence of the term illustrates a shift in perspective, by recognizing the active role people can take to protect and manage natural ecosystems.



2.3. Goals – what do proponents hope NBS will achieve?

The overarching goal of NBS is the protection and sustainable management of ecosystems and biodiversity, to address societal challenges (Cohen-Shacham, 2016; EC, 2015). While NBS are designed to address several societal challenges, such as climate change, disaster risk and food insecurity, the methods of how this is achieved varies. NBS is encouraged as a strategy to promote nature in a way to ensure a sustainable future for humans and conserve ecosystems. According to the IUCN (Cohen-Shacham et al, 2016), the main objective of NBS should be to:

“Support the achievement of society’s development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services”.

The European Commission hold a somewhat different outlook, by stating that *“Nature-based solutions harness the power and sophistication of nature to turn environmental, social and economic challenges into innovation opportunities”* (EC, 2015). NBS can thus contribute in the shift towards green growth, through sustainable measures. This is in line with the view of the World Bank (2021:10) which suggest that *“A momentum is growing for NBS as a vehicle for delivering green, resilient and inclusive development, especially in the context of economic recovery from the COVID-19 pandemic”.*

The EC (2020) presents five R&I goals for NBS within the EU policy agenda, which can be summarized as; 1) Enhance the NBS framework; 2) Develop a R&I community for NBS; 3) Provide the evidence and knowledge base for NBS; 4) Advance development and uptake of innovative NBS; and 5) Mainstream NBS within the international agenda. Similar goals are found in the *“Nature-Based Solutions for Climate”* Manifesto, where the UN (2019) outlines four areas of priority, that can be summarized as; 1) Mainstreaming NBS; 2) Enhance co-operation, that help deliver on SDGs; 3) Generate shifts in domestic and international governance and finance to value nature; 4) Up-scaling of NBS for mitigation, resilience and adaptation. Both the UN and EU are prioritizing the mainstreaming of NBS, within national and international governance. While the EC (2020) priorities innovation and research, the UN (2019) put more emphasis on sustainability and climate change in their goals.

Enhancing regional and international co-operation is key for the further reach of NBS, as well as increasing the knowledge and evidence base (UN, 2019; EC, 2020). Without an accepted framework for operational criteria and standards, there is a chance for not being able to deliver NBS in an effective way (Cohen-Shacham et al, 2016). As the concept is evolving on a global scale, there has not been a consensus on a common framework for parameters and methodologies. With the aim of creating a global community for NBS, the IUCN (2020)



published a global standard with the purpose of aiding practitioners in the work of designing and verifying NBS. The European Commission (2021) has created their own handbook for practitioners of NBS, with a set of indicators and methodologies. As the concept of NBS is still evolving, evidence from practice is still needed for further development and mainstreaming.

For the implementation of NBS, the EC (2015) outlines four interrelated goals. These can be summarized as *protection, restoration, integration and co-benefits*:

- (1) protecting essential ecosystem functions to enhance sustainable urbanization
- (2) restoring the functionality of degraded ecosystems and their services
- (3) integrating grey with green and blue infrastructure to develop low-cost technologies for lowering energy use and reducing risk
- (4) combining multiple functions and benefits such as pollution reduction, carbon storage, biodiversity conservation, reducing heat stress, enhanced water retention, recreational space, health and wellbeing.

The goals presented here involve a range of levels for interventions, from the design of regional and city-wide ecological networks to multifunctional urban parks providing recreation, cooling and flood alleviation services, and micro-scale design including streets designed to retain water and the integration of living systems with built systems such as green walls and green roofs to reduce heat stress (Scott et al., 2016). A shift from ‘hard’ engineering towards ‘softer’ approaches have resulted in more solutions, such as eco-engineering and ecological restoration (EC, 2021).

