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Published in:
Futures

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Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Neuhoff, R., Simeone, L., & Holst Laursen, L. (2023). Forms of participatory futuring for urban sustainability: A systematic review. *Futures*, 154. <https://www.sciencedirect.com/science/article/pii/S0016328723001726>

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Forms of participatory futuring for urban sustainability: A systematic review

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ARTICLE INFO

Keywords:

Participatory futuring
Urban sustainability
Systematic literature review

ABSTRACT

Making cities sustainable is a global commitment. Achieving sustainability in cities demands novel, integrative, and innovative approaches that enable communities to collaboratively anticipate, envision, and negotiate futures and enhance opportunities for sustainable action. Participatory futuring is a promising approach to drive urban sustainability; however, it can take many forms and insights are fragmented across multiple fields, creating an incomplete understanding. This systematic literature review aims to shed light on the existing forms of participatory futuring for urban sustainability and identify potential research directions. Our study identifies how existing research revolves around three forms of participatory futuring, i.e., 1) interdisciplinary expert-driven scenario-building, 2) quadruple-helix futuring informing policy agendas, and 3) public futuring for social learning.

1. Introduction

Making cities sustainable is one of the main global commitments for urban development, emphasized by Sustainable Development Goal 11 (United Nations, 2016). With the increasing urbanization of the world's population, cities are both a contributing factor and a consequence of the great sustainability challenges facing humanity (Evans et al., 2017; Nevens et al., 2013). Business-as-usual will no longer do. Instead, sustainable alternatives for organizing, planning, managing and living in cities are needed (Leminen et al., 2021).

'Sustainability' has been defined in numerous and diverse ways, but it generally encompasses environmental, economic, and societal well-being (Glavic & Lukman, 2007), i.e., 1) staying within the natural limits of the planet, 2) ensuring an adequate level of economic and material prosperity and security for all, and 3) creating societies and systems of governance that are fair, just, inclusive, and equitable, and that respect the diversity of people and their cultures (Robinson, 2004). Two definitions are particularly useful in the context of this article. The first is provided by the World Commission on Environment and Development in 1987. It defines sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). The second definition is provided by Robinson and Cole (2015, p. 137), who contend that "sustainability can usefully be thought of [...] as the emergent property of a conversation about desired futures that is informed by some understanding of the ecological, social and economic consequences of different courses of action". These definitions acknowledge the centrality of the

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<https://doi.org/10.1016/j.futures.2023.103268>

Available online 14 October 2023

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future for sustainability, the importance of examining and integrating different perspectives, and the recognition that sustainability is not a fixed end state but a process that involves negotiating possibilities.

Many scholars agree that achieving sustainability requires new integrative, collaborative, and innovative approaches (Evans et al., 2017; Leminen et al., 2021) that enhance the ability of our societies to collaboratively envision and negotiate alternative futures, to question the stories that we tell about ourselves and our values, and to give rise to opportunities for collective action as a result (Bendor et al., 2017; Hearn et al., 2011; Miller, 2013; Robinson & Cole, 2015). It requires a fundamentally social process that involves blending scientific and other forms of knowledge with the values, beliefs, and preferences of affected communities to create shared understandings of the possibilities and preferred alternatives (Robinson, 2004).

As evidenced by the literature included in this review, participatory futuring is considered an approach that can potentially find these alternatives. Unlike the traditional practices of predicting the future and conventional notions of foresight, which typically involve small groups of influential actors like expert futurists, politicians, scientists, managers, and decision-makers who possess specialized knowledge in regards to the future, participatory futuring aims to open up and also allow less privileged perspectives to participate in contemplating and deciding about the future (Nikolova, 2014). Participatory futuring is characterized by collaborative practices that aim to explore, envision, negotiate, and shape alternative futures by involving a broader range of actors. These actors may include community representatives, citizens, and other diverse stakeholders who have historically been excluded from these processes (e.g. Nikolova, 2014; Ollenburg, 2019; Ramos et al., 2019; Westerlaken, 2020). To reflect this participatory turn with a linguistic twist, we deliberately employ the term ‘futuring’. Futuring initiatives root in a realization that sustainability and an engagement with the future, can no longer rely on top-down approaches that only consider the perspectives of a few, routinary included, power-holders. Given the nature of the world, its complexity and inequality, diverse perspectives and knowledge are needed to produce enough reliable information to outline a just and sustainable path toward the future (Akama et al., 2020; Borthwick et al., 2022; Clarke et al., 2019; Nikolova, 2014; Ollenburg, 2019; Ramos et al., 2019). In fact, the United Nations Conference on Environment and Development (UNCED) has stated that participation and conceiving diverse actors as partners is not only desirable but a “fundamental prerequisite for the achievement of sustainable development” (UNCED, 1992).

There are many distinct but interconnected reasons why a diverse range of actors should be involved in the process of exploring, imagining and negotiating urban futures, including people who may not have specific expertise or formal training in a particular field, but who are affected by and live in the midst of sustainability challenges (Nikolova, 2014). These reasons include the possibility to 1) complement scientific knowledge gaps by integrating diverse knowledge, thereby increasing the capacity to accurately anticipate and respond in a satisfactory way to the multilayered and interrelated challenges of contemporary societies; 2) facilitate a complete disclosure of existing attitudes, ensure a broader and more equitable spread of the opportunities and benefits underlying change, and increase the degree of legitimacy in decision making; and 3) promote social learning and enhance the ability of citizens to improve their own inherited power to make more effective and durable differences to the qualities of their lives in cities (e.g. Abson et al., 2016; Björgvinsson et al., 2010; Disterheft et al., 2012; Meadowcroft, 2004; Michels & De Graaf, 2010; Nikolova, 2014; Ramos et al., 2019).

This review highlights the ongoing efforts to implement participatory futuring in the urban realm, where research indicating its potential effectiveness is growing. However, scholars also suggest that despite the ambitious goals of futuring, it is still unclear if current futuring initiatives are actually taking a step forward to broaden their horizons beyond those traditionally in power (Nikolova, 2014). This can be linked to a general concern about the potential tokenism of participatory initiatives, which refers to initiatives that merely create a facade of social inclusiveness while actually perpetuating established power dynamics (Palacin et al., 2020). As we will see in the following, genuinely implementing participatory futuring in practice is still very much a work in progress and riddled with challenges (Evans et al., 2016; Nikolova, 2014). Against this background, we think it is a worthwhile next step to take a closer look at what has been done so far in the context of futuring for urban sustainability. Our goal with this systematic literature review is to shed light on the following research question: *Which forms of participatory futuring for urban sustainability have so far been established?*

The remainder of the paper is structured as follows: In Section 2, we outline our research methodology, i.e., the systematic review process. In Section 3, we present the results of the thematic analysis, followed by a discussion of the most important findings and implications for future research in Section 4.

