



The roles of new foresight methods in urban sustainability transformations

A conceptual framework and research agenda

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Introduction

Objective

The objective of this agenda setting paper is to outline a new conceptual approach for increasing understanding of how new foresight processes impact efforts toward urban sustainability transformations. The ideas in this paper provide the conceptual basis for collaboration between two strategic entities hosted by Utrecht University - the Governing Futures Lab at the Copernicus Institute of Sustainable Development and the Urban Futures Studio - to inform and contribute to a range of research efforts on the topic of foresight and sustainability transformations. These activities are aligned with the core Utrecht University theme 'Pathways to Sustainability'.

Background

The significant global impacts of accelerating human activity and resource use in the 20th and 21st century are rapidly destabilizing the earth system. Cascading impacts of global climate change, the rapid decline of planetary biodiversity and other radical changes are colliding with rapid changes to human activity in terms of consumption, industry, geopolitics and new technologies¹. In the face of these human impacts on the planet, many global organizations such as UN agencies² and researchers worldwide^{3,4} recognize the urgent need for fundamental, transformative change in all aspects of human activity to ensure a sustainable future for all. 'Sustainability transformations', or fundamental systems changes that aim towards more sustainable futures, are needed in the areas of water, energy, food, land use and more^{5,6}.

However, such sustainability transformations must first be imagined in order to be realized⁷. The practice of foresight focuses on exploring potential futures and developing strategies in the face of future uncertainty^{8,10}. This is often done by exploring multiple future scenarios – narratives about potential futures, described through narratives, model outputs, and other formats^{11,12}, against which plans and strategies can be evaluated. Foresight has a long and diverse history as a future-planning tool in military, government and business contexts¹⁰. Out of this practice, an equally diverse research field has emerged, focused on

understanding foresight processes and their impacts on policy and strategy¹³. Foresight approaches are now used to explore the future across many fields and domains, and more often in processes that include a wide range of stakeholders in a consultative mode¹⁴. But in practice, foresight is still most often used in processes led by governments and private companies, for the purpose of improving strategies and policies aimed at adaptation and incremental change, rather than at broader transformations¹⁵. As a result, most foresight research has followed this focus on incremental adaptation¹⁶. Furthermore, there are methodological limitations to current foresight approaches in terms of their capacity to investigate system transformations¹⁷.

In recent years, however, new constellations of private and public actors all around the world are actively working toward sustainability transformations from local to global levels^{18,19}. Some of the efforts with the highest potential to mobilize action toward transformations occur beyond the limitations of the geopolitics of nation states – for instance, through global networks and coalitions of cities²⁰. These global networks and coalitions combine the practical benefits of integrated local governance with the power that comes from globally networked action .

A number of such groups and networks are taking the first steps in experimenting with foresight approaches to imagine the futures they are aiming for, and they are looking for methods that fit their interests in transformation and their modes of collaboration²¹. At the same time, possibilities to use fundamentally new approaches to foresight, such as gaming, online platforms, virtual and augmented reality, are emerging that have specific benefits for exploring future transformations^{22,23}. These approaches have the potential to significantly change how futures beyond current systems are imagined²⁴. However, what is missing is a clear understanding from a social science perspective of how new foresight approaches may impact efforts toward sustainability transformations from local to global levels. What are the explanatory factors of foresight processes that lead to different outcomes in this regard?

The aim of this paper is to outline a new conceptual approach for increasing our understanding of how different factors in new foresight processes impact efforts toward sustainability transformations at different levels. The ideas in this paper inform and contribute to a range of research efforts on the topic of foresight and sustainability transformations

conducted by the Governing Futures Lab, housed at the [Copernicus Institute of Sustainable Development](#), Utrecht University with a number of global partners, in collaboration with the [Urban Futures Studio](#), also based at Utrecht University. The authors of this paper are connected to a number of partners and research programs, including RE-IMAGINE, a project investigating foresight as a political intervention in a climate context), the [CGIAR's Climate Change, Agriculture and Food Security \(CCAFS\) Future Scenarios Project](#), the [IRIS project](#) on urban energy transitions and the EU-funded [FP7 TRANSMANGO](#) project on the future of food.