Urban landscapes have become a main area of interest for realizing the goals of NBS and mainstreaming the concept into environmental management (Dorst et al, 2019); Bush and Doyon, 2019). Cities worldwide are facing challenges such as population growth, densification, biodiversity loss and socioeconomic inequality. By implementing NBS into the built environment, cities can support SDGs while transitioning to a green economy (EC, 2015; Burton and Oen, 2021). In recent years, research has started to explore the relationship between NBS and urban resilience (Frantzeskaki and McPherson, 2021; Beceiro et al., 2020; Snep et al, 2020; Bush and Doyon, 2019). NBS are also implemented into urban agendas, such as the Urban Agenda for the EU (2016) and the UN Habitat III New Urban Agenda (2016). Investments in NBS is also recognized by the World Bank (2021) to play a vital part in urban resilience. However, challenges still exist regarding how ecosystem services are valued within urban planning practices today (Bush and Doyon, 2019). Furthermore, limited collaborative governance, conflict over urban space and lack of resources are some of the structural barriers working against urban NBS (Dorst et al, 2019; Frantzeskaki, 2019). While urban areas have become a main area of interest for implementing NBS, research is also being conducted



towards the effects and uptake of NBS in rural landscapes (Solheim et al, 2021; Lupp et al, 2021).

For practitioners to adopt a new concept, it might be met with resistance from existing socio-technical regimes in urban landscapes, with the rules and norms that follow governance practices, traditions and rationales (Dorst et al, 2019). By engaging society, the EC is creating innovative science-policy mechanisms, with open consultations and platforms for knowledge-exchange (Faivre et al, 2017). In addition, global cooperation through R&I has the potential to integrate NBS locally, by creating new investment models and frameworks that can be applied by practitioners, citizens and decision-makers (Faivre et al, 2017). Moreover, this requires multiple disciplines to be able to design for co-creation and recognition of the potential of NBS (Frantzeskaki, 2019). The goal of NBS is to provide long-term solutions to several societal challenges. With that, solutions have to be targeted within scientific, economic and political spheres (Maes and Jacobs, 2017). According to Nesshöver et al (2017), NBS has the potential to mainstream environmental targets into policy, business and practice, with new methods of valuing the environment. At the same time, overselling the concept of NBS have the possibility of oversimplifying the term to lose its meaning. ‘Solutions’ might imply quick and clear outcomes, but in reality it is a process that requires continuous learning from past experiences and to evaluate different trade-offs (Nelson et al., 2020).

2.4. Summary – what is the mainstream understanding of NBS?

NBS is a ‘boundary concept’ meaning that it is a loose concept with strong cohesive power (Allen, 2009). The vagueness of the term is a strength and a weakness. It provides actors from multiple disciplines and sectors with a flexible, common language to work together towards sustainability outcomes (Dorst et al., 2019). The downside of this ambiguity is that the expectation for NBS to be a panacea of win-win solutions with co-benefits does not necessarily provide a framework for evaluating trade-offs between social, environmental and economic goals. At the same time, this uncertainty can make room for innovative approaches in which old problems are addressed in new ways with more inclusive practices (Egusquiza et al., 2019).

Nature-based Solutions are often described against ‘engineered’ or ‘grey’ infrastructure although most scholars propose finding synergies between them rather than viewing them as mutually exclusive (Seddon et al., 2020; Kvamsås, 2021). The traditional approach in engineering designs has focused on using hard, resistant elements and responding to increased risk with increased size, for example increasing the diameter of sewage pipes for stormwater management or building more and larger tanks to store sewage (McPhearson et al., 2016). In contrast, a typical NBS solution to risk of flooding from increased precipitation



and stormwater may include creating forests (Kelly et al., 2016), restoring wetlands (Peh et al., 2014), or establishing green roofs and walls on existing urban infrastructure (Enzi et al., 2017). Besides the type of materials used and a focus on distributed rather than centralized solutions, a significant difference between engineered solutions and NBS is the explicit goal to contribute to societal change to achieve sustainability goals (Maes and Jacobs, 2015; Dorst et al, 2019; Randrup 2020).

The implementation of NBS can be done with existing technological and engineered solutions or alone (Cohen-Shacham et al., 2016). This can be achieved at different levels of intervention. Eggermont et al (2015) propose a typology that illustrates the level of engineering of biodiversity or ecosystems and the level of ecosystem services and stakeholder groups being targeted by any NBS. Type 1 consists of solutions for existing ecosystems; type 2 delivers solutions for sustainability and multifunctionality of managed ecosystems; and type 3 is concerned with the design and management of new ecosystems. While the different levels are not mutually exclusive, the typology offers an opportunity for NBS to be further embedded into research and policy.

