Navigating urban futures: Exploring NbS upscaling discourses, practices, and relations in reimagining human-nature relationships

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A B S T R A C T

Recent discussions within urban planning support nature as a potent ally to facing climate change in cities. Among all, nature-based solutions (NbS) and their upscaling have been proposed to address climate change challenges in the urban environment. Different visions on how NbS uscapling is advanced in the urban context, by whom, and for what purpose have generated conflicting imaginaries by which the city of the future could look like. Yet, this plurality has generated confusion and controversies on the 'right way' to perform NbS upscaling. Stemming from urban sustainability transition and governance research, the paper proposes a working definition of upscaling NbS based on three analytical dimensions: discourses, practices, and relations. The combination of the three dimensions suggests a new understanding of the complex phenomenon of NbS upscaling that implies the effort of different actors to frame a winning picture of NbS to be normalised as an implementable solution in the pursuit of a selected nature-based future imaginary. The paper argues for an alternative perspective on human–nature relationship that puts at the centre nature and considers tradition and locality for NbS upscaling for a greener and more just future in cities.

1. Introduction

Climate change increasingly confronts humanity with new and always more complex challenges (see IPCC, 2023). Recognising the profound and intricate interplay of natural and human systems, researchers and international organisation representatives stress the transformative role of nature in addressing climate change (Díaz et al., 2019; UNEP, 2022a). This transformative change would require a paradigm shift to achieve a desirable future that puts nature at the centre of urban environmental policies (McPhearson et al., 2021).

Recently, the concept of nature-based solutions (NbS) has gained significant traction in the global discourse as a cost-effective innovation to address social, economic, and environmental threats, harnessing the power of nature (see Cohen-Shacham et al., 2016; Seddon, 2022). Further, international organisations demand nations worldwide to prompt upscaling NbS to achieve broader systemic change (Science for Environment Policy, 2021; UNEP, 2022b). This view is shared by scholars who support the great potential of NbS as an urban planning practice to cope with climate change and start addressing the question of upscaling such solutions (Mahmoud et al., 2022; Xie et al., 2022).

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While the necessity to upscale NbS is recognised by many, it is still under debate in the political arena and the process to achieve this goal remains unclear. This lack of clarity has both conceptual and practical origins. On one side, upscaling and NbS are ambiguous and profoundly debated concepts (e.g. Augenstein et al., 2020; Sowińska-Świerkosz & García, 2022) for which the plethora of equivocal definitions creates additional contestation. On the other, this contestation translates into conflicting ideas of urban futures proposed by urban actors, leaving each claiming sovereignty over the 'right' reasons and ways to enact NbS upscaling (Adams et al., 2023). This paper enters the debate on NbS upscaling by asking: *What are the implications for cities in selecting NbS upscaling for pursuing desirable socio-natural futures based on human–nature relationships?*

Under the premise that NbS upscaling is a promising path for achieving specific desirable futures based on innovative human––nature relationships, the paper argues that the enormous pressure from governments and international organisations to concentrate on NbS upscaling risks creating another path dependency. Drawing on future studies, the contribution of this paper is twofold: to conceptually define and fine-tune the concepts of NbS upscaling as an act of 'futuring' and to propose an analytical framework to holistically investigate this phenomenon as a process of interlinkages between discourses, practices, and relations. The paper is organised into three parts. Sections two and three address the concepts of upscaling and NbS in transition literature and touch on the creation of urgency for NbS upscaling. Based on the concept of the sociotechnical imaginary by Jasanoff (2015), section four discusses key analytical dimensions for studying NbS upscaling through a governance perspective to describe a coherent analytical framework and set the basis for further research in this field.

2. Upscaling in transition research

The research on NbS and its upscaling is strictly linked to urban experimentation. The transition literature offers a vibrant field in trying to explain transformative forces, such as those deployed in experiments. In this paragraph, a literature review of transition research offers an overview of six transition frameworks that attempt to explain upscaling processes.

Transition research has traditionally studied transformative pathways that explain the evolution of (technological) innovations towards being accepted by the wider society (Rip & Kemp, 1998). This evolution can be related to as upscaling, whereby materials, actors, and rules join together to make explicit the linkages between science, technology, and contextual (political and social) factors (Hughes, 1986, p. 282). By using projections as an anticipatory exercise to explore possible pathways and enact desirable futures, transition research has become influential in studying transformative change as an act of 'futuring' (Brand, 2016). Through (NbS) upscaling, it is possible to trigger such change, and therefore, it became a core research interest of transition studies (Bögel et al., 2022). Although many other terms exist (see Lam et al., 2020), 'upscaling' is the most commonly used and has entered the everyday language beyond academia (see the IPCC, 2023, pp. 27–29). Because upscaling has metaphorical, symbolic, and cultural meanings in addition to an actual physical increase in the scale of things (Merriam-Webster.com, 2023), its openness has generated a plethora of ontologies and epistemologies to study this phenomenon from a transition perspective. It can express the desired outcome of transition (Durrant et al., 2018; Gorissen et al., 2018; Karic & Losacker, 2023), a measurement of the potential of transformative change (scalability in Castán Broto & Bulkeley, 2018, p. 71); or a process in which new 'ways of doing, thinking, and organising' introduced by an innovation grow in scale and become the new normal (Augenstein et al., 2020, p. 143). Within transition research, six frameworks can be identified, each with its conceptualisation of upscaling.

In studying the causal connections between technological change and economic growth, the technological innovation systems framework (TIS) detects upscaling when "the impact of the new technology on the economic system" becomes relevant enough for various economic agents (Carlsson & Stankiewicz, 1991, pp. 98–99).[2] Herein, government support plays a significant role in removing barriers through policies addressing relationships between actors, cultural values, and norms (Carlsson & Stankiewicz; Jacobsson & Bergek, 2006). Hekkert et al. (2007) explain this support through three "motors of change" (p. 426). First, 'guidance of the search' describes the process of identifying problems and defining goals, which lead to new resources and knowledge development for new technological options. The second consists of the action of 'counteracting resistance' and unlocking more resources for R&D. The last sees the government lobbying for new 'market formation'.

Strategic niche management (SNM) articulates a strategic act of the government to shift socio-technological systems[3] by stimulating new (niche) technologies (Schot et al., 1994). Accordingly, SNM describes upscaling as the act of "creation, development and controlled phase-out of protected spaces for the development and use of promising technologies through experimentation", aiming at generating new learnings and widening the application of the new technology (Kemp et al., 1998, p. 186). Rip & Kemp (1998) define three 'levels' within which the 'phase-out' occurs: an overarching socio-technical landscape made of materials, rules, and culture; a technological regime, the environment of "stabilized interdependencies [between rules and cultural patterns] that shape further action" (pp. 337–338); and niches, where novelties can develop in a "protected space, in which the product can survive more easily" (p. 355). Upscaling[4] is understood as the active and strategic role of the government to gradually minimise barriers at the regime levels, allowing niche technologies to enter the market. This happens in a nondisruptive fashion, i.e. without causing social problems during the process (Kemp et al., 2001, p. 278).