We first discuss the fields of research that we aim to connect, beginning with sustainability transformations. We then introduce urban transformations as our level and empirical domain of focus to enable concrete discussions and examples. Next, we investigate foresight as a field more generally and in the context of transformations. Our next step is to present a conceptual framework that seeks to frame the relationships between foresight and transformations. This framework inspires a research agenda that includes a series of research questions. We will then discuss how analytical and experimental research approaches should complement each other, and the need for a focus on research that integrates local, global and other levels.

Sustainability transformations

- The need for transformative change starts as the idea that incremental changes will not be enough to adapt to future challenges and create desirable, sustainable futures. As this notion has become more widespread, the term ‘transformation’ has become more popular both in research and policy contexts¹⁵. Researchers approaching transformation from all theoretical perspectives agree that transformative change can be said to refer to fundamental changes in structure, system functions and relations within and between systems²⁵. From this starting point, however, diverse research perspectives have emerged that employ different theories of transformation. Transition theory approaches transformations from a technology and innovation perspective, seeking to understand the conditions under which niche-level innovations scale up into new socio-technical regimes^{26,27}. Social-ecological systems (SES) theory has its origins and its heuristics rooted in ecology, and focuses on ‘transformability’, defined as “the capacity to create a

fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable²⁸. From a social-ecological systems perspective, transformation processes can be navigated actively by actors involved⁵. Political ecology focuses more principally on the power relations and politics of transformations, emphasizing actor coalitions and their engagement in strategic actions to shape institutional structures²⁹.

- We conceptualize sustainability transformations as taking place in fundamentally interconnected human and natural systems, or ‘social-ecological systems’³⁰. Such systems are also interconnected across geographical levels, across sectors and across research domains^{31,32}. The drawing of system boundaries should be recognized as a specific choice made by those who investigate them, rather than given by any pre-existing conditions in reality³³. Sustainability transformations come about due to a combination of deliberate action by key actors seeking change, and emergent change in the systems they interact with⁵. ‘Sustainability transformations’ are system transformations toward more sustainable future conditions – however and by whomever these conditions are defined. In terms of composition and functioning, sustainability transformations entail changes in a defined system in terms of the roles, goals, orientations and power dynamics of actors, their networks, practices and uses of resources, that lead to sustainability outcomes that would not have been possible in the current configuration of the system in question⁴. Finally, transformational change interacts across multiple levels – local transformations can help initiate higher-level transformations; transformations in systems at higher levels fundamentally change the conditions for local transformations³⁵. Our definition places a strong emphasis on actors and their dynamics, as well as on the role of goals for the future – which allows us to zoom on in the (potential) role of futures approaches in sustainability transformations.

Sustainability transformations in urban systems

In our collaborations between the Copernicus Institute and Urban Futures Studio, we use sustainability transformations in urban systems as our empirical domain of focus. Urban

systems, characterized as all activities connected to a particular urban area, offer particular challenges and opportunities for sustainability transformations³⁷. The majority of people worldwide now live in cities, and this number is growing³⁸. Urban centres have significant impacts on their environments in terms of emissions, land use change and other impacts^{39,40} but at the same time, they are sites of innovation and shared learning as densely populated centres for education, business and government, and offer possibilities for significantly increased efficiency in resource use⁴¹. As a result, efforts toward sustainability transformations have often focused around urban systems, including surrounding city regions²⁰. Actors interested in sustainability transformations include local policy makers, shop and restaurant owners, farmers and other land owners in the city region, energy, transport and waste companies, investors, consumer organizations, educational and academic centres and others. A strong example of an urban system transformation is the transformation of the governance of a city's food system by a Food Policy Council^{42,43} made up of diverse city region stakeholders - a form of governance that is being adopted in increasing numbers of cities. An example that is still in an early stage relates to attempts to take urban agriculture to scale using vertical farming and other closed, integrated urban farming systems⁴⁴. Efforts to realize urban system transformation have been connected by international and global networks of cities – where opportunities for shared learning and shared political action at a global level have become possible, as well as opportunities for out-scaling of practices to other cities²⁰. Examples are the Milan Urban Food Policy Pact adopted by 159 cities⁴⁵; urban centres connected to the global Transition Movement¹⁹; the C40 climate cities⁴⁶, the '100 Resilient Cities' project⁴⁷ and others.