Building urban and human resilience has become one of the main targets for implementing NBS (de Luca et al., 2021; Raymond et al., 2017a). With a common framework for related concepts, NBS has an opportunity to strengthen the implementation of green infrastructure, ecosystem-based adaptation and ecosystem services (Pauleit et al, 2017:43). The co-benefits of NBS offers new opportunities to environmental management, by not solely focusing on traditional biodiversity conservation (Eggermont et al., 2015). With the implementation by international organizations and R&I projects, NBS have evolved into a mainstream concept at a policy level. From exclusively being a concept of climate change adaptation and biodiversity conservation, NBS have evolved to become a resource for environmental management (Eggermont et al, 2015).

But there is still progress to be made for NBS to become mainstream in planning and governing practices. According to Tozer et al (2022), this requires several stepping stones such as providing a public mandate, creating intermediaries, generate partnerships and facilitating community-based action. This requires stepping away from a linear pathway of transition, to one that does not hold deterministic assumptions about space, scale and socio-material dynamics (Tozer et al., 2022). With coherence of key interventions, opportunities can be created to change the status quo by destabilizing urban infrastructure regimes. In turn, new socio-material relations can be created that generate change.



3 Public participation and co-production – evidence from the research literature

The NBS approach to urban development advocates the inclusion of a broad range of relevant actors in planning and decision making (EC 2016; Pauleit et al., 2017). In the Global Standard for Nature-Based Solutions, the IUCN present eight criteria, where criterion five calls for *“inclusive, transparent, and empowering governance processes”* (IUCN, 2020). The European Commission's (2021) handbook for NBS practitioners contains a long list of indicators for participatory governance. The EC emphasizes experimental approaches for innovation and continuous learning, institutional spaces for cross-sectoral dialogue and collaboration and citizen participation. Participatory planning and governance are advocated to enhance social, political and financial support of the nature-based solution (EC, 2016; Frantzeskaki and Kabisch, 2016; Pauleit et al., 2017).

3.1. What types of participation have been tried, according to the research literature?

Actors, themes and initiatives in the NBS space are multiplying and so are governance approaches. To ensure that local needs are being met, participation to gain insight into local knowledge is increasingly seen as important (Frantzeskaki, 2019). The pilot cities in the VARCITIES project will be involved in stakeholder mapping exercises and processes of co-design.

The research literature provides assessment of a range of different approaches to participation. Participation takes different forms and can be thought of as a spectrum ranging from top-down approaches with consultation to co-design and co-production to empowerment of bottom-up initiatives from self-organized citizens (Dorst et al., 2019). Table 1, adopted from Mattijssen et al (2018) illustrates the roles that government actors can take, and how they lead to different outcomes for participation

Table 1: illustrates the different government roles in the different possible governance arrangements (Source: Mattijssen et al., 2018).

<i>Government actor role</i>	Leading ←-----→ Enabling				
<i>Form of non-government actor participation</i>	Information	Consultation	Involvement	Partnership	Empowerment
<i>Non-government actor role</i>	Provide information about NBS plans and projects as part of decision making process	Some involvement in planning, management, and maintenance	Shared roles and responsibility around planning and management	Leasing or purchasing of public land	Management agreement, leasing or purchase of private land
<i>Governance model</i>	Government actor led consultative democratic processes	Co-management	Co-governance/ co-production Consensus oriented	Non- government actor led governance, Self governance	

Formal participation processes have traditionally used methods aimed at information gathering (e.g. surveys, focus groups, informal interviews), awareness raising (e.g. role-playing exercises, planning walks and games), and public meetings to inform citizens and hear complaints or ideas. The goal of these activities is primarily transparency as a pre-condition for legitimacy in democratic societies. There is usually minimal room for citizens to change the plans in meaningful ways or participate in the early stages of formulating problems or later stages of evaluating the solutions. NBS are themselves considered a new way of defining problems and solutions. By facilitating participatory approaches, the potential of NBS can be better supported, as collaborative methods can help increase understanding and awareness of NBS (Pegano et al., 2019; Lupp et al., 2021).

