

The Nature of Innovation for Urban Sustainability



KEY POINTS

- We reviewed the conditions enabling and limiting innovating with urban nature-based solutions
- We pursued a systematic literature review drawing on environmental governance literature, transition studies and urban scholarship
- A range of factors including policies, resources, personal qualities and partnerships are identified
- No single factor can qualify as root explanation; a systemic understanding is necessary
- Success is reflected in the quantity, quality, distribution, transferability and sustainability of interventions

ABOUT THE PROJECT

NATure-based URban innoVATION is a 4-year project involving 14 institutions across Europe in the fields of urban development, geography, innovation studies and economics. We are creating a step-change in how we understand and use nature-based solutions for sustainable urbanisation.





What are nature-based solutions?

Urban nature-based solutions are interventions in which nature is strategically used in order to address societal challenges such as climate change and urban regeneration. Examples of nature-based solutions include green roofs, rain gardens, sustainable urban drainage systems and community gardens. They are intended to provide multiple benefits, such as climate change adaptation and mitigation, health and well-being, biodiversity enhancement and economic development. There is now an increasing interest in whether they provide a viable alternative to grey 'engineered' interventions to address urban challenges.



Our approach

Despite the interest in developing nature-based solutions, there is limited understanding about the processes of innovation and scaling up through which they can be developed. Available knowledge is often fragmented across different disciplines, including urban studies, socio-technical transition studies, and environmental governance. We carried out a systematic literature study to bring together relevant knowledge from these largely disjointed fields using a central research question: what conditions enable or limit the development and uptake of innovative 'green' interventions in cities? We found 75 relevant publications and undertook a detailed reading, coding and analysis of a subset of 39 papers from which we identified the key drivers of and barriers to innovation with nature-based solutions. These are presented in Table 1. We suggest that none of these success factors operate in isolation: the feasibility of nature-based solutions are often dependent on a series of events and local circumstances which together create the conditions for nature-based solutions to flourish or perish.

Identifying the factors shaping innovation with nature-based solutions

Table 1 provides an overview of the factors that were found in our systematic review to be of significance in shaping innovation with nature-based solutions. As people make the decisions around implementing nature-based solutions, **cognitive** factors directly influencing action or inaction, such as awareness, uncertainty, a sense of urgency or flexibility play an important role. Related to this, **capacity** for action and personal motivation (described here as **agency**) also need to be considered. While attitudes and motivations play a role at individual and group level, collective worldviews do so at the level of society, with ramifications for the



actions of individuals and groups (*discourses and future visions*). Discourses also interact with *strategic plans, legislation and regulation* which can be used to directly and indirectly steer sustainable practices.

The way powerful institutions organize themselves influences the degree to which they have a strategic overview, and therefore potentially budgets for and collaboration on developing NBS interventions (*institutional set-up and governance structures*). This will also influence the institutional capabilities to *collaborate* and *learning* in this domain, two factors that are essential to success of NBS in their own right. Collaborating takes place in professional networks and partnerships, but also includes citizen participation which is becoming an increasingly dominant urban practice. Learning may happen in various ways, including education, experimentation, research or monitoring and evaluation.

Another critical category is that of *resources*, comprising materials and technology, knowledge and human capital or financial factors. In addition, one cannot understate the role of the local geographical context; aspects such as the design of the built environment, types of available amenities, environmental qualities, societal processes, local culture and land/property ownership greatly influence the feasibility of measures such as green roofs.

Table 1: Overview of factors influencing NBS innovation in cities

Variable	Subfactor	Description
Cognitive factors	<i>Awareness</i>	Awareness by decision-makers and users of the role NBS interventions could play as a solution to complex problems. e.g. holistic thinking (in organisations), the role of “NBS advocates” and (formal) knowledge brokers, changing perspectives
	<i>Uncertainty</i>	Limited clarity about right course of action influencing decision-making regarding NBS
	<i>Sense of urgency</i>	A new problem presents itself or is perceived to be increasingly urgent as a result of pulses, which prompts the exploration of new solutions (if solution-focused, it is part of <i>discourse</i> factor)
	<i>Flexibility</i>	Individuals or organizations showing openness to external input or circumstances using a ‘learning-by-doing’ approach
Agency	<i>Leadership and power</i>	People and organizations taking up leading roles, taking charge of the process. E.g. champions, mayoral leadership, frontrunners etc.
	<i>Commitment</i>	Long-term devotion to processes of change. Could be by individuals or groups (community groups, municipalities, a company’s CEO, ...)
Discourses and future visions		Collective worldviews (e.g., sustainable development, biodiversity, governance) influencing the interpretation of a problem or a course of action (e.g. urban greening)
Strategic plans, legislation, regulation and policies		Formal documents outlining a development trajectory, projections of ideal futures. Also planning regulations and legislation relevant to NBS pathways
Institutional set-up and governance structures		Diffusion of responsibilities and power between decision-making units at micro (intra-institutional), meso (at city or regional level) and macro level (at national or transnational level)
Collaboration	<i>Networks, partnerships and social interaction</i>	Formal and informal coalitions between individuals, collectives or organizations, and attempts at strengthening these