2. Methodology

2.1. Systematic literature review

This literature review presents a comprehensive overview of the research published within the field of futuring for urban sustainability until June 2023. We conducted a systematic review to ensure a rigorous and precise research process. Opposed to narrative reviews, systematic reviews follow a transparent process that employs explicit procedures and which depends on the clarity of reporting (Tranfield et al., 2003). Systematic reviews present a summary of the evidence in an area of practice for interested actors to draw from (Bryman, 2016). To ensure methodological rigor and transparency we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Moher et al., 2009). Fig. 1 depicts our six-step review process, which included 1) iterative development of keywords and search strings, 2) identification of relevant articles while eliminating duplicates, 3) screening of articles, 4) eligibility assessment of full-text papers, 5) snowballing to discover additional papers, and a second search in databases to locate newly published articles, and finally 6) the analysis and selection of categories.

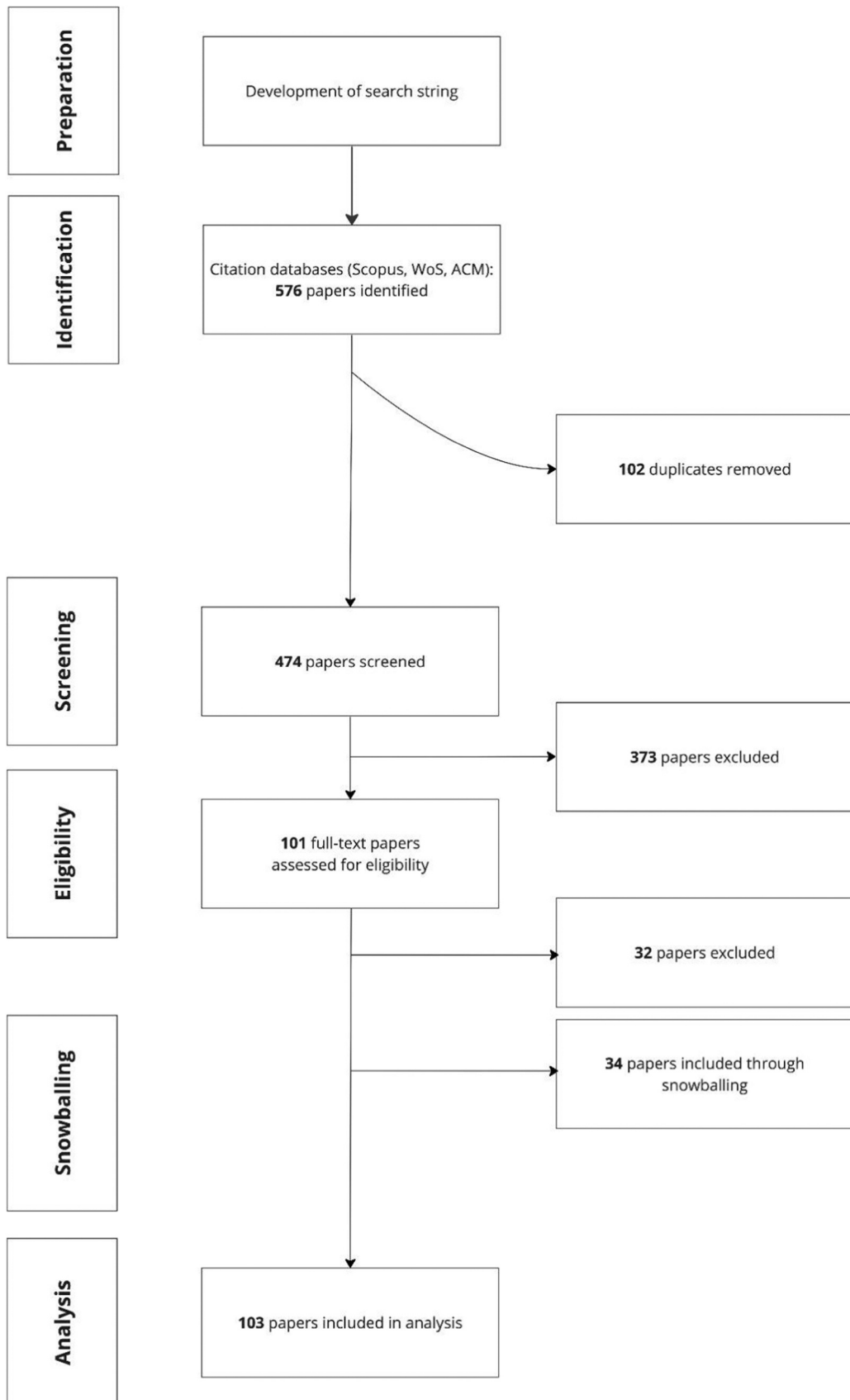


Fig. 1. PRISMA flow diagram illustrating the method of data collection and sorting [adapted from Moher et al. (2009)].

2.2. Identification of relevant articles

We conducted a structured keyword search in Scopus, Web of Science (WoS), and the Digital Library of the Association for Computing Machinery (ACM) to find papers addressing participatory futuring for urban sustainability. Scopus and WoS are recognized as the most frequently used databases for literature searches (de Oliveira et al., 2018; Mongeon, 2016). They provide extensive coverage of various research areas, including sustainability and social sciences (Hamdan et al., 2021). ACM is particularly relevant as it publishes the proceedings of the Participatory Design Conference, known as PDC, which is highly relevant in light of the topics analyzed in our literature review. We iteratively developed and tested the keywords to enhance the search strings and the relevance of the articles retrieved. Urban sustainability, as well as futuring, are often referred to interchangeably in multiple ways. Our search string consisted of two parts. The first part addressed participatory futuring, while the second focused on urban sustainability. The respective parts of the search string included various alternative terms, synonyms, and descriptions (see Table 1). One limitation worth mentioning is the exclusion of ‘participatory planning’ as an additional keyword. Despite its potential importance due to the inherent future-orientation of planning, this decision was made after careful consideration to avoid an overwhelming number of articles, most of which were not directly relevant to our specific review focus.

We conducted one search each, limited to English articles, in Scopus, WoS, and ACM. We searched for journal articles, conference proceedings, book chapters, and articles in-press. In total, we obtained 576 papers, which we fed into the reference management software Zotero to utilize its integrated duplicate detection feature, which identified 102 duplicates, resulting in 474 remaining articles.