Frantzeskaki (2019) argues for current practices to move beyond consultative and regulative practices, and holds that participation should aim towards collaborating and learning from multiple types of stakeholders. One way of doing this is through co-design and co-producing solutions – key terms in the VARCITIES project. In the literature, the term *co-design* is used when citizens are involved from the early stages of defining problems and solutions and co-produced means citizens are further involved in the implementation and maintenance of the solutions. Co-production strategies are recognized as approaches to include citizens on the



same footing as professional actors (planners, politicians, experts, institutional and private sector stakeholders) (Basnou et al., 2020; Buijs et al., 2016). The goal of co-design and co-production is to include the lived experiences, views and skills of many different actors to establish long term strategies to address specific problems (Szebeko and Tan, 2010). According to Frantzeskaki (2019), co-creation and co-design with various stakeholders can generate socially acceptable NBS designs. By facilitating spaces for urban social innovation, co-creation and co-design can come in the forefront of urban development (ibid).

Continuous learning, including reiteration between steps, should be a key part of the process of co-design (Webb et al., 2019). This may include offering webinars or online videos preceding co-design events; drawing, ideation cards or public participatory GIS (Raymond et al., 2016) and generating debate around the established objectives. Various methodologies can also be used to raise interest amongst participants from the very beginning, and to maintain their interests (i.e., social mapping, visual thinking, gamification, flipped classroom, outdoor learning etc.). Other examples include social media, blogging, community events such as “discovery days” and conservation volunteering (Basnou et al., 2020).

Another method being employed in the implementation and research for NBS, is citizen science (Cárdenas et al, 2021; Restmeyer and Boogaard, 2020; Cendejas et al, 2021; Schuttler et al, 2018; Di Grazia et al, 2021). Citizen science involves data collection at a local level by trained volunteers in research activities, which can enhance data collection (Di Grazia et al., 2021; Cárdenas et al., 2021). According to Schuttler et al (2018), this can also benefit participants as their attitude and behavior towards the environment can change. Cárdenas et al (2021) illustrate this circular benefit of NBS with their paper on “walk and reflect” and citizen science. With “walk and reflect”, citizens were presented with potential or real NBS, to reflect on the benefits of NBS from a local perspective. By engaging with NBS through these activities, participants can gain benefits such as improved mental health, a sense of empowerment and increased motivation to act more sustainable (Cárdenas et al, 2021).

Urban living labs are another approach that is growing in popularity. Living labs aim to foster experimentation and innovation through multi-stakeholder engagement to establish new approaches for sustainable development. The intention is to test new ideas in real world settings to produce evidence to support policy generation and diffusion (Mahmoud et al., 2021). Some living labs focus on commercialization while others focus more on democracy and social justice. Local authorities play a key role in creating these spaces and facilitating urban sustainability transition processes (Voytenko et al., 2016). Thus, Living Labs are both a physical arena and an approach for collaboration and experimentation adapted to local contexts (Voytenko et al., 2016). The concept of living labs has also shown promise in non-urban areas, with increased support of NBS (Lupp et al., 2021). In rural mountain areas, living labs can result in trust and understanding, by creating an equal meeting ground.



Within natural resource management, social learning has become part of a collaborative approach in decision making processes (Murti and Mathez-Stiefel, 2019; Fisher and Dodman, 2019). Within planning practice, social learning is viewed as a positive contribution for desirable outcomes (Schönfeld et al., 2020). It involves negotiation and reflection of knowledge through social interactions with involved stakeholders, such as developers, citizens or politicians (ibid). According to Reed et al (2010), social learning must happen at a broad enough scale where *“A change in understanding must therefore be demonstrated in the individuals involved”*. Social learning must not be confused with participation, but participation can facilitate social learning. As a part of socio-ecological resilience, social learning can strengthen social capital, mobilize resources, and contribute to consensus building (Ferreira et al., 2020). Moreover, transdisciplinary knowledge co-production can be enhanced by establishing collective understanding (Murti and Mathez-Stiefel., 2019).

With the rise of web 2.0, there has been an increase in the use of digital tools to encourage citizen engagement. Examples include public participation geographic information systems (Raymond et al., 2016), geo-questionnaires (Czepakiewicz et al., 2017), social media (Williamson and Parolin, 2013) and virtual reality technology (Liu et al., 2019). Digital technology can both be a tool for participation and increase awareness of the local environment. As Mattijssen et al (2020) highlights, digital tools can foster new relationships with nature, which can increase support for nature policy. Experiencing nature through apps and webcams for instance, has the potential to support participation in different ways which can engage various stakeholders. People who might not be able attend public meetings for instance, can engage in the planning process through online participation tools (Afzalan and Muller, 2018). As such, online participation tools can support other forms of participation.