According to the multi-level perspective (MLP), upscaling involves the "breaking out of radical innovations from niche- to regime-level" (Geels, 2002, p. 1262), stimulating the shift from one socio-technical system (ST-system) to another (Geels, 2004). An ST-system

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[2] Carlsson and Stankiewicz talk about diffusion.
[3] Schot et al. talk exclusively about technical systems.
[4] Kemp, Rip, and Schot refer to uptake, diffusion, or adoption.

is characterised by linkages between different social (actors) and technical (materials) elements organised in ST-regimes, each based on coherent stories and symbols. Geels defines these linkages as meta-coordination between different ST-regimes, making up for clearly recognisable routines, organisations, and rules. Meta-coordination allows constant adaptation through learning, delineating dynamic stability that allows ST-regimes for incremental innovations (Geels, 2002). This dynamic stability also generates tensions and mismatches among social and material elements: these tensions create a window of opportunity that can be used for innovation to 'breakthrough' in the market (Geels, 2004, p. 914). Thus, MLP suggests an active role of ST-regimes and niches in selecting new technologies, focusing on supporting or hindering dynamics between these two levels (Geels, 2014). This dynamism introduces a temporal understanding of upscaling (Geels, 2006) and links actors, institutions, and technologies in a multi-level system (Geels, 2011).

Transition management (TM) conceptualises upscaling as different possible development pathways that lead from a dynamic equilibrium to a new one (Rotmans et al., 2001). Based on a temporal understanding of transition, TM identifies different phases: innovations are predeveloped in niches (phase 1) until they get stable enough to take off (phase 2) and breakthrough in the system acquiring momentum (phase 3); as a consequence, the system starts to change until it stabilises in a new equilibrium (phase 4). In particular, the breakthrough phase is associated with the wording acceleration, describing the "accumulation of socio-cultural, economic, ecological and institutional changes that react to each other" through learning, diffusion, and embedding (Rotmans et al., p. 17). The idea of acceleration suggests that transitions can occur at different speeds (see Geels & Schot, 2007). TM envisions a relevant role of the government that varies in all phases, both content-wise (agenda setting) and process-wise (as controller, facilitator, leader, etc.). Loorbach (2010) successfully applies a governance approach to TM and identifies four governance activities: strategic, tactical, operational, and reflexive. In this perspective, innovations alone are not considered responsible for broader system transformation. Rather, transition is the result of bringing a successful innovation (operational) from the niche to the regime level through upscaling (Loorbach, p. 176). Success means that the innovation has met the evaluation and learning expectations (reflexive) based on the commonly defined vision (strategic) and that it was able to overcome all identified barriers (tactical).

These frameworks make technology their core study object. Conversely, socio-ecological systems (SES) and socio-ecological-technological systems (SETS) focus on the dynamics between the ecosystem and society. The SES framework understands transition as a "collective management of natural resources […] within a territory" (Triboulet et al., 2019, p. 129). Mathias et al. (2020), highlighting the non-linearity of human–nature relations, base their interpretation of the SES framework on uncertainty. Accordingly, even the slightest change applied to a complex system such as the environment opens up highly diverse but equally possible transition pathways. In this conceptualisation, upscaling describes reaching specific tipping points, moments in which cumulative small changes can trigger a non-linear shift in the system (Mathias et al., p. 1). The SES framework is based on perceptions, i.e. subjective opinions of the actors when assessing a specific socio-ecological situation that drives various possibilities of change in the system. The consideration of different actors' perceptions involves social, economic, and political settings in the governance of a territory (Ostrom, 2009). With its focus on the linkages between nature and society, SES highlights the complexity of managing expectations between long-term and short-term benefits when dealing with the natural environment (Mathias et al., p. 8).

Similarly, the SETS framework considers the world as a complex, rapidly changing system of pluralism and diversity where all events are uncertain (Chester et al., 2023, p. 2). Specific to the urban context, the SETS framework urges a "paradigm shift from human-centeredness, isolation of domains, and control" and concentrates on the interdependencies of humans, nature, and technology (Chester et al., p. 3). Thus, SETS refers to a profound transformation at the institutional level to cope with uncertainty, pushing 'city managers and stakeholders' to challenge existing conceptualisations, reimagine institutional goal, promote experimentation, and foster institutions restructuring. Institutions can deploy four different strategies: 'sustained adaptation' is the ability to adapt to future surprises; 'anticipatory futures' reflect the ability to identify key signals for future trajectories, allowing for dynamic long-term time horizons understanding of problems and solutions; 'loose-fit design' represents the ability to provide more freedom in designing responsive solutions adapting to complex systems; 'co-governance' is the ability to understand knowledge as an entanglement of shared values, views, politics, and identities besides scientific data and information, favouring reflexivity.

These six frameworks have some elements in common when referring to upscaling. First, highly diverse elements, such as actors, artefacts, culture, and language, are involved in the upscaling. These elements are entangled and form complex structures and more or less stable sets of practices. Second, different levels are identified to synthesize the complexity of reality, namely niche, regime, and landscape. Upscaling seems to occur mainly between niche and regime levels, while the landscape is a stabilised set of guiding pathways (Geels, 2002). Third, upscaling is an essential and contested moment of the evolution process of innovation where different actors, beliefs, politics, markets, and culture interact and conflict (Geels, 2011). Fourth, as part of a process, upscaling can be identified as one phase among many in a more or less defined 'upscaling phase'. This phase is also called acceleration, when "new practices accumulate momentum" (Durrant et al., 2018, p. 1540), highlighting the temporal character of transition. Lastly, researchers confer a privileged role on public institutions when it comes to governing upscaling processes.

3. Constructing the future through NbS upscaling

This section discusses the concept of nature-based solutions (NbS) as a practice of 'futuring' to enhance human–nature relationship in cities. NbS are currently defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UNEP, 2022c, p. 2). After briefly introducing how the NbS concept entered the current political debate, this section presents a literature review to identify key elements for understanding how socio-natural futures are imagined through NbS upscaling.

3.1. NbS concept

NbS was first mentioned in the title of a report by the World Bank promoting biodiversity conservation in combating climate change (World Bank, 2008). Afterwards, other international organisations, especially the International Union for Conservation of Nature (IUCN), started to use the wording NbS to refer to actions for combating climate change, fostering human health, and bringing economic benefits through the preservation of nature.

IUCN proposed the first known worldwide accepted definition of NbS for the IUCN World Conservation Congress in 2016: "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN, 2016). In the same year, the European Union (EU) adopted this definition with some modifications: "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" (R&I, 2016). While IUCN focuses on the relationship between nature and society, the EU definition reveals efficiency and economic growth as central foci. The concept of NbS was successfully placed near other more well-known concepts, such as ecosystem-based adaptation (EbA) and green infrastructure (GI). The juxtaposition with other concepts and its broadened use raised essential questions concerning the policy, practice, and science of NbS (Cohen-Shacham et al., 2016) and specifically their monitoring and evaluation (Raymond, Berry et al., 2017; Raymond, Frantzeskaki et al., 2017). In response to some of these questions, the IUCN (2020) published the first standards for NbS, followed by the Handbook on NbS evaluation in the EU context (Dumitru & Wendling, 2021).