2.3. Screening and eligibility assessment

Following the PRISMA guidelines (Moher et al., 2009), we conducted an exclusion process following a series of steps. The first step included an initial screening of the titles and abstracts. We filtered out those papers that addressed only one or none of the parts of the search string. For example, if a paper addressed participatory futuring but not the context of cities, we excluded it. As a result, we excluded 373 articles, leading us to 101 papers that we considered relevant for a full-text eligibility assessment. As a result of the full-text eligibility assessment, 32 more papers were excluded due to irrelevance. The sample of the remaining 69 articles was complemented through a semi-structured snowballing approach. Snowballing refers to using a paper’s reference list or the citations of the paper to identify additional papers based on their thematic relevance (Wohlin, 2014). Snowballing resulted in 34 additional papers that we added manually, leading to a final sample of 103 papers. The publication timeline in Fig. 2 shows that participatory futuring for urban sustainability has become increasingly popular over time.

2.4. Analysis and clustering

A thematic analysis (Braun and Clarke, 2022) of the papers allowed us to identify a number of clusters. We deliberately use the term ‘cluster’ rather than ‘category’ to avoid the notion that the articles can be assigned to precisely defined and confined classes. Rather, we intended to identify similar characteristics between the articles on the basis of which they can be grouped to highlight certain aspects of urban futuring initiatives. The clusters we identified resulted from an integrated deductive and inductive approach. The deductive approach drew inspiration from established participation frameworks (Arnstein, 1969; Hart, 1992, 2008), serving as a reference to recognize different participation forms in our reviewed articles. However, these frameworks propose a typology of levels of citizen participation, arranged according to a ladder pattern, in which higher levels correspond to a higher power in determining the end product. We found this developmental model limiting, as it suggests that participation is a linear process that necessarily follows a set sequence of stages (Hart, 2008). Therefore, we viewed these frameworks as an informative rather than exhaustive tool, which we used to further our initial understanding of participation forms. In tandem, we conducted an inductive clustering based on actors involved, methods used, and goals pursued. A distinguishing aspect, for example, was whether or not actors traditionally excluded from futuring (e.g., citizens) were involved in the initiative. The next section will introduce the clusters in-depth.

3. Findings of the thematic analysis

3.1. Overview of the forms of participatory futuring for urban sustainability

The review identified three different forms of participatory futuring; 1) interdisciplinary expert-driven scenario-building; 2) quadruple-helix futuring informing policy agendas, and 3) public futuring for social learning. Table 2 provides an integrative overview of these forms, preparing the ground for the following subsections, where each cluster is thoroughly examined, offering detailed insights based on the table’s information. Table B (in Appendix B) synthesizes the participants, methodology, and geographic locations of the futuring initiatives for each article included in this review.

3.2. Interdisciplinary expert-driven scenario-building

In our sample, we have identified 18 articles that report on exploratory urban futuring initiatives involving interdisciplinary experts, i.e., actors from diverse fields within academia, government, and industry (Dixon et al., 2018). In these initiatives, the public, such as citizens or their representatives, was at times informed but not directly involved in the process (Hajer & Pelzer, 2018). Besides this characteristic, the articles in this cluster have in common that the initiatives they report about mostly employ and/or advance exploratory methods, mostly scenario-building in the form of quantitative climate models (Molinero-Parejo et al., 2023; Upham et al., 2016) to better anticipate plausible scenarios within urban realms such as energy (e.g. Ernst et al., 2018), mobility (e.g. Banister & Hickman, 2013), climate (e.g. Puntub et al., 2022), the built environment (e.g. Hunt et al., 2013; Molarius et al., 2018), or socio-economic contexts (e.g. Reimann et al., 2021). For example, in the field of mobility, scenarios can be used to anticipate and address potential increases in traffic volume, energy demands, and CO₂ emissions and to develop adaptive strategies for the built environment (Banister & Hickman, 2013). To accurately explore probable futures, the interaction of interdisciplinary experts is seen not only as a positive side effect but as a decisive factor in creating important knowledge transfer, learning and unlearning, common grounds between opposing viewpoints, and coalitions needed to accurately explore, model, and understand urban futures (Chakraborty, 2011; Cook et al., 2021; Hajer & Pelzer, 2018; Kim et al., 2021; Molarius et al., 2018).

The literature in this cluster, however, clearly highlights a number of challenges and limitations. One limitation concerns exploring urban futures primarily through quantitative approaches. Quantitative scenario-building tends to focus on scientific explanations, technological feasibility and solutions, and economic impact whilst disregarding socially sustainable content, i.e., content that embodies factors such as equality and diversity while preserving environmental sustainability (Banister & Hickman, 2013; Ernst et al., 2018; Starkl et al., 2013; Timms et al., 2014). This traditional approach to scenario-building is rooted in the positivist assumption that scientific models based on rigorous data collection and analysis can accurately describe sustainability (Starkl et al., 2013) and that technology can be the solution to what are essentially social problems (Banister & Hickman, 2013). This assumption underpins several widely accepted frameworks for depicting environmental pressures and protection measures used by organizations like the European Environment Agency (EEA) or the Organization for Economic Cooperation and Development (OECD) (Starkl et al., 2013). It is unlikely, however, that quantitative models can fully describe what will happen.

The literature states that more critical and collective thinking and input are needed and that the boundaries of what participants define as plausible must be debated, questioned, negotiated, and agreed upon as part of the scenario-building process (Upham et al., 2016). Therefore, many papers in this cluster propose new frameworks and approaches that enable more integrated perspectives on the futures of cities. For example, Starkl et al. (2013) developed a 'Planning-oriented Sustainability Assessment Framework', which places a clear emphasis on the integration of qualitative stakeholder knowledge and encompasses four steps: 1) participatory scenario-building to raise awareness and make stakeholders engage in a dialogue; 2) a technical feasibility study; 3) a participatory assessment using established methods but involving stakeholders in defining the assessment criteria and in determining the social acceptance and compatibility with existing institutional systems; and finally, 4) an analysis of trade-offs and social networks to support consensus finding. Molinero-Parejo et al. (2023) proposed a framework that intimately couples the commonly used model-based approach with a narrative-based approach that aims to support the active participation of stakeholders and facilitates the integration of quantitative and qualitative input. Iwaniec et al. (2020) developed an interdisciplinary research-practice approach that integrates participatory scenario development, modeling, and qualitative scenario assessments to construct strategic, adaptive, and transformative scenarios. The strategic scenarios are derived from existing governance strategies and primarily reflect probable futures. However, they also feature optimistic visions based on policies and strategies that may or may not be put into practice. In contrast, the adaptive scenarios revolve around addressing issues and enhancing resilience against anticipated challenges, such as floods or droughts. Conversely, the transformative scenarios prioritize normative objectives, aligning with sustainability science principles and striving for profound changes in the present systems.