3.2. What are the challenges of participation in NBS, according to the literature?

One of the biggest challenges that prevents planners from seeking more involvement of citizens into truly participatory or co-production processes is the problem of deadlines and budgetary constraints. While there is a large body of planning literature advocating for more participatory processes, there is a perception amongst many planners and policy makers that deeper participatory processes might hinder rather than improve the development of projects (Raymond et al., 2017a).

A recent investigation of participatory processes in NBS initiatives observed that most case studies are selected because they are successful examples, but there is little empirical evidence regarding the actual value of participation for sustainability (Wamsler et al., 2020).



The authors found that there are structural conditions that often lead to participation influencing sustainability outcomes in negative ways. These include a lack of organizational flexibility and the role of participatory processes as a secondary concern whereby planners must seek a ‘technocratic compromise’ in which involvement is ‘punctual, isolated, and often counterproductive’ (Wamsler et al., 2020). In some cases, participation might not be desirable, if there is a lack of resources, previously made decisions, past failures, or no civic culture (Anderson and Renaud, 2021).

Urban planning also often results in the same citizens being involved in the planning process, which can lead to participation fatigue (Frantzeskaki, 2019). Deeper levels of participation are necessary for the implementation of NBS to be successful (Puskás et al., 2021). But according to Wamsler et al (2020) there is a lack of focus on the personal sphere (*see also* O’Brien and Synga, 2014), as opposed to the political and practical spheres. Another challenge is that large institutions, such as the European Commission, require that problems and solutions are already well defined in order to receive funding (O’Sullivan et al., 2020). Furthermore, inclusion of diverse and marginalized people can be a challenge because people with the most resources are more likely to participate in the traditional processes. Factors contributing to this challenge include holding meetings with no childcare, language barriers, and a perception amongst marginalized and minority groups that their opinions and experiences do not matter to people with positions of power.

While proponents of participation of NBS argue that these experiments build trust between the city and its citizens both for the aim of the experiment and for the experimenting process itself (Frantzeskaki et al., 2019), in practice, this is not always the case. There is potential for participation to deteriorate trust if the participants do not feel their contributions or opinions made any impact. This means that decision making power must be delegated but also balanced with the regulatory and technical expertise of professional planners and engineers. Studies have shown how knowledge from citizens can contribute to formal ‘silos’ of expertise, with new insight and local knowledge (Eversole, 2012; Luyet et al., 2012). But a barrier exists regarding the use of ‘sectoral language’ within these formal ‘silos’ (Kabisch et al., 2016).

Planners are then challenged to go beyond the role of expertise towards the role of motivators and facilitators (Puskás et al., 2021). As table 1 illustrates, this requires a more enabling role from the government. According to Arnstein’s (1969) participation ladder, this will result in increased power towards citizens. This challenges the existing capacities of civil servants away from the traditional view of rational and objective practitioners (Wamsler et al., 2020). Participatory forms of planning within modern governance, require that the relational qualities of planners and decision-makers are addressed. Furthermore, a wider collaborative approach might be challenged when balancing knowledge from experts with knowledge and input from citizens. With NBS, knowledge is required from a range of various



expert, depending on the scale and scope of the project. This might include landscape architects, engineers or biologists. The local needs and wishes might go against what is possible or necessary to implement regarding the nature-based solution.

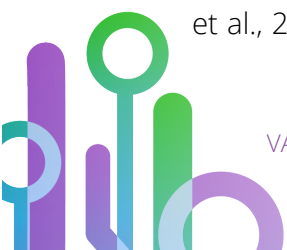
A further challenge for an increased form of participation, is the capacity of civil servants to handle conflict and create a positive relationship with civil society (Wamsler et al., 2020). In the implementation of NBS, various narratives might come to light regarding the socio-ecological aspect of resilience (Goldstein et al., 2015). According to Frantzeskaki (2019), NBS creates new green urban commons, with new relations between people and nature. This might challenge different views of what a sustainable urban future looks like. In some cases, NBS might lead to resistance in the form of Not In My Backyard (NIMBY) protests (Kati and Jari, 2016).

Inclusive participatory processes must also be sensitive to cultural differences and to intersectional challenges related to socio-environmental justice and gender (Bjuis et al., 2016; O'Brien et al., 2017). Broader stakeholder mapping also requires attention to the scale of the collaborative effort. An example is how local citizens will have different needs and values attached to an urban green space compared to citizens coming to the area from a longer distance (Kabisch and Haase, 2014).