Successively, NbS started to be associated with a more active role of nature towards fostering biodiversity rather than limiting its conservation. In the EU context, the EU Biodiversity Strategy 2030 drafted in 2020 explicitly mentioned NbS to reverse the trends of green space loss in urban areas. Aspiring to reach the objective of restoring, making resilient, and protecting the world's ecosystems by 2050, the strategy aims at creating incentives and eliminating barriers to the uptake of NbS in urban areas that will require the investment of "a significant proportion of the 25 % of the EU budget dedicated to climate action" (EC, 2020a, p. 17). Underlying this statement is the general understanding that NbS must be systematically upscaled in cities to reach desired results, which otherwise would remain fragmented attempts (Cohen-Shacham et al., 2019). The EC has underlined the importance of fostering the uptake of NbS in cities multiple times in several official documents (EC, 2023; R&I, 2016, 2023). Such efforts have materialised in the Horizon 2020 research and innovation funding programme (EC, 2020b; Wild et al., 2020). Specifically, the EC allocated €282 m subdivided among 33 projects, starting from 2016–2020 (EC, 2020b, p. 7), for studying and implementing NbS, and confirmed the urgency of NbS upscaling in the new strain of investment for R&I (EC, 2022). Additionally, projects like NetworkNature (NN), platforms such as OPPLA, and working groups such as the Task Forces work to streamline interproject learning and strengthen knowledge generation on NbS. In particular, the importance of speaking different languages has been taken up by the NN project (and continued by NertworkNature+), whereby also art can play a role in proposing alternative ways of telling about nature in cities, such as the NbS comics (NetworkNature, 2022).

The increased emphasis at the political level on NbS treats the concept as a panacea for addressing sustainability in cities through the re-introduction or strengthening of nature in the urban context, and NbS eventually became an umbrella concept including all other similar approaches (Cohen-Shacham et al.; Nesshöver et al., 2017; O'Sullivan et al., 2020). The resonance was such that NbS was officially included as one of the priorities at COP26 (IUCN, 2021) and COP27 (Natue Based Solutions Initiative, 2022). Nevertheless, the utilitarian tendency of the definition and the term solution in the name make NbS a concept that primarily pursues benefits for humans and not nature itself (Welden et al., 2021). Conserving nature has also become attractive to private actors and corporations, which have entered the market of nature protection investment under the concept of natural capital (Monbiot, 2014). Big oil corporations, such as Shell Global, TotalEnergies, and ENI, developed their business strategies for a greener future by promising to implement NbS (e.g. Shell Global, 2021). However, the conduct of such actors has been flagged by activists as greenwashing or off-setting under the slogan #OurNatureIsNotYourSolution (GFC, 2020). This may create the risk of deviating from actual decarbonisation and instead supporting greenwashing and land-grabbing practices (WRM, 2021; FOEI, 2021; GYBN, Y4N, & YOUNGO, 2021; GYBN, YOUNGO, & Y4N, 2021; Melanidis & Hagerman, 2022). This has raised concerns about the definition and its possible misuse expressed by activists (CLARA, 2020) and within the scientific community (Hanson et al., 2020; Nesshöver et al., 2017; O'Sullivan et al., 2020). These critiques have shown the discursive power of NbS and the risk of treating nature apolitically (Kotsila et al., 2021; Seddon et al., 2020; Seddon et al., 2021). Also, it has been demonstrated that specific ways of framing nature enable some actors and constrain others (Woroniecki et al., 2020). In particular, Melanidis & Hagerman (2022) warn of using NbS either as a way to 'leverage the power of nature' or as a 'dangerous distraction'.

The call to clarify the NbS concept led to a new definition, developed during the United Nations Environmental Assembly in 2022, that shifts the conceptualisation of NbS from a techno-economic perspective to an ecological one (UNEP, 2022c). Following this understanding, Europe's role has been central in bringing forward the NbS concept by passing the new EU Nature Restoration Law, considered the first law worldwide on biodiversity and ecosystem protection (European Parliament, & European Council, 2022). There are still, however, concerns around justice (Y4N et al., 2022) and inequalities perpetrated through a narrative that depicts nature as a positive alien force; instead, nature is not passive nor external to human society (Woroniecki et al., 2020). While many governments, private actors, and NGOs are embracing NbS, grassroots movements and other local communities are more sceptical and cautious, rejecting NbS due to uncertainties about the term and its possible misuse, revealing a relevant gap between needs and implementation (Seddon, 2022).

3.2. Upscaling of NbS: a literature review

To answer the matter of the meaning and implications of NbS upscaling, a literature review was conducted in Scopus on the 20th of September 2023 using the following search string: "*scal* " AND "transition" AND "urban experiment" AND "nature-based solutions" OR "NbS" OR "biodiversity" OR "nature" OR "green" AND "2000 to 2023" AND "Europe (in the title, abstract, and keywords)". The reason for the last criterion reflects the attempt of the EU to position itself as the world leader in NbS research (Davies et al., 2021) and implementation (El Harrak & Lemaitre, 2023). A total of 23 articles were found. An additional 18 papers were identified through the snowball method, for a total of 41 papers reviewed. These additional papers were mainly based on the references within the 23 papers identified previously but were excluded by the Scopus research because they do not refer explicitly to upscaling. As the analysis in this paper should not be limited to terminology, these additional papers were considered relevant for the discussion, although they did not fulfil all criteria. More than half of the papers (26 out of 41) refer to urban sustainability transition, embracing a governance perspective. The review focuses on three aspects: the concept of NbS upscaling, related problems, and relevant actors involved in this process.

NbS upscaling can refer to "extending, linking or merging successful" realised NbS (Fastenrath et al., 2020, p. 63). Success implies fulfilling specific expected values (Jørgensen et al., 2022), which are translated into increased benefits for all (Kiss et al., 2022). Following a governance perspective, scholars refer to NbS as an experiment (Cortinovis et al., 2022) characterized by ad hoc governance configurations (Egusquiza et al., 2019). Such experiments are considered as showcasing (Albert et al., 2021), and if successful, they can be transformed into business cases (Frantzeskaki et al., 2020). A broader understanding of upscaling refers to the integration of NbS practices in the current policy mix (Bayulken et al., 2021; Bona et al., 2023; pp, 1301, 0168; Tozer, Bulkeley, & Xie, 2022) in combination with formal and informal instruments or approaches, such as co-creation (Mahmoud & Morello, 2021; Mitić-Radulović & Lalović, 2021). Co-creation refers to the participation of citizens, which is supposed to facilitate the integration of NbS in policies (Brokking et al., 2021; Kauark-Fontes et al., 2023). Thus, integration is another word used for upscaling: it suggests a slow process of stepping stone alignment of NbS with strategic priorities (Xie et al., 2022), thereby changing the status quo through bundling of solutions, normalisation, and mainstreaming (Tozer, Bulkeley, van der Jagt et al., 2022). Also, some authors refer to mainstreaming as alternative wording describing "the process of uptake [NbS practices] and 'becoming the new norm' in policy and planning" (Adams et al., 2023, p. 2; Hölscher et al., 2023; Kabisch et al., 2022; Tozer, Bulkeley, & Xie). Mainstreaming occurs with the support of new narratives and spaces for actors to bridge across different levels (Hölscher et al.). Each governance level has different hierarchical power relations. This reflects the "mix of agendas [of different actors] and involves interpreting, translating, or realising top-down agendas, policies, and/or strategies" (Adams et al., p. 5). Hence, upscaling can be understood as a combination of actions among local actors, such as horizontal expansion of the experiments and vertical coordination actions among actors of different levels (Petrovics et al., 2022). The concept of NbS itself implies the recognition of the more-than-human as central in NbS experiments (Pineda-Pinto et al., 2023). This change of perspective is regarded as a disruptive structural change that involves emotions, touching upon cultural and personal values (Raymond et al., 2023).