Whilst the number of urban futuring practices that connect quantitative modeling techniques and participatory methods is still limited, the few existing examples are encouraging in their results (Chakraborty, 2011; Harb et al., 2020; Simoes et al., 2019). Simoes et al. (2019) found that co-modelling and co-reviewing complex urban energy models with stakeholders led to substantial differences in what is considered a desirable scenario and improved communication of model results to non-experts, which in turn, supports the scrutiny and further development of the models. Similarly, Harb et al. (2020) found that while extrapolating quantitative data led to business-as-usual predictions, complementing them with participatory modeling techniques revealed some previously unknown urban development scenarios that would have remained unidentified without stakeholders' involvement.

However, interdisciplinary expert collaboration presents challenges. Cook et al. (2021) identified power dynamics, conflicting short- and long-term needs, and opposing expectations as obstacles to meaningful collaboration. Banister and Hickman (2013) highlighted the dilemma between the increasing complexity of the challenges at hand and the need to communicate this complexity in ways that ensure engagement and understanding among diverse disciplines and stakeholders to drive fruitful collaboration. Effective communication, knowledge transfer, and understanding between diverse disciplines and stakeholders appear to be a key challenge, leading authors to propose supporting frameworks and approaches (Hunt et al., 2013; Kim et al., 2021; Pollastri et al., 2017). Pollastri et al. (2017), for example, used design methods and visualization techniques to support stakeholders in developing diverse visions of urban futures through a 'composite' scenario approach. This approach combines interdisciplinary, non-linear, and contrasting information to reveal potentially conflicting perspectives, ideas, and insights, similar to compositing in photography, where multiple individual images are combined into a single image. Kim et al. (2021) proposed an approach for municipal scenario-building processes for climate adaptation, where stakeholders collaboratively develop goals and visions in participatory workshops. The approach complements traditional planning processes by assessing municipal strategies through the lens of interactive

social-ecological-technological systems. It allows stakeholders' insights into these coupled systems, which, in turn, help them identify overlooked insights crucial for effectively responding to extreme events like heat, drought, or flooding. Similarly, [Hunt et al. \(2013\)](#) proposed a framework to support planning and designing urban infrastructure, which enables a coupled human-natural-engineering view, i.e., a systematic layering of different types of information. This integrated view facilitates the exploration of future demands and aims to support interdisciplinary communication and understanding among stakeholders.

3.3. Quadruple-helix futuring informing policy agendas

This cluster comprises 44 articles that feature urban futuring initiatives characterized by collaborative engagements involving government, industry, academia, and the wider public. This approach, also known as quadruple helix collaboration, originated from a European Commission policy emphasis on civic engagement and open innovation ([Dixon et al., 2018](#)). Unlike expert-driven scenario-building, which tends to focus primarily on technical aspects, results from participatory processes that involve the broader public show a clear emphasis on social needs, personal well-being, relationships, work ethics, or community ([Rosa et al., 2018](#)). Shedding light and taking into account the diverse and potentially opposing ideas, issues, agendas, and power relations between the various stakeholder groups involved in quadruple-helix collaborations is essential for addressing problematic power imbalances and structural forms of oppression, including patriarchy, racism, class exploitation, and unsustainable path dependencies ([Moglia et al., 2018](#); [Monstadt et al., 2022](#); [Recio & Shafique, 2022](#)).

Reviewing the literature, we see quadruple-helix collaborations are gaining popularity in urban futuring and sustainability governance. However, opportunities for citizens to genuinely engage in informed discussions or co-creation sessions about the future of their cities are still scarce ([José, 2022](#); [Mangnus et al., 2022b](#)). Most of the articles in this cluster leverage futuring to support policy agenda-setting processes ([Gudowsky et al., 2017, 2021](#); [Rosa et al., 2021](#)). Going beyond scientific facts, calculations and reasoning, citizen engagement can provide a deeper understanding of public perceptions and do justice to the important role of human factors in developing urban strategies, thereby building a bridge between citizen needs and policymaking ([Rosa et al., 2021](#)). However, the role of citizens in these initiatives varies and can range from assessors and evaluators to co-creators, reflecting different forms of participation and raising questions regarding the motives for adopting a participatory approach. As we will see, participatory processes also carry inherent risks, including the potential for tokenism, where the impression of social inclusion is only feigned ([Palacín et al., 2020](#)).

Some initiatives, for example, assess stakeholder perceptions on 'what if' scenarios, which often inform policy decisions ([Larsen et al., 2011](#)), to confirm or challenge their social acceptability but also to understand stakeholders' power in promoting or hindering their potential implementation ([Accastello et al., 2019](#)). Various approaches exist to facilitate these perception studies. [Shaw et al. \(2009\)](#) developed a multi-scale scenario approach featuring 3D views of alternative climate scenarios. In contrast, [Paraschivoiu et al. \(2023\)](#) adopted a lower fidelity approach using design fiction in the form of postcards from the future featuring suggestive visuals and concise captions representing future scenarios. Through interactive workshops and pop-up activities, citizens were encouraged to envision themselves in these future scenarios and provide written reflections on potential impacts, uncertainties, and alternative paths. [Accastello et al. \(2019\)](#) employed a semi-quantitative methodology to assess stakeholders' perceptions of alternative future scenarios for Gällivare, a Swedish mining city where the indigenous Sami people live. Some of these pre-developed scenarios were clearly disadvantageous for the Sami and would, for example, "further limit the possibilities for the Sami to carry out reindeer herding and to keep their traditional way of life and culture" ([Accastello et al., 2019](#), p.16). The scenario further states that the conflicts arising from this scenario could be mitigated by implementing participatory approaches, which are known to improve social acceptance and have proven particularly effective in areas with strong indigenous communities. This example clearly illustrates that participative approaches risk being misused and exploited to serve the interests of specific (e.g. industrial) stakeholders, which raises profound concerns about the authenticity, sincerity, and integrity of their application. It also emphasizes the importance of these processes taking into account diverse lived experiences, historical issues, memories of the past, and alternative problem framings and views of what constitutes desirability and sustainability ([Daffara, 2011](#); [Eames & Egmore, 2011](#); [Feola et al., 2023](#)).

The review also identified a number of initiatives whose stated aim is to engage citizens' perspectives in policy-making, such as those for the EU's New Horizons program ([Rosa et al., 2021](#)), as a way to identify pathways toward (socially) sustainable future states ([Carlsson-Kanyama et al., 2008](#); [Gudowsky et al., 2021](#); [Repo & Matschoss, 2018](#)). These initiatives acknowledge that citizens can provide important knowledge, actionable steps, and ideas rooted in their lived experiences and understanding ([Pereira et al., 2021](#)). In

Table 1

Keywords of search strings divided into part 1 and part 2.