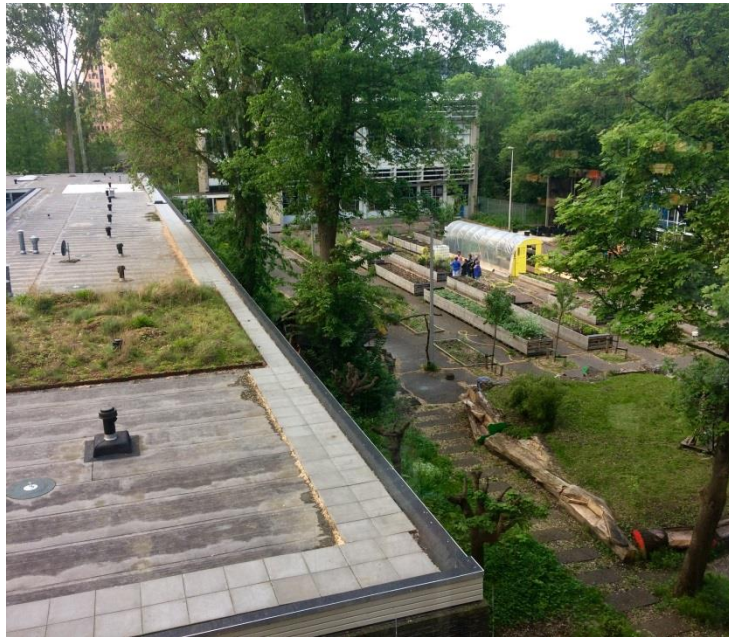


	<i>Participation</i>	Citizen participation and engagement in plan development or NBS maintenance, including consultation, co-governance and community action
Learning	<i>Education and training</i>	Actors and organizations engaging in a process of active learning, with a view on increasing resources
	<i>Experimentation</i>	Testing or piloting projects or forms of governance aimed at change/innovation
	<i>Research</i>	Knowledge partners/ institutions contributing to the knowledge base (on topics such as climate change) by systematic studies
	<i>Monitoring and evaluation</i>	Keeping track of (changes to) the process and assessing outputs, outcomes and impacts
Resources	<i>Materials, tools and technology</i>	Computer, physical and engineered tools that are used towards innovating practice
	<i>Knowledge and human capital</i>	Relevant knowledge, skills, abilities, relevant experience of individuals, collectives or populations
	<i>Financial factors</i>	Funding, incentives, cash flows, market demand etc.
Local geographical context	<i>Built environment and urban amenities</i>	Characteristics of certain places, tied/bound to that space. (e.g. to built environment, environmental qualities, demographics)
	<i>Environmental qualities and climate</i>	Local flora and fauna, presence of water and vegetated areas, type of soil, etc., as well as the influence of local weather climate and climate change
	<i>Societal processes</i>	Societal processes affecting local populations. E.g. urbanisation, unemployment, urban agglomeration dynamics
	<i>Local culture and image</i>	Cultural or individual preferences and norms (e.g., regarding aesthetics or lifestyles), or regional role of city (e.g., as trading centre or creative hub) influencing NBS pathways
	<i>Land or property ownership</i>	Ownership of the land (e.g., public or private)



How to evaluate the success of nature-based solutions?

The review highlighted different ways of measuring the success of nature-based solutions. The first and most obvious indicator of success is the extent of their actual implementation. In addition, we can consider the extent to which interventions are fairly distributed across the city. Another and often overlooked way of assessing success is the ability of interventions to sustain themselves over time. The success of innovations with



nature-based solutions can also be apparent from the extent to which targets, such as environmental quality, adaptive capacity (in relation to climate change effects) and health and well-being, are met or potential drawbacks, such as nuisance by insects or leaf litter, are avoided. Finally, the degree to which interventions are copied elsewhere could also serve as an indicator for success.

Conclusion

A range of mutually interacting factors including personal attributes, collective worldviews, policies and resources influence the scope for interventions intended to deliver nature-based solutions and the forms of innovation that are taking place. Yet, none of these factors can be said to be more important than one another. The success of interventions can be assessed in different ways by examining the extent, quality, spatial distribution, transferability or long-term nature of examples. Future work will relate the findings of this review to the wider field of urban innovation in order to understand the extent to which the challenges and opportunities for nature-based solutions can be improved by learning from other examples of urban sustainability.