Many authors report the difficulty of NbS upscaling in cities due to the specificities of the urban context (Cortinovis et al., 2022; Dignum et al., 2020; Shahani et al., 2022) and the regime structure, which is considered stable and dominated by rational thinking (Hansen et al., 2022; Kabisch et al., 2022). Resistance from the regime to the integration of NbS in policy can refer to the existence of current technologies and infrastructure; existing actors' networks and organisations; dominant cultural values, policies, regulations, economic mechanisms, and funding structures; and inadequate knowledge and user behaviour (Dorst et al., 2021; van der Jagt et al., 2023). In addition, the upscaling of NbS in one region can lead to problems in other regions (Anderegg et al., 2020), demanding efforts in cross-boundaries collaboration. While some authors criticise the incrementalism of change as non-disruptive enough (Hansen et al., 2022), others point out that some NbS never actually leave the experimental state (Rizzo et al., 2021), underlining a gap between the experiment and its adoption into practice (Barbanente & Grassini, 2022). The effective upscaling of NbS practices is also hindered by the different understanding of the concept of upscaling itself (Adams et al., 2023; Dorst et al.; Fastenrath et al., 2020; Schmid & Taylor Aiken, 2023). An excessive instrumentalisation of upscaling would tend to privilege novelties over already existing (and functioning) solutions and contribute to creating a politics of urgency through the narrative of "impact-effecting change-the-world perspective" (Schmid & Taylor Aiken, p. 5). Additionally, NbS upscaling is obstructed by competing visions of nature (Kabisch et al.; Tozer, Bulkeley, & Xie, 2022), whereby only the most powerful actors' idea of nature wins (Kiss et al., 2022). Also, NbS can be seen as reframing older concepts that risk being oversold as a panacea based on an idealised nature (O'Sullivan et al., 2020). This reframing raises the matter of justice both for society as a whole and for nature itself (Pineda-Pinto et al., 2022).

Given these caveats, researchers agree that NbS upscaling requires inter- and transdisciplinary expertise (Adams et al., 2023; Fastenrath et al., 2020; Kabisch et al., 2022; Kiss et al., 2022). Scholars call for actions that lead to capacity building, favouring the link between science and political commitment (Frantzeskaki et al., 2020) with the support of data monitoring and evaluation models (Xie et al., 2022). Thus, connecting different levels, visions, and actors appears essential for the proper governance of NbS upscaling. Co-creation, co-governance, or similar all-including approaches contribute to rising expectations on the success of these processes, most of the time clashing with the complexity of reality (Mahmoud et al., 2023; Mahmoud et al., 2021). In this direction, Bradley et al. (2022) suggest that these promises cannot be maintained throughout the process. In contrast, an ideal governance setting would instead require actors to collaborate in a hybrid setting in between a complete horizontal and bottom-up model and a command-and-control approach. Hence, a relevant role is attributed to the figure of the connector or intermediary in linking adequately different governance levels (Petrovics et al., 2022), primarily through mediation in communications (Adams et al.; Fastenrath et al., 2020; Xie et al.). Communication between levels and actors can influence how systemic changes occur (Frantzeskaki et al., 2022). Through communication, new significance can be attributed to NbS through novel storytelling, which could lead to

building other actors' networks (Hölscher et al., 2023). By describing a tactical scaling for NbS, Schmid and Taylor Aiken suggest considering diverse factors of NbS upscaling, namely: which is the type of NbS to upscale, why, for whom, and by whom; which power unbalances are present and are generated through the upscaling; and which temporal orientation to consider, mediating between the urgency of upscaling and the 'patience' needed to account for the slow growth of nature (Alberti et al., 2020).

4. Enacting socio-natural imaginaries through NbS upscaling

Because there is no consensus on how cities will look, N. Brown et al. (2000) emphasise the co-existence of parallel and contrasting visions of the future, each supported by specific groups of actors sharing defined interests and beliefs. Once a specific idea of the future is commonly shared, it can be called an imaginary, i.e. "collectively held and performed visions of desirable futures" that are temporally situated and culturally particular (Jasanoff, 2015, p. 19). Having implications on both the material (e.g. nature, people, buildings) and the non-material (e.g. values, culture), NbS upscaling represents a complex pathway to enact specific imaginaries of a particular urban future. Baker & Ruming (2015) analyse the effects of urban future imaginaries on spatiality. While each urban imaginary is probable per se, groups of actors can deploy "strategic and political tools […] to achieve political objectives" (Baker and Ruming, p. 66). These groups work constantly to create "powerful political narratives [which] capture future promises" in creating a specific urban imaginary of the future (N. Brown et al., p. 9). Creating specific urban future imaginaries produces pre-determined pathways that can directly influence the direction of innovation development (Geels & Smit, 2000). In turn, selecting a particular innovation and its practices and materiality can obstruct other futures and create path dependency (N. Brown & Kraft, 2006). The understanding that humans can influence the future implies that such futures can be, to a certain extent, governed, thus creating the new expert category of the future maker (Adam & Groves, 2007, p. 80). Sections 2 and 3 of this paper have shown that the upscaling of NbS in the urban context can be fundamentally treated as a political subject whereby the construction of futures is determined by the framing of a problem and its solutions by groups of future makers through a narrative of urgency that creates path-dependent actions.

Thus, this paper argues that *NbS upscaling in cities is a process of 'futuring' by which urban actors deploy NbS as newly routinized practices to enact a specific urban future imaginary*. This includes an emotional re-definition of human–nature relationships, the just