Database	Part 1	Part 2
Scopus (title, abstract, or keywords), WoS (topic), ACM (title, abstract, author keyword)	"participatory futures" OR "participatory foresight" OR "participatory futures thinking" OR "participatory futuring" OR "futures literacy" OR "futuring" OR "futures thinking" OR "participatory scenario" OR "bottom up futures" OR "speculative design" OR "design futuring"	AND "city" OR "cities" OR "citizens" OR "circular cit*" OR "sustainable cit*" OR "green cit*" OR "resilient cit*" OR "sustainable urban transition*" OR "sustainable urban transformation*" OR "urban sustainability transformation*" OR "urban sustainability transition*" OR "circular urban transformation*" OR "circular urban transition*" OR "urban circularity transformation*" OR "urban circularity transition" OR "sustainable urbanism" OR "circular urbanism" OR "future urbanisation" OR "future urbanization" OR "urban futures" OR "sustainable urban future*"

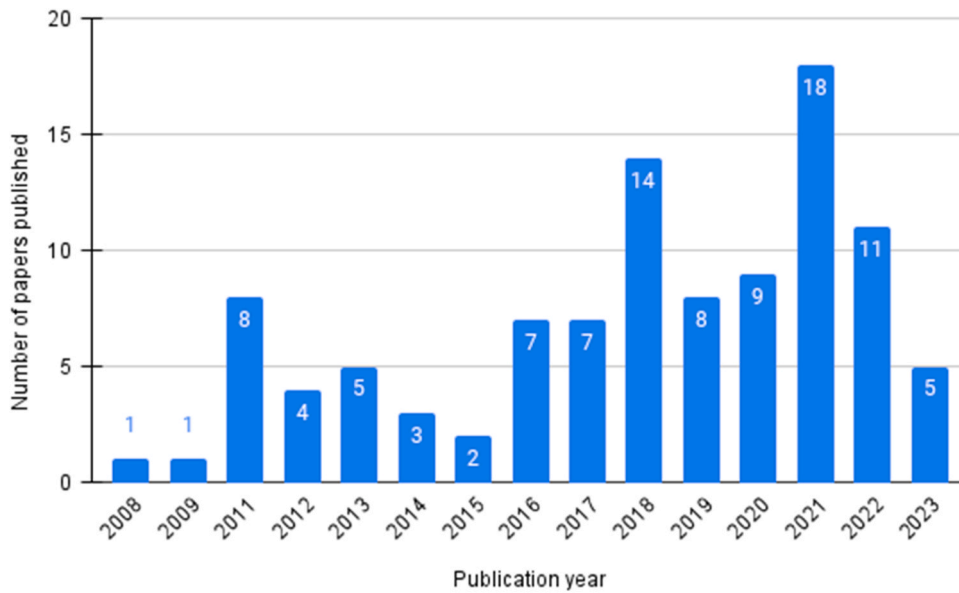


Fig. 2. Overview of publications over time (2008 – June 2023).

Table 2
Overview of the forms of futuring and their distinct characteristics.

	Interdisciplinary expert-driven scenario-building	Quadruple-helix futuring informing policy agendas	Public futuring for social learning
Short description	Integrating quantitative modeling and qualitative input from industry, academic, and governmental experts to develop scenarios that help in exploring plausible future problems and opportunities within fields such as urbanization, energy, or transport primarily to support urban planning processes.	Collaboration between academia, governments, industry, and citizens through visioning and backcasting methodologies the aim of enhancing policy-making and agenda-setting processes by providing insights into the social desirability and acceptability of policy ideas.	Stimulation of social learning in the wider public through experiential and experimental futuring processes that promote futures literacy capacities needed to anticipate, challenge, imagine and shape the future in more effective and responsible ways.
Actors involved	Interdisciplinary experts from industry, academia, and government	Collaboration between academia, governments, industry, and the wider public	The wider public including children, youth, and students
Methods employed	Participatory workshops; integrated qualitative and quantitative scenarios modeling techniques	Visioning and backcasting workshops, interviews, focus groups, surveys	Visioning workshops; experimental formats that harness the power of art, storytelling, embodiment, and open-ended experimentation
Purpose/output	Plausible scenarios in the form of models and written descriptions	Socially accepted and desired scenarios and policy agendas	Facilitating social learning and democratization of sustainability-driving competencies
Goal orientation	Output-focused	Output and process-focused	Process-focused
Data used	Integrated qualitative and quantitative	Mostly qualitative with quantitative bits	Qualitative
How does this form of collaboration aim to support urban sustainability?	By adopting and enhancing scenario-building techniques based on both qualitative and quantitative data, this form of collaboration aims to accurately anticipate plausible urban futures, thereby informing urban planning processes.	By integrating the viewpoints of quadruple helix city stakeholders, this form of futuring aims to improve policy-making and agenda-setting processes, which both extend into and result from the human and professional competencies, knowledge, and learning that emerges from such processes.	By empowering the wider public with the capacity to think critically and reflectively, challenge conventional perspectives, and adopt an imaginative mindset.
Challenges	<ul style="list-style-type: none"> - Power dynamics - Conflicting short- and long-term needs - Different expectations - Tensions between high complexity and the need to create mutual understanding between diverse stakeholders - Transfer of expert knowledge and facilitation of effective communication between diverse disciplines 	<ul style="list-style-type: none"> - Power dynamics - Communication of specialized knowledge - Unlocking visionary thoughts - Participants' skepticism towards the quality of outcome and extent to which outcome impacts policy agendas - Tensions between operational and visionary aspects of scenarios 	<ul style="list-style-type: none"> - Consistently integrating futuring into institutions to facilitate learning - Limited understanding of the actual learning and capacities emerging from participatory futuring - difficult to assess the effectiveness and long-term impact of this form of futuring

agenda-setting processes, participatory ‘visioning’ and ‘backcasting’ approaches are highlighted as particularly suitable (Carlsson-Kanyama et al., 2008; Gudowsky et al., 2021; Repo & Matschoss, 2018). The outcomes of visioning processes, known as visions, represent desirable future states. Research states that a well-articulated and inspiring vision can potentially have the capacity to inspire change and transform people (Dixon et al., 2018).