Moreover, nature does not follow the cycles of political change and require long-term investment (Gearey, 2019). Short-term action and decision-making can make it unclear as to who as the responsibility of the long-term maintenance of the project (Kabisch et al., 2016). The lack for clear responsibility can in turn affect the socio-economic and environmental benefits that NBS provide in the future. This also raises the question of who to involve and when. Furthermore, a challenge exists when we look to how some of the benefits of NBS are not seen immediately, but for the local citizens the change in environment is experience right away. A further challenge for participation is then connected to how socio-environmental and cultural history is understood with different perceptions, interactions and use of urban nature (Tozer et al., 2020).

3.3. What needs to be improved for participation NBS to work, according to the literature?

NBS are according to van der Jagt et al (2021) vulnerable for being co-opted by powerful interests. In addition, 'green' projects can lead to gentrification of urban areas that further increase the uneven accessibility to blue-green space (Wolch et al., 2014). Furthermore, a lack of collaborative practices can prohibit implementation of NBS on a broader scale (Lupp et al., 2020). A reflexive approach might thus be necessary, to achieve sustainable and just



cities, with more open-ended and inclusive approaches (van der Jagt et al., 2021). This can be achieved by broadening the view of urban sustainability, which allow for a context specific approach that includes various stakeholders. The awareness of failures and learning from them through a reflexive approach, can then bring new networks of society together (Kabisch et al., 2016). With the implementation of NBS, local government must consider social cohesion through new modes of governance with the inclusion of diverse stakeholders and residents (Kabisch et al., 2016). By strengthening the relational and reflexive capacities, public institutions can make room for different voices and narratives in different arenas for discussion (Kiss et al., 2022).

In their paper on governance models for NBS in seventeen cases in Germany, Zingraff-Hamed et al (2020) found that no “one-size-fits-all” governance model exists. Although NBS implementation is context specific, the authors identified a commonality between governance models, with the inclusion of different stakeholder groups. The authors suggest that a key factor for NBS implementing NBS successfully, is a collaborative governance approach. With the cooperation between stakeholders, implementation of NBS can be improved. Arlati and co-authors (2021) propose that the development of NBS is sustained by co-creation principles, where restructuring of decision-making processes is needed. Moreover, participatory design has evolved to where decision-making power must be shared within a flexible approach to problem solving.

Citizen involvement in the formulation of problems and desirable solutions in the earliest stages of planning is still an underutilized tool for more creative and effective NBS (Breuer et al., 2017). There is also substantial room for involving citizens in implementation, maintenance and post-ante evaluations (Dorst et al., 2019). There are few examples where multi-stakeholder initiatives have been systematically monitored and evaluated (Raymond et al., 2017b). Cost-benefit analyses alone does not adequately capture the multiple benefits over time of NBS, thus new methods are required for ex-ante assessments such as participatory assessments, group modelling and integrated sustainability assessments (Kabisch et al., 2016). Participatory evaluation is also a way to respect the legitimacy of different views on NBS quality (Nesshöver et al., 2017).

Another success factor is a fluent grassroots-municipality power relationship (Van der Jagt et al, 2017; Wamsler & Riggers, 2018). Buijs et al (2016) propose a framework of mosaic governance to meet the increased heterogeneity in the collaborative approaches to planning for environmental sustainability. This framework propose that governance look to the micro level of active citizenship together with the macro level of strategic urban planning (Buijs et al., 2019). Organized citizen groups make participatory planning easier to sustain over longer time periods and can potentially improve the inclusion of marginalized people by involving delegates from communities that tend to be underrepresented in traditional participatory



processes. This also addresses some of the challenges of participation such burn-out and lack of familiarity with the regulatory and technical issues in play. The collaborative networks that grassroots innovation provide, is significant for the new urban green commons that NBS generate (Frantzeskaki, 2019; Anguelovski, 2013).

Organized citizen groups also learn over time such that they are able to participate with more understanding of the perspectives and challenges faced by planners, policy makers and other stakeholders. Strong civil society and community groups are therefore important for another success factor in participatory NBS, delegating power. If no power is delegated to participants to make decisions, then they are resources for information at best and at worst, the participatory processes erode trust in planners and policy makers. Some scholars have argued that delegating power is not only about legitimacy but about improving the sustainability outcomes because community groups are often better situated to think of integrated, holistic approaches than urban governance organizations because of scale and specialization (Randrup et al., 2020).