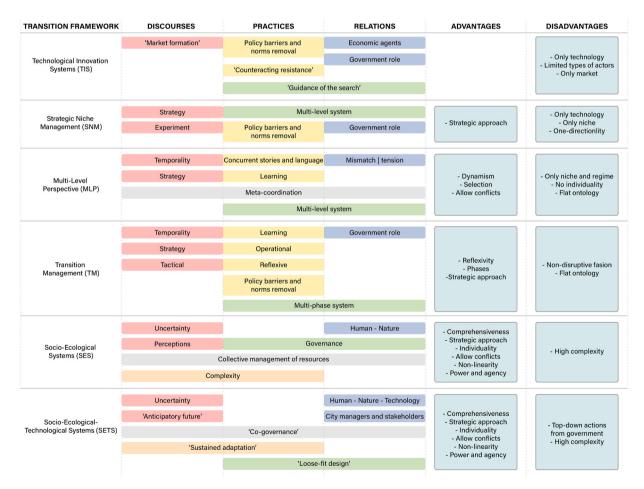| TRANSITION FRAMEWORK	DISCOURSES	PRACTICES		RELATIONS	ADVANTAGES	DISADVANTAGES
Technological Innovation Systems (TIS)	'Market formation'	Policy barriers and norms removal		Economic agents		- Only technology - Limited types of actors - Only market
				Government role		
		'Counteracting resistance'				
		'Guidance of the search'				
Strategic Niche Management (SNM)	Strategy	Multi-level system			- Strategic approach	- Only technology - Only niche - One-directionlity
	Experiment	Policy barriers and norms removal		Government role		
Multi-Level Perspective (MLP)	Temporality	Concurrent stories and language		Mismatch | tension	- Dynamism - Selection - Allow conflicts	- Only niche and regime - No individuality - Flat ontology
	Strategy	Learning				
		Meta-coordination				
		Multi-level system				
Transition Management (TM)	Temporality	Learning		Government role	- Reflexivity - Phases -Strategic approach	- Non-disruptive fasion - Flat ontology
	Strategy	Operational				
	Tactical	Reflexive				
		Policy barriers and norms removal				
		Multi-phase system				
Socio-Ecological Systems (SES)	Uncertainty			Human - Nature	- Comprehensiveness - Strategic approach - Individuality - Allow conflicts - Non-linearity - Power and agency	- High complexity
	Perceptions	Governance				
	Collective management of resources					
	Complexity					
Socio-Ecological-Technological Systems (SETS)	Uncertainty			Human - Nature - Technology	- Comprehensiveness - Strategic approach - Individuality - Allow conflicts - Non-linearity - Power and agency	- Top-down actions from government - High complexity
	'Anticipatory future'			City managers and stakeholders		
		'Co-governance'				
	'Sustained adaptation'					
		'Loose-fit design'				

Fig. 1. Key elements of the six transition frameworks organized in discourses, practices, and relations. The advantages and disadvantages of each framework in studying NbS upscaling as a practice of 'futuring' are reported in the last two columns (Author 2024).

inclusion of nature in everyday practices, and the capacity to work inter- and transdisciplinarily between different actors. Hence, upscaling NbS designates a complex process of entangled material and non-material elements whereby it is relevant: what future is to be achieved, how that future is communicated, how existing practices are malleable for accommodating that communicated future, and which actors deploy what resources to support the achievement of that future. Based on this definition, the article identifies three analytical dimensions to study NbS upscaling as a performative process of imagining futures: discourses, practices, and relations. Fig. 1 presents key elements of each transition framework organized within the three proposed analytical dimensions. The three dimensions and their interdependencies are discussed in the following pages.

4.1. Discourses: rightly communicating the 'right' imaginary

A performative understanding of urban future imaginaries highlights how discourses function as methods to secure a specific future (N. Brown et al., 2000). In the discourse literature, discourses are defined as an "ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer & Versteeg, 2005, p. 175). Discourses follow some rules that are organized in frames. Framing means "making a piece of information more noticeable, meaningful, or memorable to audiences" (Entman, 1993, p. 53). Policy actors use different frames to make their discourses more plausible and to gain supporters (Dodge & Lee, 2017). This understanding shows that futures are objictified and can be disembodied and decontextualized by actors to be at will filled with beliefs, values, ideas, etc. (Adam & Groves, 2007).

Thus, the frames conveyed by discourses can guide specific sustainability transition pathways (Wittmayer & Loorbach, 2016, p. 20), exercising the social action of 'visioning' and 'futuring' (Brand, 2016). In response to the urgency to act in the face of the current climate change challenges, NbS upscaling can be seen as the selected pathway towards a specific urban future imaginary, whereby the 'need to upscale' acquires a political connotation (Castán Broto & Bulkeley, 2018). By becoming fashionable, NbS upscaling has created political tensions between international and local policy-making levels that have translated into organisations at the international level, such as the EU, devolving responsibility to local governments to conduct the upscaling of innovations a priori (Pfotenhauer et al., 2022). As a result, cities are pulled "into a hyper-competitive game whereby they must produce a narrative of innovation to get money" (Hodson et al., 2018, p. 1495). This understanding of upscaling requires governments to demonstrate "fast and visible returns on investment and impact at scale", often resulting in over-promising and quick but short-lived wins (Schut et al., 2020, pp. 1–2). Similarly, expectations of specific urban future imaginaries can steer or hinder a transition pathway, especially when these futures are uncertain and complex (Tutton, 2017). In fact, discourses can support dominant existing structures rather than promoting transformative change by "providing agency and legitimacy to a larger group of actors who then support the existing system" (Leipold et al., 2019, p. 455).

From a discourse perspective, networks are understood as groups of actors sharing the same set of beliefs and responding to a selected urban future imaginary. The advocacy coalition framework describes a recognisable network of actors following a single storyline and pursuing a stable equilibrium where different advocacy coalitions try to impose their frames over others' frames to reach stability, which can last more than a decade (Zafonte & Sabatier, 2004). The discourse coalition concept offers a more dynamic understanding of networks. Maarten Hajer defines 'discourse coalitions' as groups of actors sharing a common interpretation of the world, which structures their individual and collective actions (Hajer, 1993). A discourse coalition is described as dominant if all actors accept the new discourse structure, and this leads to its institutionalization (Hajer, 1993). Herein, the path dependency created by the specific urban future imaginary creates a network of actors that is based on commonly communicated expectations (N. Brown et al., 2000).

Within SNM, strategies of upscaling are elaborated and communicated by urban actors based on expectations. Drawing on institutional theory and the sociology of expectation, Konrad et al. (2012) consider discourses as actors' "public communication activities about the novel technology" (p. 1087) through which alternative trajectories are put to the fore. As environmental problems are socially constructed and subjectively experienced, no consensus around 'right' or 'wrong' can easily be reached. Thus, transitions count on languages, values, and symbols to enact certain pathways or justify specific choices (Brugger & Henry, 2021). The TM cycle offers a strategic approach to guide urban actors along this complex process and allows for reflection on past choices. MLP considers the simultaneous existence of conflicting ideas specifically arguing tensions and mismatches; whereas TM and SNM advocate for a more linear process. Conversely, SES and SETS explicitly embrace uncertainty and highlight the need to understand upscaling as a non-linear process including mechanisms of reproduction and routinization of innovation to control the complexity of current environmental problems (Shove & Walker, 2010, p. 475). Thus, the attempt to upscale NbS can be understood as the "endeavour of normalising an idea from one policy domain into the decision-making and routine activities of other policy domains" to deliver effectiveness over the long term and try to persuade other actors to follow that idea (Scott et al., 2022, p. 201).

In this context, NbS upscaling can be understood as the attribution of new meanings of nature developing from actors' discourses at different governance levels to enact a specific urban future imaginary. Thus, relations affect discourses by defining the rules within which discourses take place and how, and discourses affect relations by setting the agenda and defining acceptable relations.