The literature in this cluster presents a number of visioning methodologies and tools. For instance, Moglia et al. (2018) developed a visioning methodology based on community workshops and strategic conversations. Metzger et al. (2018) took a different approach by conducting a crowdsourcing experiment where young Europeans were asked to create graphic novels depicting their imagined lives in 2040, which revealed a strong desire for sustainable lifestyles among the participants. Törnroth et al. (2022) proposed a four-step participatory utopian sketching framework, emphasizing its potential to shift urban design from a problem-based focus to a values-based orientation. Berbés-Blázquez et al. (2021) introduced a tool designed to facilitate reflective multi-stakeholder dialogues in which participants reconsider their visions, identify what works or is missing, and further develop their ideas. Both Collie (2011) and Börütecene and Löwgren (2022) focus on the significance of narratives in their respective approaches to visioning. Collie (2011) proposes using science fiction and other narrative forms to engage communities in the visioning process. Börütecene and Löwgren (2022) introduce coffee cup reading, a traditional practice of narratives-based glimpsing into futures, as a low-threshold, non-digital way to engage people in envisioning and reflecting on futures. Van Den Eijnden et al. (2022) adopt a citizen-science-inspired and speculative design approach for engaging citizens in imagining futures that shed light on diverse values and perspectives. Gudowsky et al. (2012) present a three-step visioning methodology for citizen-expert collaboration: citizens share their future ideas; experts translate these inputs into practical policy recommendations, and finally, citizens are given the opportunity to review and prioritize the outcomes. Involving experts in evaluating the consequences of scenarios that incorporate input from laypeople is considered important for ensuring they align with sustainability targets and enhancing their robustness for policy-making (Larsen & Gunnarsson-Ostling, 2009). Tori et al. (2022) offer a creative and participatory scenario-building approach that considers so-called ‘wild cards’, i.e., low probability but high impact events such as the Covid pandemic, to increase the effectiveness of scenarios used in policy-making.

Backcasting refers to those processes whereby stakeholders work chronologically backwards from visions to identify the actions required to achieve them (Aoki et al., 2020; Carlsson-Kanyama et al., 2008; Robinson et al., 2011). Visioning and backcasting can enable participants to think beyond incremental changes and embrace the more radical and disruptive socio-technical changes required to achieve sustainability (Eames & Egmore, 2011). But this potential must first be unlocked (Mallan & Greenaway, 2011). Approaches that stimulate the imagination, allow participants to build relationships, explore commonalities, and engage with emotions, feelings, values, assumptions, and complexity can help (Pereira et al., 2018; Repo & Matschoss, 2018). Urban tinkering (Elmqvist et al., 2018; Karuri-Sebina, 2019), living labs (Ehn et al., 2014; Nevens et al., 2013), and democratic urban playgrounds and ateliers (Asenbaum & Hanusch, 2021) are examples of such experimental and playful approaches. They share practical, hands-on experimentation, iteration and democratic co-creation with a wide range of stakeholders (Asenbaum & Hanusch, 2021; Elmqvist et al., 2018; Karuri-Sebina, 2019). For instance, Ehn et al. (2014) showcase three illustrative instances of living labs situated in socially marginalized neighborhoods within Malmö, Sweden. These initiatives strive to counterbalance market-oriented innovation and foster social innovation through the cultivation of long-term relationships between citizens and non-governmental entities and by using prototyping as a means to elicit and explore opportunities and dilemmas.

Various factors can enable or constrain this quadruple-helix collaboration, including the institutional landscape, the participatory culture, the project design, and the futuring methods (Mangnus et al., 2022b). Generally, there is a strong emphasis on making the design of the futuring initiatives and their processes an explicit focal point. For those inexperienced with setting up participatory futuring initiatives, some scholars offer a general introduction covering aspects such as time span, types of futures, futuring methodologies, and implications for policy and practice (Fudge & Fawkes, 2017; Hancock & Bezold, 2017). For a step-by-step futuring methodology that can be integrated into broader urban strategy processes, Tatar et al. (2020) provide an ‘engage-analyze-diagnose-envision-plan-integrate’ approach. If the futuring participants are unfamiliar with futuring, Wright et al. (2017) suggest starting with a micro-course in contemporary futuring to familiarize participants with core tools, concepts, and methods. When confronted with the complexity of the issues and the specialized knowledge they are expected to engage with, non-experts may feel overwhelmed (Robinson et al., 2011). In such situations, tailoring the information to each group of social actors involved can play a crucial role in fostering familiarity and enhancing understanding (Pereira & Funtowicz, 2013). Yet, even when participants appreciate the initiative and its procedural aspects, doubts may arise regarding the quality of the resulting outcomes (Carlsson-Kanyama et al., 2008), or participants may feel frustrated by the lack of impact their ideas and opinions have on the research and innovation agenda (Estrada Grajales et al., 2018; Gudowsky et al., 2021). Some scholars claim that participatory futures, with their normative function of creating shared visions accountable to the public, may always be at odds with their operational function of making transitions governable (Urquiza et al., 2018). In addition, normative scenarios that aim to address specific targets, such as minimizing climate change, often rely on behavioral changes. This poses the question of whether it is reasonable to expect people to change their behavior even if they may not feel adequately represented (Larsen et al., 2011).

The literature in this cluster reveals that shaping urban futures involves complex processes marked by ongoing power struggles among multiple agents with varying degrees of influence. Local governments typically maintain control over city futures and the implementation of participatory mechanisms (Estrada Grajales et al., 2018). However, the literature offers a few inspiring cases of bottom-up approaches that challenge conventional power structures and seeks to empower citizens, transforming them from passive residents into active city co-creators. Estrada Grajales et al. (2018) shed light on an activist grassroots organization in Brisbane that leverages playfulness and fun as active principles in appropriating, reimagining, and implementing the co-production of urban futures. And Ehn et al. (2014) describe a number of experiments undertaken largely by grassroots organizations, non-governmental organizations, and multi-ethnic working-class neighborhoods that aim at making socially sustainable futures.

3.4. Public futuring for social learning

This cluster of 41 articles differs from the previous two in that it places more emphasis on the processual values of participatory futuring rather than on its concrete outputs like models or scenarios. It primarily focuses on social learning and futures literacy emerging from the futuring process itself and the value this has for the broader public (Toivonen et al., 2021). Social learning is the process by which individuals and groups learn from each other, and challenge and develop common understandings and goals through interactions, dialogue, and shared experiences (Albert et al., 2012; Johnson et al., 2012; Schuppenlehner-Kloyber & Penker, 2015). Futures literacy refers to skills that enable people to anticipate, challenge, imagine, and shape the future effectively and responsibly. These skills include critical-, reflective-, systems-, and imaginative thinking (Albert et al., 2012; Johnson et al., 2012; Schuppenlehner-Kloyber & Penker, 2015; Spellman et al., 2021). Research on the human capacities needed to effectively deal with sustainability issues is still limited (Kerry et al., 2012). However, futures literacy is increasingly seen as a crucial skill set for individuals, organizations, and societies to navigate today's complex and rapidly changing world and foster sustainable ways of living (e.g. Toivonen et al., 2021). The articles in this cluster argue that participatory futuring initiatives can support the development of skills comprising future literacy.

One important capacity of futures literacy is the ability to critically question what shapes futures, including assumptions and preconceptions, and approaches to futures (Bina & Ricci, 2016; Toivonen et al., 2021). As we have seen above, futuring approaches serve distinct objectives and can afford and hinder certain futures and are, thus, a matter of politics and power dynamics. Assumptions, worldviews, and deeply held beliefs mediate society's perception of what is possible and, thus, afford or limit peoples' actions in the world, including their engagement with sustainability. By rendering these ontological dimensions, or 'worlds', explicit and available for reflection, new understandings of sustainability may arise (Bendor et al., 2017). Challenging assumptions can lead to paradigm shifts, for example, in relation to what is valued or what the purpose of human relationships and activities is. These ontological shifts can potentially contribute to the transformative change needed to realize sustainability (Bina & Ricci, 2016).