This overview shows that there is both a large amount of activity in practice and attention in research for the role of cities, and that they are being championed as pioneers or frontrunners of sustainability transformations²¹. However, some recent studies also claim that the materialization of transformations at the city level is still ambiguous, and question whether the attention they garner is rather born out of frustration with the speed of transformation at other levels of governance than out of success with urban transformations⁹³. Moreover, recent studies of global city networks suggest that while popular, they still fall short of being an effective substitute for ambitious international climate action as they are not yet ambitious, transparent and representative enough⁹⁴. These conclusions suggest a number of issues. Firstly,

the comparison between cities, city networks and international organizations suggests that these levels of governance are not well aligned. While there is potential for synergy, currently there is no optimal flow of knowledge between different levels, and there is confusion as to what responsibilities belong at which level⁹⁵. Secondly, there is an imbalance between the energy put into initiating transformations at the city level and the actual impacts of these efforts⁹⁴. Finally, when zooming into the local level it is important to take into account the varying levels of socioeconomic development and the different governance contexts of cities⁹⁴. However, recent literature suggests a reframing of the urban resilience and transformations as policy experiments. To put the numerous calls for transformation into practice, research should be grounded in the realities of actors at the city level; address how local governments, civil society and people's movements operate and interact; and how space for transformative change can be created. To do so, it is important that any intervention is a process of social learning, in which these actors can temporarily step out of their governance environments and positions in order to truly reframe the urban context in which they operate. Processes of co-design are especially fit for orchestrating collective urban transformations⁹⁶.

Foresight and urban sustainability transformations

The field of foresight spans a highly diverse and disparate world of practice and research that at least initially developed largely independently from notions about system transformations, though both fields share a common root in complex systems thinking¹⁰. The field emerged from practices in militaries and government think tanks around the mid-20th century, moving on to become a business planning tool¹³ and a tool for the quantitative projection of future scenarios by researchers⁹. The use of foresight in multi-stakeholder contexts is more recent¹⁰. Arguably, foresight is a field that started as a practice, and became a subject of academic study later. As a result of this basis in practice, and because of the many empirical domains involved, theory around foresight remains highly fragmented and partially under-developed⁸. Foresight can be applied to any domain – energy, food, water, climate and environmental change, geopolitics and global economic development, technology, and more. Many futures processes in fact integrate drivers and variables in many of these domains, recognizing the

interconnectivity of global systems¹⁴. A wide range of methods, including various combinations of quantitative simulations and qualitative stakeholder and expert processes, is used¹¹. Many categorizations of foresight types exist on a number of variables^{10,49}. While in reality they are often combined or blended, a main distinction can be made between explorative scenarios that focus on future uncertainty and unforeseen challenges; and normative scenarios, often broken down into visions, that focus on what would be desirable to achieve, and pathways, focusing on how to get there⁹. Much progress has been made within the field of futures studies regarding sustainability challenges, leading to strong insights on the integration of qualitative and quantitative future scenarios^{17,50,51}, the down-scaling of macro-level scenarios to local contexts⁵², and novel ways of constructing scenario frameworks⁵³. However, in terms of understanding how foresight relates to governance in a sustainability context, there is an important disconnect between foresight research, rooted mainly in environmental sciences, macro-economics, land use change and business planning, and research on environmental policy and governance⁵⁴. What is clear is that the majority of futures work is still conducted by larger businesses, by national governments, and by global multi-stakeholder platforms, focused on incremental adaptation and not on systemic transformations⁵⁵. New networks of actors looking for ways to initiate sustainability transformations do not commonly have experience with approaches to imagine transformative futures in an action-oriented way⁵⁶; and foresight methods are not typically designed with a view of imagining societal transformations¹⁶.

Researchers are now starting to recognize the importance of investigating the societal need to imagine and experiment with futures that represent sustainability transformations. Such interest emerges regarding transformations at all levels, from cities and local communities²¹ to national and global levels⁵⁷⁻⁶⁰. Major global foresight research efforts that the authors are involved in, like the United Nations Environment Global Environment Outlook⁶¹ and the World in 2050 Project⁶² are similarly interested in the use of foresight for sustainability transformations. But a theoretical basis to understand the potential impact of foresight on transformations is missing. Moreover, there are noted limitations to current foresight processes in terms of their capacities to explore transformations. Foresight that relies heavily on quantitative models cannot typically simulate transformative change because model assumptions are set and based on past conditions⁵³. More participatory processes focusing on

classic qualitative scenarios have important limitations in their ability to let societal actors interact and experiment with transformational change, and limitations in terms of the numbers of people who can participate in such processes¹².