4.2. Practices: upscaling as routinization of innovations

Jasanoff (2015) claims that understanding urban future imaginaries necessitates investigating action and performance beyond language. As the future can be considered a realm that can be governed, its performativity also affects everyday practices that must deal with uncertainties regarding future scenarios (N. Brown et al., 2000). Adam and Groves (2007, p. 6) refer to knowledge practices

as actors' attempt to provide structural security for society. For sustainability transition research, upscaling symbolizes a destabilisation of this security. SNM, MLP, TM, and SES describe a process when "new practices accumulate momentum" (Durrant et al., 2018, p. 1540) and, thus, the acquisition of a new set of routinized actions through structural change. Yet, TIS refers only to economic agents and, therefore, does not include the broader set of urban practices. SNM remains linked to a linear and one-directional action between niche and regime. MLP, TM, SES and SETS address practices more comprehensively. Yet, transition research rarely considers the everyday activities of the users it aims to study (Hargreaves et al., 2013; Shove & Walker, 2007). Additionally, MLP tends to conceptualize regimes as compact blocks, leading to difficulties distinguishing individualities (Schot & Kanger, 2018), and its notion of upscaling mostly follows linear and hierarchical ontologies (Bouzarovski & Haarstad, 2019). While TM refers rather to a non-disruptive change, MLP and SES accept more courageous actions towards the destabilization of existing regimes. SES and SETS refer to a broader and collective attempt to manage resources and drive transformation. Considering regimes and practices "as overlapping and closely interlinked entities that hold one another in place and mutually coevolve" (Hargreaves et al., 2013, p. 416), the combination of practice theory, the governance perspective, and transition research looks at upscaling as processes of collective appropriation of new practices in everyday life (Shove & Walker, 2010; Welch & Yates, 2018).

Coming from organisational studies, Nicolini uses the concept of 'site' to describe the geography of practices (and of experiments) by which one activity becomes the resource and antecedent for others, forming "complex nets with dense patterns and mutual references" (2011, p. 603). The site suggests a specific location of the practice and in a specific place in time. Practices are, therefore, not isolated events; rather, "practices […] constitute enduring regimes of activity" (Nicolini, 2009, p. 1405). The interface between practices and their context suggests a continuous adjustment of internal rules through the carrying out of the practice. The tensions between practices and context create preferable courses of action while refusing others: power thus plays a role in defining the 'right' practice to promote (Nicolini & Monteiro, 2016). In turn, the chosen practice pre-determines and limits others' actions, which are not part of the selected urban future imaginary. The stabilisation of any connection is based on the ability to "reinterpret, represent, or appropriate" others' interests through a negotiation process where power is exercised (Nicolini, p. 605). Reckwitz (2002) defines discursive practice as a type of practice through which the world is meaningfully constructed through language (p. 254). This conceptualization of practices as discourses is not explained simply in linguistic terms, but rather on how the truth is being told (Bacchi & Bonham, 2014). Similarly, the creation or elimination of specific urban future imaginaries and their adoption at a broader level is the result of an act of power by individuals or a small group of individuals (Jasanoff, 2015) in the understanding that the humans can transform the future by controlling and imposing "one's will on the world" (Adam & Groves, 2007, p. 98).

In a later work, Hajer (2006) defines a discourse coalition as a "group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time" (p. 70). Practices are defined here as embedded routines and mutually understood rules and norms that provide coherence to social life. Accordingly, linguistic utterances cannot be usefully understood outside the practice in which they are uttered. Actors in a discourse coalition use storylines to produce, reproduce, and transform particular discourses and the practices linked to them. Similarly, Nicolini explains that a practice "constitutes the figure of discourse" (2011, p. 602). Through discourses, actors enable the formation of new practices or the modification of existing ones by setting the agenda and framing acceptability for practices. Additionally, Nicolini and Monteiro argue that to examine practices, they must be turned into discursive objects. In their view, practices are defined as "orderly sets of materially mediated doings and sayings", where mediation occurs through an act of translation, a negotiation between the different interests of the carriers of specific practices (Nicolini & Monteiro, 2016, p. 110).

While Reckwitz states that "practice theory does not place the social in discourse, nor interactions" (2002, p. 249), Davide Nicolini (2011) instead argues that practices must be studied according to a relational ontology, suggesting that actions, reactions, and interactions make sense of the practices in a spatially and temporally determined context. His concept of 'site' contributes to explaining reality as being formed by a nexus of interconnected practices. This interconnectedness is facilitated by an act of 'translation' as in the actor-network tradition. Through this translation, connections between entities are established among actors carrying out different practices (Nicolini, 2011, p. 605). As a particular type of communication, translation involves an act of appropriation of the practice to be translated, whereby a selection of the features an urban future imaginary should have occurs. Power and agency are, therefore, fundamental to successfully arguing for following trajectories that will enact specific futures (N. Brown et al., 2000). Altogether, the inherent relationality described by Nicolini and Monteiro makes practices as "meaning-making, order-producing, and reality-shaping activities" (2016, p. 114). Rules, habits, and culture contribute to these activities of practice and provide a 'safe' structure to refer to (Adam & Groves, 2007).

As power and interests define which connection is maintained and which is discarded, discourses provide the structure in which the selection of practices takes place. Hence, the upscaling of NbS can be seen as enhancing and justifying new practices by the selected urban future imaginary through discourses.

4.3. Relations: networks for supporting future imaginaries

As action is not possible in isolation, the enaction of urban future imaginaries creates a divide between actors that support a specific urban future imaginary and actors that endure it, or, using the words of Adam and Groves (2007), between future makers and future takers. Accordingly, future makers actively create some futures while eliminating others by spoiling or filling them with new meanings. Aiming to enact the urban future imaginaries they prefer, actors intentionally engage in the political debate around upscaling and form networks (Smith & Raven, 2012). Sustainability transition research focuses on social actors' contributions to achieve a broader change (Wittmayer et al., 2017), whereby (NbS) upscaling can be read as meanings and learnings actively transferred from a single individual to the level of society (Bögel et al., 2022, p. 180). MLP uses the concept of meta-coordination to depict this transfer; whereas TM

envisions strategic actions based on learning and interpretation. Specifically, intermediaries are actors situated at the interface between niche and regime and can hold more or less power according to the dimension and number of 'entities' (individuals and networks) they can connect (Kanda et al., 2020). Sovacool et al. (2020) address the matter of power by describing hindering (gatekeeper) or supporting (guide) roles. SNM, TIS, SETS, and TM focus on the role of governments in removing or reducing barriers to the transfer of innovations and learning. However, TIS and SNM contemplate mainly two types of actors: the government and economic agents, whereas MLP and TM mainly consider all actors involved in the process of upscaling being represented by a single voice and pursuing the same objectives (Augenstein et al., 2020; Hermans et al., 2016) thus failing to account for contrasting, conflictual, and incumbent orientations (e.g. R. R. Brown et al., 2013; Durrant et al., 2018; Grin, 2010a; Pesch, 2015; Westley et al., 2013).