With involvement of various stakeholder in the implementation of NBS, actors and citizens can get a sense of ownership, which contribute to the overall acceptance of NBS (Lupp et al., 2020). Although NBS are usually initiated by local governments, the collaborative approach can lay a foundation for the municipalities or other stakeholders to take on an enabling role in the later stages of a project (Frantzeskaki, 2019). This will in turn result in a deeper and wider participation process, where citizens play a vital part in defining their futures (Puskás et al., 2021). In NBS projects where citizen have an initiating role, collaboration with local governments can be a source of knowledge of how to maintain and operate NBS (Frantzeskaki, 2019).

The ability to move towards conflict is a crucial part of increased stakeholder involvement of NBS. According to Kati and Jari (2016), local conflict might emerge as a result of public participation failing to identify different values and meanings attached to places. This is also related to how the public and experts have different perceptions of the role of biodiversity in cities (Campbell-Arvai, 2019). But with a collaborative approach, building consensus through deliberation of different perspectives and arguments, can ensure that key stakeholders are involved in the planning process. By addressing the various values attached to the socio-cultural aspect of the environment in the early planning process, the capacity of ecological and social systems can be enhanced (Kati and Jari, 2016). Capacity building can further balance the uncertainty of NBS as a new approach for urban sustainability and resilience (Egusquiza et al., 2019).

Urban resilience for humans and environment can increase through positive feedback mechanisms. According to Dennis and James (2016a;2016b;2016c), the value of ecosystem



services can increase alongside a collaborative management of urban green space. Increased ownership and empowerment for citizens can further support the long-term maintenance of nature and increase the relational value of nature (Mattijssen et al., 2020). This requires attention to the uptake of the relational language in policy discourse alongside the focus on intrinsic and instrumental values of nature. Mattijssen et al (2020) highlights the need to re-think the intent and design of nature policy with a pluralized meaning of nature, re-structure for institutional change, and re-connect through the relationship people have with nature. With the increase of bottom-up grassroots initiatives and focus on increased participation in planning for NBS, the relational value of nature is necessary to address and implement (Mattijssen et al., 2020). This can improve the collaborative effort, by looking to both citizens and professionals understanding of nature and how to manage it (Buijs and Elands, 2013).

Addressing the multiple values of nature requires involving various stakeholders in the planning process. Through urban social innovation, planners can increase the degree of input with a wider stakeholder mapping, with different fora for co-creation. This is in line with the shifting regulative role of planners towards a collaborative and enabling role (Mees et al., 2019; Frantzeskaki, 2019). Mees et al (2019) have demonstrated how this role can be flexible in support of different citizens initiatives. As Reed et al (2018) argues, a “wheel of participation” can enable all types of public engagement to be considered depending on the context.

Lastly, public acceptance is crucial for the success of NBS (Anderson and Renaud, 2021). Challenges exist in how tangible the benefits of NBS are to the public, which is connected to generating awareness of these benefits, not only providing them. Anderson and Renaud (2021) find that public acceptance is important in all phases of a project, with some increased importance in the design and planning phase, and during maintenance and sustainable use. To increase public acceptance the authors, propose four recommendations; 1) provide benefits, 2) increased awareness, 3) communicate effectively, and 4) promote participation and collaboration.

Planners have the responsibility and the capacity to ensure the inclusion of different groups in the benefits of NBS by analyzing socio-economic and demographic data to identify who is not present and how they might be engaged. This is an important aspect in the role municipalities can play in coordinating and integrating different bottom-up initiatives together with ensuring climate change adaptation outcomes by connecting patchworks of grassroots initiatives. It is also necessary to be clear what the goal of participation is for the specific solutions. Various contextual differences mean that participation will move between top-down and bottom-up initiatives.



4 Citizen involvement in NBS – lessons from case studies

Finally, we would like to highlight some examples of citizen involvement in NBS, also drawn from the research literature, that can provide helpful lessons through further reading.

Example 1:

The City of Vienna adopted a multi-level communication process during development of its Green and Open Space Strategy (2016). Residents in each district in Vienna were asked about their values for green spaces (including activity preferences) and how they would like to see their green spaces managed into the future (Raymond et al, 2017b).