New foresight approaches for imagining and initiating urban transformations

In the meantime, interest among practitioners and researchers in the use of foresight for sustainability transformations coincides with the increasing availability of new ways to imagine, engage and experiment with transformations. Principles from the domains of design, media and art are increasingly used as futures methods. This shift at least partly originates from a frustration with both the capacity of traditional foresight methods to capture the complexity and multiplicity of futures¹³, and with the lack of a translation of scenario outcomes into action¹⁴. For both generating and communicating futures, it is important that there is a balance between the experiential and the analytical¹⁵. Not all methods capture this balance yet, but there are some promising developments. An example is the use of narratives, which can be used to bridge the gap between anticipation and action, by generating deliberative, negotiation-based futures¹⁶. Narratives can also serve as ways to critically reflect on urban, digital or other design choices by exploring different futures that lead to different endings, and question the assumptions made along the way¹⁷. Design principles can be used to set up workshops for inclusive design, to vision and plan for the futures of abstract concepts such as the “smart city”¹⁸. Participatory workshops can also be set up to enable the co-design or the collective visioning and planning of scenarios for less concrete but equally important urban futures such as liveable cities¹⁹.

Simulation and gaming encompass a domain of approaches to foresight with a particularly diverse set of potential benefits in this regard. Games for strategic planning have their beginning in military, policy and private decision-making contexts, and have moved from more positivist to increasingly more constructivist, pluralist approaches interested in taking human complexities into account²⁰. Today, the landscape of games relevant to foresight consists increasingly of games used as methods for public participation in planning and

preparing for futures⁶⁴. In the context of foresight, games have many similarities to simulation modeling and to participatory scenario methods. Like system models, games are essentially dynamic system representations that can be used to explore interactions/feedbacks between system elements, providing insights and recommendations for action. However, games also have a strong focus on actor perspectives in systems through the roles of players and non-player characters, allowing for a better representation of human systems, as well as identification with actor roles and interaction with other actors/players that is not possible with a system model or scenario^{12,65}. This creates many opportunities for understanding and experimenting with systems. Scenarios can bring potential futures to life through powerful, concrete narratives. Games can provide such narratives as well, but players can actually enter into them and play immersive actor roles, experimenting with other identities, while games and their players can respond dynamically to (other) player choices^{12,66}. This way, games can create insights from creative interactions, as well as opportunities for greater mutual understanding and empathy²³. Finally, games have been demonstrated to support empowerment and a greater sense of self-efficacy⁶⁷ in the face of complex challenges, which can be an asset for planning, educational and research purposes if it can be connected to real-world challenges.

Beyond current practices that include games in foresight, moreover, the game industry has grown exponentially over the last decades – a significant cultural shift resulting in many more people than before worldwide with experience with games. Significantly, new design and distribution methods have loosened the needs for games to be creative ‘mainstream’ products, creating a continuous stream of games that offer challenging, critical experiences, create empathy, or connect individuals in new, creative ways⁶⁸. All these developments offer possibilities for new approaches to imagining and initiating sustainability transformations beyond what is currently possible in the domain of foresight. Several possibilities for significantly enhancing simulation and gaming for foresight in a transformation context are especially apparent. Virtual Reality (VR) is now easily and cheaply available – allowing for unprecedented levels of immersion in potential future worlds^{22,69,70}. Its complementary technology, Augmented Reality (AR)^{71,72} allows for the interactive integration of visualisations of envisioned futures with present day settings. On-line technologies allow for the inclusion and interaction of many more participants than would normally be possible in a foresight

process⁷³. Rapid prototyping of such new approaches is now more accessible than ever⁷⁴. Such developments offer the possibility for radically novel foresight approaches – both at the local level and globally through the possibility to transfer approaches and involve many more global perspectives in foresight. But their potential for the imagination and initiation of transformations is poorly understood.