In social network theories, actors situated between networks have been invested with a fundamental role in bringing about innovations (and upscaling them). These actors have the power to create new relations and bring novelty benefiting both connected networks (Burt, 2003; Vedres & Stark, 2010). David Obstfeld (2017) proposes three orientations that can be assumed to guide the upscaling of innovation towards specific urban future imaginaries: actors can exploit their influence and power by manipulating the network to shut other actors out (*tertius gaudens*); incentivise strategic connections or ease coordination (*tertius iungens*); or pass information neutrally without any attempt of altering existing relationships (conduit).

Further, transition research considers power mainly with a negative connotation, as being a feature of existing structures used to foster stagnation rather than change (Giddens 2002, in Avelino, 2021). Avelino, working on the nexus between power and politics, argues that power is possessed by actors and can either be used or not used in a given situation. Accordingly, upscaling processes can be understood as disruptive events producing new power relations or as reproducing existing relations (Avelino, p. 442). MLP, by accepting co-existing and conflicting ideas, offers the possibility to account for power and agency; but its flat and linear ontology limits the understanding of more complex systems proper of the natural environment. SES and SETS talk generally about city manager and stakeholders but suggest a more profound interrelation between human, nature, and technology and accept conflictual actions on the base of different perceptions and expectations.

From the network literature, the relational sociology of Harrison White and colleagues considers communication as foundational for understanding social phenomena. They see communication as a motor through which social structures are reproduced and stabilized. Ann Mische (2003) argues that social networks evolve as a result of a series of communicative events. In this view, relations acquire importance based on their ability to govern the communication process. As relations are based on communication and generate meaning, it is possible to study relations not only between groups or individuals but also between practices and events (Mische). Jan Fuhse takes this conceptualization further and argues that the reality of networks is characterised both by the ability of identities and relations to form a 'meaning structure' (Fuhse, 2009) and by 'regularities of communicative events', suggesting that relations are the results of the continuous process of meaning formation resulting from the series of communicative events. Therefore, actors give importance to the continuity of communication and the relations built through the series of events rather than on the single events per se (Fuhse, 2015).

By linking discourses and relations ontologically, it is possible to understand network structures and the meaning behind these structures (Fuhse & Mützel, 2011) to explain the influence of specific urban future imaginaries on the urban context. Additionally, recent work on social innovations links discourses and actors on different levels of governance. Communications among actors occur differently according to the specific technical and institutional features of each governance level (Pel et al., 2020), creating distinct meaning structures that can become incompatible. Similarly, Hajer's concept of discourse coalition can be used to understand how discourse affects the positions (or relations) of actors created out of the discourse (Lynggaard, 2019). According to the morphological characteristic of the network, relations can be altered more or less easily through the advent of a new practice and the work of actors holding in-between positions. In this sense, it is possible to connect the concept of translation with the one of the tertius. The orientation of the tertius in its three described variants can be deployed to explain the dynamics that can bring either the modification of existing practices or the introduction of new ones, depending on the particular context.

Thus, the upscaling of NbS can be interpreted as the adoption of specific practices facilitated by actors' relations to pursue a selected urban future imaginary. In contrast, the selection of practices defines, in turn, which relations are allowed.

4.4. A governance perspective: socio-natural imaginaries

Stemming from transition governance, urban sustainability transition claims that through the upscaling of innovations, it is possible to steer urban development towards a more desirable future by triggering political and institutional transformations of current 'unsustainable' pathways (Loorbach & Shiroyama, 2016). As such, it considers holistically the interdependencies between institutions, actors, culture, and practices concerning solving specific and commonly defined governance problems (Dorst et al., 2021). Thus, upscaling is not limited to a phase-out of innovation – as in TIS and SNM – but involves a restructuring of political and institutional systems in a broader sense through the interactions of politics, society, and markets (Grin, 2010b). The management approach in TM, MLP, SES, and SETS towards transition refers to a broader and more comprehensive understanding of environmental issues, which are diverse, specific, and complex (Meadowcroft, 2002, p. 176). As sparks of novelty that challenge the status quo, urban experiments are instruments to control and facilitate the governance of new and complex changes (Durrant et al., 2018; Ehnert et al., 2018; Schut et al., 2020). Urban experiments can create interlinkages between people and place (and nature), challenge current systems structures, actors' relations, and policies, and promote systemic approaches to social-ecological-technological systems (Frantzeskaki et al., 2021). Reflecting on the experience within the experiment allows a better governmental response to environmental challenges and facilitates the upscaling of innovation (Rotmans et al., 2001). Experimentation also allows for reflection and learning. Pahl-Wostl suggests a form of adaptive management based on social learning. Through learning, it is possible to provoke changes in existing structures, which in

turn influence the learning process as well (Pahl-Wostl et al., 2010). In this sense, social learning is the base for breaking through innovation and shifting from one governance regime to another. Urban sustainability transition authors have used the multi-level governance (MLG) model to describe the relations between planning and policies in the upscaling of new practices, stressing the involvement of societal actors in decision-making positioned at various levels of governance (Frantzeskaki & Tilie, 2014; Gorissen et al., 2018). In between these levels, the role of mediators, translators, networkers, and intermediaries are considered vital for the upscaling process (Ehnert et al., 2018; Naber et al., 2017; Sengers et al., 2021). Thus, the governance perspective describes upscaling as a sum of fundamental changes in 1) practices, referring to behaviour, beliefs, and routinised actions; 2) culture, related to values, norms, and ethics; and 3) structures, namely institutions, rules, and laws (Ehnert et al., 2018; Frantzeskaki & Haan, 2009; Gorissen et al., 2018; van den Bosch & Rotmans, 2008).

However, while upscaling is considered by transition research a specific and limited phase of innovation development, its effects perpetrate temporally and spatially far beyond that phase as "long-term change [is] messier and more conflicted than transition management intimates" (Meadowcroft, 2009, p. 335). The process of upscaling seems to be a natural evolution for the innovation, as the wording 'mechanism' used in the transition literature suggests (Adams et al., 2023; Durrant et al.; Fastenrath et al., 2020; Karic & Losacker, 2023; Lam et al., 2020). Instead, upscaling would consider a much deeper process of production and reproduction of practices and knowledge linked to the upscaled innovation. In fact, MLP stops its interpretation of upscaling with the newly established system and does not inquire about successive dynamics. Similarly, experiments in their protected space tend to be treated as isolated from other urban processes. This implicitly creates discrepancies on temporal and spatial scales with the existing political system that is supposed to govern the desired shift through upscaling (Tozer, Bulkeley, van der Jagt et al., 2022). Additionally, the reflexivity exercise celebrated by TM has paradoxically produced an increase in uncertainty about the future, whereby any action to counteract climate change requires caution, even if causal connections are clear (N. Brown et al., 2000). In fact, examples of unsuccessful upscaling have been documented, revealing a grounded mismatch between theory and practice (Augenstein et al., 2020; Bossink et al., 2023). In their seminal book, Adam and Groves (2007) attribute to this mismatch a profound dis-embedding of the technology from its social context. They describe a politics of broken promises whereby administrators and regulators tend to represent material objects abstracted from the society, and always more specialised and discontinuous knowledge risks losing the bigger picture (p. 87). Hence, dealing with nature recalls a more profound link with the context, in the understanding that nothing works in isolation. In this sense, the TIS framework is not appealing to discuss NbS upscaling as it refers exclusively to technology; while SNM considers actions only between niches and regimes, excluding the context. Although MLP and TM link upscaling with broadening, widening, and including more elements in the attempt to make sense of the complexity of reality, the simple addition of measures, actors, and meanings leads to increased intricacy and variety of possible answers (Meadowcroft, 2002). SES and SETS try to deal with such complexity by embracing uncertainty in constructing pathways for governing the future of human-natural systems. However, complexity, as celebrated today, can lead to a moral nihilism whereby agency, causes, and responsibilities are too distributed and promiscuous (Jasanoff, 2015, p. 16). To conclude, introducing a political dimension in urban sustainability transition seems imperative to understand how societal interests are considered, how institutions can shape or hinder specific future trajectories, and how ideas of the future shape the definition of the problems and the acceptance of solutions (Meadowcroft, 2011).