Example 2:

Melbourne's Urban Forest Strategy was produced with a co-creative process integrating local knowledge into the governance of NBS through neighborhood-specific co-governance forums and reflexive decision making (Gulsrud et al., 2018; *see also* Van der Jagt et al, 2021). The governance process re-focused climate adaptation solutions from technological strategies to context specific social issues including well-being and community-based decision making.

Example 3:

“Biodiverse edible schools” in Berlin combine a focus on biodiversity conservation with efforts to eat local food and provide children with opportunities to connect with nature (Fischer et al., 2018). The components of the project included (1) a school kitchen supplied with food from regional producers; (2) a garden on the school's grounds for producing food; (3) a neighboring vacant wild site as a habitat for wild edible plants, and, most importantly, (4) collaborative activities in planning, managing, and using the garden and the wild site.

Example 4:

In Barking Riverside, London, a brownfield development site was redesigned to provide stormwater storage, recreation access and biodiversity with participatory processes from planning to implementation to maintenance (Connop et al, 2016). A knowledge transfer partnership (KTP) of key stakeholders, including academics, development agencies, local authority and local SMEs was set up to engage with the local community. Later, a Community of Interest Company, which includes residents, was created to assume responsibility for the management of the public space from the Greater London Authority and the developer (Raymond et al, 2017b).

Example 5:



The Penllergare Valley Woods in Swansea, UK are protected through a community trust established through grassroots organizing. Based on informal agreements with the city or in some cases no agreements at all, volunteers took on maintenance of the landscape. After 12 years and nationwide promotion of its environmental and historical value, the land was assigned to the community trust for the duration of 100 years, securing the woods for the public benefit. Being autonomous of the government yet receiving their support was important to the success of the trust (Ambrose-Oji et al., 2017).

Example 6:

By investigating six cities in the EU, Van der Jagt et al (2017) found that communal urban gardens (CUG) can act as NBS contributing to social resilience. Some of the benefits of CUG include providing social cohesion, protection of fertile and uncontaminated land, changes in attitude towards the environment and additional income. Furthermore, CUG benefit people that are not involved, with access to affordable food, environmental education and local green spaces being transformed. The participation of actors in hands-on and political activities is an important part of the success, where *"we need an approach that enables local people to discover, nourish, adapt and co-create their own culture"* (Van der Jagt et al, 2017).

Example 7:

In the Neugraben-Fischbek district in Hamburg, NBS are being deployed through the CLEVER Cities Project funded by Horizon 2020. Several NBS are explored to address challenges for urban regeneration in the pilot area. Insights from the project illustrates how involvement of various participants can generate a learning effect through a co-creation process (Arlati et al., 2021). With a focus on co-creation, participation have included a kick-off event with several tools such as digital participation and graphic recording, that were used for further work with different urban living labs. The authors describe the workshops in this case study as a knowledge transfer tool, where the understanding of complex topics are enhanced for the general public. It is also pointed out that showing the result from the co-creation process can increase further motivation. Direct involvement is also said to contribute to a degree of empowerment (Arlati et al., 2021).

Example 8:

A case study conducted in the Karlova Ves district in Slovakia, have illustrated how participation can improve green infrastructure development as an NBS. According to Vano et al (2021), a collaborative approach can result in enhanced stewardship for green infrastructure, as new forms of participatory governance is created. Although increased flexibility is needed at the top-down level, the physical quality of green spaces can be improved by enhancing social inclusion and the interdisciplinary processes. The case study looked at several greening programme activities and their outcomes, where seven out of ten employed social inclusion. Example of activities were participatory mapping targeting local



needs and knowledge, public workshops and information days, and adopt a flowerpot for revitalization of neglected sites led by citizens.

Example 9:

Citizens in Amersfoort, Netherlands, have taken an active role in transforming an old hospital site into a green park (Mattijssen et al., 2019). Through active citizenship, a green discourse was established, as opposed to the vision from local political parties to create affordable housing at the site. The citizen promotion of the transformation of a brownfield into a green space, have contributed to a broader co-creative change in the local governance. The case study by Mattijssen et al (2019) illustrates a shift from protests by citizens towards collaboration. Citizens organized excursions with a focus on how the site could become a part of the landscape again. By connecting with citizens, policy makers changed their plans for the transformation of the area, which was influenced by the reference to the historical value of the landscape, as well as biodiversity and recreational values.



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