Finally, an important new development is the increase of possibilities for co-design in foresight methods. An example of a game being used in the urban context specifically is the Generative City Gaming concept¹⁰², which has been used in cities such as Amsterdam, Almere, Rotterdam, Brussels, Istanbul, Tirana and Cape Town. Each of these cities has their own "urban question", or main problem that their specific game aims to solve. The most important factor in each gameplay round was the set of rules, which was determined at the start by the players themselves, with their roles differing in each city's game depending on what was deemed appropriate. Other examples of advancements in co-designed foresight methods include entirely co-designed workshops on urban futures for transformations⁹⁶, and participatory exercises that utilize successful existing transformational practices ("seeds")⁹⁵. This selection of examples indicates that new foresight methods, simulation and gaming specifically, and the technological advancements that make them possible on a larger scale open up new ways for addressing the current urban question⁹⁶. They enable players to step out of their own roles and freely experiment with new roles and governance modes. This fosters a participatory process of social learning. Moreover, new possibilities are opening up for co-design in these processes, either by letting urban actors define the rules of the game or method, their environment or both.

A conceptual framework for researching the role of foresight in urban sustainability

To understand the link between foresight and urban sustainability transformations, we propose that the following main question should be used as guidance for research:

To what extent do interacting institutional, social, methodological and cross-level factors influence the impact of existing and new foresight processes on the imagination and initiation of urban sustainability transformations?

What is meant here with a ‘foresight process’ is any process that involves stakeholders in the system in question –such as a city’s food system- in a process where foresight methods are used to imagine and experiment with potential futures. The foresight process is also understood to include whatever steps are involved in stakeholder engagement – preparatory meetings, process steps to ensure foresight results are used, et cetera. Such a foresight process can inform sustainability transformations in the following fashion. Actors attempting to initiate transformative change are motivated by ideas of what futures are desirable to work toward, and what futures should be avoided. Foresight can shape ideas about desirable futures through the use of visioning⁷. It can help explore possible pathways toward these futures through techniques like back-casting^{14,75}. Explorative scenarios may function as tools to investigate contextual challenges and opportunities, to test the robustness or flexibility of pathways toward a given vision^{14,76}. On the basis of imagined future visions and pathways toward these visions, networks of actors engaged in the foresight process can then work to establish new coalitions to initiate these transformations through the re-organization of resources and institutional structures. This can be achieved through the development of concrete policies, strategies, legislative changes and investments that have strong funding and political support – supported by plans for capacity development among the actors involved in the new coalitions^{14,21}. The initiation of sustainability transformations is assumed to be dependent on the use of foresight to imagine what futures are desirable, and how to get to them. It may, however, be that a foresight process is only interested in or mandated to help imagine sustainability transformations – an example could be a local community that imagines global transformative change. What determines the capacity of a foresight process to contribute to the imagination and initiation of sustainability transformations? Based on relevant literatures, we propose the following typology of interacting explanatory factors (figure 1):

- Institutional factors. Institutional conditions can help determine the space to operate for actors involved in efforts toward sustainability transformations^{21,34}.

Such conditions may be actively supportive of investigating transformative change – for instance through flexible and adaptive regulations, by having supporting resources at higher levels of governance, by offering opportunities for collaboration between state and non-state actors, and through other means. They may also be restrictive – limiting spaces for action through heavy regulations or complicated bureaucratic procedures. Restrictive institutional conditions can also include contexts in which government control is strong but civil society’s political influence is much less pronounced; or centralized top-down decision-making from higher levels. Such institutional conditions may also be weak – offering little support and capacity for transformations but also offering little active resistance to change. In the context of more general possibilities and limitations for sustainability transformations, there may be different levels of support for foresight processes investigating possible transformations⁵⁵. Foresight may be an accepted and commonly used approach for participatory governance; it may be unknown; or opening up governance through participatory foresight may be considered dangerous or undesirable⁷⁷.

- Social factors: The actors involved in the process and their capacities^{21,33,56}. Funders and supporters shape the process^{13,78}; individuals and organizations leading and facilitating the foresight process have many opportunities to frame, open up or restrict the process⁷⁹. Their capacities or lack of capacities in different areas of process facilitation and organization are a key factor. Participating actors have different capacities related to different foresight approaches⁸⁰ – some may be more comfortable with or interested in quantitative approaches, while others may be more interested in visual or storytelling approaches⁸¹. Familiarity with new methods like simulation gaming or on-line platforms may also determine who participates most actively, and how resulting foresight results are shaped⁸¹. Participants may bring different connections to the process. Different groups of participants generate different future visions, pathways, and scenarios. The inclusion or exclusion of participants is highly political, given the potential impact of visions, coalitions and plans formed through a foresight process. More

diverse groups of participants may be more likely to establish novel networks and coalitions for action beyond pre-existing collaborations²¹.