Challenging assumptions and the status quo concerns, for example, the deeply ingrained anthropocentric approaches that shape cities and urban futures (Forlano, 2016). To date, a growing number of researchers argue that urban futures should not be perceived in isolation from nature, nor should they be exclusively or predominantly designed to cater solely to human needs (Akama et al., 2020). These scholars advocate for other-than-human approaches to urban futuring – approaches that expand the scope of who is considered a legitimate and relevant participant in envisioning urban futures beyond human boundaries to include other-than-human entities (Clarke et al., 2019; Forlano, 2016). This perspective not only critically challenges anthropocentric paradigms but also presents unique opportunities to develop new approaches that challenge dominant notions of human privilege (Clarke et al., 2018). Although a work in progress, this cluster presents a number of papers that explore how to include other-than-human perspectives in urban futuring. Neuhoff et al. (2022), for example, staged a participatory process in which human stakeholders envisioned the consequences of some trends for the lives of other-than-human stakeholders, such as birds, bees, and trees, which enhanced participants' feelings of empathy and responsibility towards these more-than-human stakeholders. Others experimented with collective participatory speculative urban walks (Clarke et al., 2018) and speculative fabulation (Nijs et al., 2020) to foster other-than-human imaginaries and inform and engage citizens on a variety of human and non-human urban issues.

Some scholars investigated how to extend the realm of participation beyond the present, exploring intergenerational futuring practices fostered through role-playing exercises where participants represent imaginary future generations and their concerns (Hara et al., 2019, 2021; Kamiyo et al., 2017; Uwasu et al., 2020). Findings indicated that scenarios created by imaginary future generations significantly differ from those developed by current generations, with potential implications that may even be disadvantageous for the present. Nonetheless, these approaches have garnered support from present generations, demonstrating the potential for intergenerational empathy and increased efforts to mitigate climate change (Uwasu et al., 2020). This aligns with research indicating that joint futuring exercises can strengthen relationships, enhance empathy, and foster understanding of diverse perspectives (Johnson et al., 2012). Despite these promising examples, practical guidelines for implementing a comprehensive shift toward other-than-human and intergenerational perspectives remain scarce (Sheikh et al., 2023).

Challenging anticipatory assumptions is also closely linked to the capacity to imagine. Many studies have found participatory futuring to stimulate social imagination (Bennett et al., 2016; Gouache, 2021; Hajer & Versteeg, 2019; Iwaniec et al., 2021; Mangnus et al., 2019; McPhearson et al., 2016; Pelzer & Versteeg, 2019; Pereira et al., 2018; Raudsepp-Hearne et al., 2020). Social imagination refers to the cognitive and creative capacity that enables individuals and communities to think beyond prevailing narratives and generate positive visions about the future. A lack of social imagination matters particularly in the face of complex challenges which require a wide range of motivating ideas and options to be addressed (McPhearson et al., 2016). Positive visions afforded by social imagination can counteract and balance the often pessimistic discourses about the future (which can make people feel like change is impossible) and inspire people to work towards more sustainable, fair, and resilient futures (Gudowsky et al., 2021).

As sustainable urban futures require a fundamental rethinking of how we want to inhabit the world (Jégou & Gouache, 2015), a lack of imagination can be a significant obstacle (Hajer & Versteeg, 2019). In the face of this, numerous articles in this cluster explore how to foster higher degrees of imagination. Rosenbak (2018) argues that to imagine a city's future, it is crucial first to understand its present. To do so, Rosenbak suggests focusing not on what the city *is* but exploring what the city *is not*, for example, by encouraging citizens to share lies about their city, which can then be used to imagine and prototype alternative urban futures. Some scholars use 'seeds', i.e., innovative ideas not yet widespread, as a means to imagine positive futures that sustain a link to the already existing world (Mangnus et al., 2019, 2022a; Pereira et al., 2018; Raudsepp-Hearne et al., 2020). Tyszczyk (2021) introduces speculative improvisations – an approach integrating strands from futures studies, speculative research and design thinking – to imagine futures and consider responses and responsibilities in the present.

Various scholars explore and harness the potential of design to support imagination, for example, in the form of design workshops, exhibitions, digital interactive media, futures visualizations, or projection exercises (Bendor et al., 2017; Jégou & Gouache, 2015; Neuhoff et al., 2022; Pelzer & Versteeg, 2019; Zohar and Neuhoff, 2023). Zohar and Neuhoff (2023) staged a number of participatory design workshops that engaged citizens of all ages and were geared towards building 'The City of our Dreams'. Drawing from these workshops, they suggest 'life-centered design', a form of design that considers all life forms and not just human life, as support to expanding the imagination, challenging anticipatory assumptions, and considering futures from multiple perspectives. In their design-driven futuring workshops, Neuhoff et al. (2022) experimented with 'time travels', i.e., facilitated thought journeys supported by music and storytelling, to expand the imagination of their participants. Pelzer and Versteeg (2019) tried to enrich academics' imagination by inviting artists to contribute ideas to the 'Post-Fossil City Contest', resulting in a public exhibition. Gouache (2021) proposes experiential methods such as forum theaters, philosophy talks, and idea markets.

Various other studies highlight the importance of actual experiences for stimulating social imagination. Formats such as interactive art and multimedia installations make it possible to virtually or vicariously experience alternative futures and, thus, to better engage with, remember, comprehend, and deliberate them (Bendor et al., 2017; Garduño García & Gaziulusoy, 2021; Hajer & Versteeg, 2019). However, liberating oneself from the limits of conventional thinking proves to be difficult, as dominant narratives often unconsciously perpetuate through the dominance of specific forms of knowledge and power structures. In contemplating this challenge, Chopra et al. (2022) found valuable insights in reflecting on 'monocultures of the mind' – a notion that calls for resistance through embracing diversity as a fundamental aspect of both life and thought.

To foster future literacy skills more widely, scholars advocate for integrating urban futuring initiatives in school and university curricula. Responding to the French Ministry of Education's decision to include futuring in education for sustainable development, Julien et al. (2018) developed a framework of learning tools for school children to project themselves into the future, manage complexity, consider different perspectives, and make decisions. Similarly, Demneh and Darani (2020) engaged school children in futuring through drawing, writing, showing, and storytelling. At the university level, Barbara and Scupelli (2021) offered an open-source course to design futures in cities, while Hoffman et al. (2021) used a mixed classroom futuring approach with policy-makers to imagine possible futures around the transition to a circular economy.