The complexity of the NbS upscaling process, which involves the three dimensions discussed, originates in the increased uncertainty of dealing with futures dominated by discursive practices faced with the increased uncertainty of dealing with futures dominated by the spectre of climate change and its material manifestations (Tutton, 2017, p. 480). The six transition frameworks attempt to navigate this complexity by comprehensively including all measures, actors, and meanings. However, the governance perspective on transition, attempting to create a consistent structure, neglects how forms of power and agency impact processes in highly political ways (Meadowcroft, 2009), thereby often creating additional problems rather than solutions. Also, upscaling is not only a phase of transition; rather it is a more comprehensive process to embrace NbS as part of the culture through constant production and reproduction on the ground of social and planning practices (Geels & Smit, 2000). Thus, it is not sufficient to upscale an innovation only in terms of quantity; rather, it must undergo a process of appropriation and internalization by the wider public discourses, in lived daily and planning practices, and within relational structures and framings. This understanding needs a more fundamental conceptualization that involves shifts in cultural beliefs, new routinized practices, and formation and stabilization of networks.

5. Conclusions

This paper aims to provide an analytical tool to understand NbS upscaling processes as experimental innovations to bring nature back into cities as an action of 'futuring'. It does that by reviewing the concepts of upscaling and of NbS within transition and governance literature. The analysis shows that the term 'upscaling' is only one of many equivalent concepts which are used interchangeably in transition literature to describe the migration of innovation from the niche level to the regime. This conceptualization is made more complex through the inclusion of nature: in fact, upscaling NbS involves a combination of social, ecological, technological, and economic factors that are brought to the fore when making an urban environmental policy that considers cultural aspects, actions of framing, and different understandings of nature, routines, values, and behaviours.

However, NbS as a concept has proved to be controversial. While on one hand it is celebrated as a new panacea, on the other, caution is suggested in the use of this type of solution. First, the very definition of NbS represents an issue. Due to its indefiniteness, the concept aims to achieve 'everything', creating challenges in defining precisely what, in practice, an NbS is and what it is not. The huge popularity of NbS upscaling, demonstrated through a plethora of reports and documents from various organisations, has contributed to promoting NbS upscaling as 'the way' to cope with contemporary societal challenges through nature. This has placed pressure on the limited capacities of urban administrations that are committed to dealing with NbS and its upscaling (e.g. Seddon et al., 2020). Second,

the word 'solution' in NbS suggests an outcome-oriented approach focused on effectiveness, linked to business thinking in terms of economic growth and job creation (Welden et al., 2021). This conceptualization risks leaving out less quantifiable aspects of the NbS upscaling process such as culture, values, behaviours, and nature itself. Also, the here-and-now narrative contrasts with the slow and long-term horizon in which nature grows and develops (Alberti et al., 2020). Third, as a new concept, NbS is relatively appealing to those actors who are interested in selling new solutions as part of their political strategy. This may allow certain actors, such as oil corporations, to profit from this momentum to preserve the status quo instead of pursuing carbon neutrality (FOEI, 2021). Fourth, the debate about upscaling NbS is relatively new and very dynamic making its analysis arduous (Melanidis & Hagerman, 2022). The literature review shows that, within only a few years, the different disciplines and actors engaged in understanding the NbS upscaling have generated a plethora of concepts and definitions for referring to the same process. Fifth, matters of power and knowledge imbalances, if not properly considered, can turn the upscaling of NbS into an engine for sustaining injustice and inequality by reproducing existing dominant structures. The specificity and complexity of local realities make a generalisation of an approach to upscaling difficult and risk ignoring fundamental aspects when trying to upscale NbS in cities.

As advocated by many scholars, advancements in transition research will require look at other disciplines to account for the complexity of reality and the process of upscaling innovations based on nature, such as NbS. Consequently, transition researchers have started to unpack the upscaling concept describing a series of mechanisms of acceleration and integration. Transition research has developed six transition frameworks to make sense of NbS upscaling where discourses, practices, and relations have been identified as relevant analytical dimensions. The interlinkages among these dimensions have been analysed within the six transition frameworks, each presenting advantages and disadvantages in analysing (NbS) upscaling accordingly. Drawing on future studies, the concept of urban future imaginaries expands the interpretation of upscaling within the six frameworks, which regards NbS upscaling as a chosen pathway that locks in actions towards reaching specific socio-natural urban futures. This has created performatively path-dependent discourses, practices, and relations to achieve a particular urban future imaginary with, at its core, a new understanding of human-–nature relationships. The combination of the three dimensions suggests a new understanding of the complex phenomenon of NbS upscaling, whereby language, culture, and symbols are used by different actors to frame a winning picture of NbS to be normalised as an implementable solution in the pursuit of what can be called a socio-natural imaginary. Following the governance approach, upscaling has acquired a more profound conceptualization that goes beyond the mere quantitative increase of the innovation towards the inclusion of ways of doing, thinking, and organising while linking different levels of governance and the actors located in these levels. From this premise, the paper proposes that *NbS upscaling in cities is a process of 'futuring' by which urban actors deploy NbS as newly routinized practices to enact a specific urban future imaginary.*

To conclude, adopting the lenses of future studies allows to ontologically perceive NbS upscaling as an urban future imaginary dominated by the human–nature relationship with new eyes, whereby humans are seen as part of and dependent on nature rather than existing in a separate realm. Epistemologically, 'with new eyes' does not automatically mean innovation, as NbS upscaling implies less the invention of new technology and more the rediscovery of traditional solutions that may have been abandoned, as well as reconnection with the past and opening up to a set of possible future pathways. Socio-natural urban futures are not a distant technological-driven utopian vision of the urban, rather it is a commonly built space bringing together society and the nature realm in shaping new forms. The NbS concept, with its proven ability to affect discourses, practices, and relations, are playing a relevant role in constructing such futures. Particularly, attention should be devoted in understanding urban actors' agencies, considering whose actions, which conditions, and what effects lead to a determined urban future imaginary, which is told through discourses, enacted through practices, and supported by relations. This openness should reflect the uncertainty of future challenges concerning climate change. Empirically, researchers should look for methodologies able to consider discourses, practices, and relations simultaneously. Methodologies from other disciplines could be explored to analyse such linkages and spotlight both successes and failures for a more just upscaling of NbS in cities.

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