- **Methodological factors:** foresight methods and process design. Different foresight methods can structure engagement with potential futures in significantly different ways, leading to different problem framings, different imagined futures, different plans and strategies. Several typologies exist that demonstrate the diversity of existing methods and what scenarios these result in^{9,10,49}. Scenario approaches may include a systematic analysis of only a few drivers, or include many different dimensions and drivers of change⁵³; they may construct their narratives from the future back to the present or vice versa⁷⁶; they may be based in quantitative modelling or entirely in qualitative information, and so on. Beyond the limits of ‘conventional’ foresight methods, methods based in simulation and gaming, on-line interactions, VR and AR can allow for significantly different futures both in terms of their content and how they can be engaged with⁶³. A fully realised game world that allows for iterative choices, different exploration pathways and dynamic interactions between players creates completely different insights about the future than a set of model results or a set of short narratives⁶⁵. The organization of the process and its embedding into governance processes also plays an important role. The timing and structuring of time steps in a foresight process might be designed make optimal use of opportunities for the use of its results. Different strategies may be used – to conduct foresight right at the beginning of increasing interest in sustainability transformations to facilitate the first imaginings of what transformation might look like; or right when momentum and interest among a wide range of actors has been generated¹⁴. Importantly, process design can impact who participates and how the process is perceived⁵⁶. A process (including methods used) that is presented and perceived as timely, credible and legitimate may significantly influence who participates, and what contextual governance conditions it could benefit from⁵².
- **Cross-level factors:** Narratives of the future at higher levels, such as global future scenarios - whether they are available as concrete foresight or as more general

societal narratives, shape how contextual changes are understood in more local processes⁸³. Local foresight processes may or may not have access to global narratives of the future that were developed by researchers, think tanks or international organizations. If local foresight processes know about and use such global futures, these may either offer new perspectives on their local cases, or limit thinking about what is possible, if the futures are too narrowly framed. If no structured global or otherwise higher-level futures are available, dominant societal narratives of the future may implicitly frame what futures can be imagined at lower levels⁸⁴. At the same time, foresight processes as well as actual present-day changes at the local level (such as the city level) may also inspire and extend global futures. Several global and sub-global foresight initiatives that the PI is involved are explicitly seeking to develop bottom-up futures that draw from insights and practices at the local level to create global sustainability pathways^{85,86}. Moreover, the approaches available and considered most useful at higher levels also affect choices for methods and process design. Examples of this are foresight methods promoted by governments; or repositories of foresight methods made available by change networks (such as sustainable food city networks in our case)

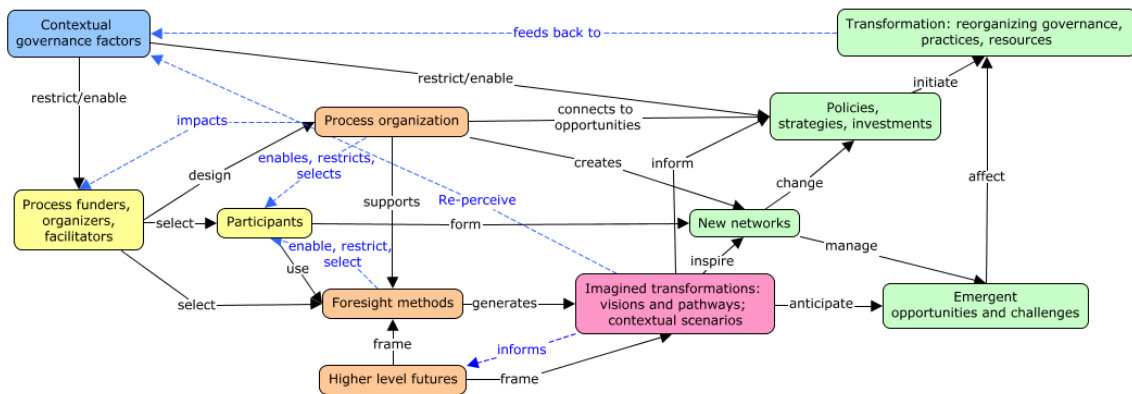


Figure 1. Dynamics between explanatory factors for the role(s) of foresight in urban sustainability transformations. Dotted lines indicate feedbacks from foresight to other factors.