Whilst more research is needed to understand the actual learning and capacities emerging from participatory futuring, Brown et al. (2016) proposed the concept of three 'learning loops' to understand the dynamics. Single-loop learning is reactive and incremental, double-loop involves changing assumptions, and triple-loop learning challenges decision paradigms. They observed instances of double-loop and triple-loop learning in participatory futuring, but noted that long-lasting engagements are needed to promote triple-loop learning. Similarly, Ravetz and Miles (2016) suggested futuring should not just be a one-off initiative but embedded into urban policymaking and institutions to build capacity for social learning and collective intelligence. Schuppenlehner-Kloyber and Penker (2015) offered some propositions for participatory futuring geared towards futures literacy development, including the need for interdisciplinary research, professional communication and management of futuring processes, group-building and development activities, and facilitating a shift in values, self-organization and learning for long-term action.

4. Discussion & future research

4.1. Different attitudes towards the future

This systematic literature review set off to explore which forms of participatory futuring for urban sustainability have so far been established. As illustrated in our findings (Section 3), we could identify three clusters of initiatives, i.e., 1) interdisciplinary expert-driven scenario-building, 2) quadruple-helix collaboration informing policy agendas, and 3) public futuring for social learning. These clusters are characterized by different attitudes towards the future. The first cluster largely operates on the premise that the future can be made at least partially knowable, and therefore focuses on responding to its contextual implications. Thus, the corresponding approaches include practices and techniques that can be used to determine the probability of various futures occurring, and to understand and develop adaptive capacities and mitigate their risks. These approaches especially evolve around integrated quantitative models and participatory (though expert-led) scenario-building. Rather than waiting for the future to arrive, the second cluster sees the future as something that can be partially shaped in the present. It primarily aims to open up alternative pathways by using consciously designed visioning and backcasting processes that draw on techniques that elicit the publics' desires and concerns about the future. Finally, the third cluster primarily sees contemporary values, beliefs, and assumptions as a root cause of the unsustainable present and as a decisive factor in whether a sustainable future is possible. Therefore, rather than strengthening and reproducing the ontology from which the unsustainable present stems (e.g. anthropocentrism), this cluster aims to uncover, challenge and possibly even transcend prevailing ways of thinking and implicit assumptions about the world and its futures.

4.2. The decisive role of our minds

Cities are the hubs where people live, work, produce, recreate, consume, eat, and spend. It is now widely acknowledged that many things have to radically change along these dimensions to overcome the "civilizational crisis" humanity has inflicted on itself and the planet (Escobar, 2022, p. xxiv). Foregrounding that the climate crisis has its roots in a civilization in crisis inevitably leads to a set of tough questions that can be asked in relation to the effectiveness of futuring approaches aimed at tackling unsustainability. For example, one can ask whether an approach brings forth radically different, i.e. transformative, alternatives in relation to the aforementioned themes, that is to say whether these alternatives break with the dominant system that causes unsustainability (ibid.). Whilst

this literature review did not focus on an in-depth examination of the outcomes of a futuring initiative, some patterns are recognizable. As described above, only a few initiatives, most of which can be found in cluster 3, actively aim at challenging unsustainable paradigms (e.g. anthropocentric ways of thinking and doing that separate the human from the non-human) and help participants rediscover themselves as relational beings. The majority of the articles focus on reimagining the external world – policy agendas, urban planning, etc. This makes another provocative question inevitably arise: How can a futuring initiative ever have a truly transformative impact if it only focuses on the external world but neglects the decisive role of individual and societal attitudes, norms, and belief systems for how we relate to ourselves and the world? Effective futuring, one could argue, demands to do justice to the intimate relationship between mind and (un)sustainability.

4.3. Temporality

Thinking about the transformative impact of a futuring initiative, we can also reflect upon temporality. The majority of articles included in this review present one-off futuring initiatives extending across relatively short time spans, which, one could argue, represents a rather volatile mode of participation, and neglects that the effects of the envisioned futures may extend over a much longer periods; that sustainability is not a fixed end state but a process that requires constant (re-)negotiation; and that engaging in futuring over a more extended period may enhance the learning outcomes and amplify the impacts of these initiatives (Brown et al., 2016; Ravetz & Miles, 2016). To democratize futures for a wider audience and promote futuring as an integral practice, scholars stress that further research is needed to investigate how futuring can be consistently integrated into education, urban policy-making, and institutions (Carlsson-Kanyama et al., 2008; Gudowsky et al., 2021). Another question is how the future initiatives and the visions and ways of thinking they generate can become so present in people's lives that they eventually replace the current elements they are seeking to rethink.

4.4. Equity and decolonization

Another observation is that research on participatory futuring for urban sustainability has not adequately addressed the critical impact of factors such as class, gender, race, and ethnicity on individuals' engagement with and participation in futuring initiatives. There exists a notable absence of reflexivity concerning the full spectrum of diverse lived experiences. The prevailing tendency in many initiatives involving citizen participation is to overlook the unique qualities of the participants, assuming a uniform and homogeneous group. This failure undermines the fact that one person's reality is not another's reality, but that different people have different needs, experiences and concerns. This in turn leads to a distorted understanding of the potential impact and desirability of an imagined future and prevents the achievement of a truly sustainable future. Scholars within futures studies have emphasized that sustainability disproportionately affects marginalized groups who are often excluded from or lack the agency to participate in such processes (Feola et al., 2023; Pereira & Funtowicz, 2013). In order to promote equality and inclusivity, more knowledge is required on how to secure the inclusion of diverse demographics and entities beyond living humans (e.g. Clarke et al., 2019; Hara et al., 2019, 2021). Additionally, approaches are needed to facilitate constructive dialogues and negotiations among these distinct stakeholders, fostering convergence amid their potentially differing viewpoints.

Furthermore, Table B (located in Appendix B) reveals a notable concentration of the geographical location of urban futuring initiatives in Western and Central European cities. Although this literature review did not thoroughly explore the country of institutional affiliation of the authors – an issue that should be explored in future research – there seems to be a large imbalance. This imbalance indicates that our current understanding of participatory futuring for urban sustainability is limited to only certain dominant methodological, epistemological and ontological approaches. Unfortunately, problems related to inclusion and patterns of dominance in scientific debates and publication processes are neither new nor limited to a particular field (Perry & Pereira, 2023). So there is a clear call for more diversity. The inclusion of a variety of voices, perspectives and experiences will enrich the field; it will influence the approaches and interpretations of the topics studied; contribute to a more complete and accurate representation of human knowledge; and promote the principle that all voices deserve recognition.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

We sincerely thank the reviewers and editors for their invaluable comments, careful editing, and timely handling of our manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.futures.2023.103268](https://doi.org/10.1016/j.futures.2023.103268).

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