The core dynamic that this framework helps investigate is that institutional and social factors and higher level narratives involved not only determine the planning and methodology of the foresight process – but that planning and methodology also shape and frame who is involved, what higher level contexts are relevant, and how contextual governance conditions can be re-

perceived to identify previously unforeseen possibilities for change. This creates a dynamic interaction between institutional, social and cross-level factors on the one hand and process planning and methods on the other. The visual representation of the framework in figure 1 indicates where methodological factors might influence other factors. There is a potential here for feedback loops – a longer loop that goes through the initiation of sustainability transformations back to contextual governance factors, but also for shorter loops between the foresight process and other factors for foresight as the process is being designed and started.

Key research directions and questions for investigating the roles of foresight in urban sustainability transformations

We propose that the relationships between foresight and (urban) sustainability transformations discussed above should be researched using complementary research approaches. Here, we offer a number of questions that are informing current research efforts and project proposals, including questions framed for the authors' personal projects - a personal fellowship (Joost Vervoort), PhD research (Astrid Mangnus). Firstly, we propose 1) explanatory research on existing cases, aimed at providing the understanding that supports 2) experimentation through interventions with new foresight approaches in practice contexts. This leads to the following two research questions:

- *How have different factors relevant to foresight processes impacted the imagination and initiation of sustainability transformations in existing case studies?*
- *How do new foresight practices aimed specifically at transformation affect other foresight factors and resulting impacts on sustainability transformations?*

Such research on urban case studies should be embedded in a multi-level analysis that investigate the potential for transformation between cities, city networks and other levels of governance and the role of foresight in such interactions, as well as the role of higher-level

futures on local foresight in a transformation context, again leading to an explanatory question:

- *How do foresight factors interact across local and global levels to impact the imagination and initiation of sustainability transformations at each level?*

And a more experimental/design-focused question:

- *How can futures methods shape strategic action towards sustainability transformations at the level of global city networks?*

More methodological questions about the specifics of different foresight methods and their interactions can also be investigated, such as:

- *How do design choices within individual foresight methods shape how transformations are imagined?*
- *What factors influence the capacity of complementary futures methods to contribute to the participatory conceptualization of urban system transformations?*

The question of the interactions between complementary futures methods is particularly relevant when considering how different methods approach the future entirely differently - for instance, as a vision and a pathway versus a world that can be inhabited and experimented with. Such methodological research can in turn be combined with a multi-level focus, for instance:

- *How can complementary foresight methods help explore the uncertainty generated by the interactions between transforming urban systems and wider global contexts?*

We also aim for research that focuses more specifically on the initiation of sustainability transformations in terms of politics and power in a multi-level context, for instance:

- *How can research based in foresight methods support diverse actors involved in city governance in the initiation of urban system transformations using new models of governance?*
- *What determines the capacity of foresight methods to negotiate a balance between public participation and top-down change in multi-city urban transformation initiatives?*

Finally, we propose to investigate the potential of approaches that engage with futures beyond foresight approaches which typically focus explicitly on planning and policy processes, such as:

- *How can virtual and real-world experimentation with of the built environment help actors at the city level explore a wider range of sustainable urban futures?*
- *How can new futures practices aimed specifically at transformation empower urban actors to reconfigure the consumer choice architectures in which they operate?*
- *What is the role of the cultural sector in contributing to societal discourses on what transformative futures can be imagined and realised?*

Through our conceptualization of existing and new links between foresight and futures approaches and urban sustainability transformations, and the proposed research questions, we aim to offer the tools to break new theoretical ground by connecting and extending current research on foresight, transformations, interactive media and multi-level governance. We propose to conduct this research while offering concrete insights for a wide range of actors interested in the practical challenges of imagining and initiating sustainability transformations in urban and other contexts.

While this conceptual paper is proposed as an agenda setting paper for collaborative efforts between our projects at the Copernicus Institute and the Urban Futures Studio, we warmly welcome feedback and participation from a wide range of research communities on the presented ideas.

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