
June 2025

# Transforming the Built Environment: A Systems Thinking Approach for Sustainable Urban Futures

THE CLUB OF ROME

HotorCool


## Acknowledgements

The development of this exploratory paper was led by the Hot or Cool Institute in partnership with The Club of Rome. The exploratory paper is part of commissioned work by the Laudes Foundation.

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The authors are grateful to several individuals for their input to this paper. The list of experts and practitionners that contributed to this Paper can be found in Annex 1.

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# Contents

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# 1. Introduction

The built environment is in many ways at the intersection of the planetary emergencies and social crises that the world is grappling with. Although there is no unique definition for the built environment, different descriptions tend to agree on the fact that the term refers to human-made physical structures and vital networks that underpin urban life (Williams L, 2013). While the built environment is importantly affected by the changing climate conditions, it is also at the source of the activities that produce them, being also a crucial determinant of the life quality that an urban area can offer. The built environment is for instance associated with important environmental impacts related to construction and operation (Gallego-Schmid et al., 2020). Moreover, the design, characteristics and interactions between its different components crucially determine the spatial organisation of cities; shaping the spaces where people live, work, and interact and the choices they make (Moffatt & Kohler, 2008).

There is a pressing need to encourage the revaluation of urban spaces and structures for them to contribute to the creation of more resilient cities and healthy communities, prosperous and thriving within planetary boundaries. Unfortunately, there remains a limited understanding of the systemic structures and interactions that characterise the built environment. Current approaches to the built environment often treat solutions in isolation and linear terms, rather than through a holistic, systems-based perspective that integrates socio-economic and environmental factors, and addresses key interactions between human-made structures, the natural environment and the cultural (non-material) aspects of society. This is problematic because, in complex systems, the greatest potential for change comes from reorganising the system to enable new patterns and outcomes, rather than altering isolated parts (Meadows, 2008)—yet decisions regarding the built environment often focus on the latter.

Moreover, short-term economic interests often overshadow long-term wellbeing and environmental stability, resulting in poor decision-making that fails to emphasise the built environment's critical role in fostering meaningful human-nature relationships — where nature is valued intrinsically and for its contributions and humans see themselves as part of nature, rather than merely extracting from it, as is common in mainstream approaches (Galli et al., 2024.) Regenerative practices, which "actively seek[s] to establish a positive and reciprocal relationship with nature by realigning our values, decisions and actions in a more contributive and harmonious partnership between human and natural systems" (Craft et al., 2021) remain, under these circumstances an exception, being hindered by decision-making that is guided, in the best case, by a "do no harm" principle (Craft et al,. 2021). This short-sighted, narrow approach is inadequate for (re)designing our living environments in response to emerging contingencies—including a climate-altered world that will bring more natural hazards, shifting migration patterns, and new cultural norms and values.

We need to move away from this and seriously consider how systems thinking, which views complexity through the lens of relationships and wholes, offers a way to better understand the interconnectedness of the built environment and urban systems more generally. This paper is part of a joint scoping phase[1] undertaken by The Club of Rome and the Hot or Cool Institute to address this need and explore how systems thinking can be made operational for decision-makers, helping them to reorganise urban systems and the built environment to make low-carbon and nature-positive lifestyles affordable, appealing, and accessible; thus reconciling ecological limits with social imperatives.

[1] The paper is linked to different activities conducted throughout the scoping phase developed: The research methodology consists of a questionnaire distributed to experts and practitioners, semi-structured interviews (Annex 1), and a comprehensive literature review. This led to the drafting of a preliminary version, which served as the foundation for organising a workshop with stakeholders and practitioners in the field in October 2024. The workshop offered a space for discussions and creative thinking, allowing The Club of Rome and the Hot or Cool Institute to gather feedback and insights on the framework described in the paper; the barriers impeding systems thinking and potential ways of shaping the next phase of work. A list of participants can be found in Annex 2. This final paper reflects and builds on the workshop discussions and describes the initiative that is the main result of the scoping phase developed.

The paper calls for reframing the built environment beyond isolated infrastructure and as part of a broader, interconnected urban and ecological system.[2] We argue that this shift demands a fundamental change in mindset and policy approaches with: a) increased attention on the interactions between different built elements – buildings, transport infrastructure, public spaces, etc.— and between these elements, ecosystems, and key societal dimensions like culture and social imaginaries; and b) greater emphasis on enhancing stakeholder engagement, co-creation, and creating local ownership and shared visions and understanding of a wider set of interconnected social, economic and environmental challenges. We argue that this shift in mindset and policy approaches, for which a systems approach is necessary, is crucial to take decisions beyond sector-based optimisation to a solution space where transformative solutions can effectively emerge and be implemented.

The Cities Living On ONE Planet (Cities LOOP) initiative (explained in section 5) is proposed as a way forward to work with cities in undertaking this crucial shift, helping them to use systems thinking in a practical way to reprioritise action, reshape the built environment, and open the door to more sustainable and equitable urban futures. By working with different cities the initiative aims to create new narratives and pathways towards success. By equipping local decision-makers with practical tools, a sound evidence base, and cross-sector strategies, our approach provides a practical way to deal with complex challenges and implement change. By combining systems thinking with participatory and co-creation methods, Cities LOOP fosters innovative thinking and collaboration with the aim to bridge the growing disconnect between decision-makers and society. In this way making bold and innovative policy implementation more socially and politically feasible and sustainable, and helping accelerate the transition to cities that provide the places and services for both people and planet to thrive.

Photo by Lance Cheung/USDA

[2] While talking about cities throughout the paper, an urban systems approach also considers the importance of looking at relations that go beyond city cores, and the increasing need to understand the relations and interdependencies in the whole of functional urban areas, and even beyond, between urban and rural territories. Functional urban areas include a city and its commuting zone, i.e. the set of contiguous local units that have at least 15% of their employed residents working in the city (Dijkstra, Poelman and Veneri, 2019).



# 2. Moving to a transformative solution space

Achieving ambitious sustainability and wellbeing goals for cities and the built environment requires expanding the scope of both problem definitions and solutions. This section introduces a framework to better understand the policy landscape shaped by two key factors: (a) differing narratives on the sustainability and wellbeing goals cities should achieve, and (b) varying decision-making approaches that determine how solutions are prioritised. The goal is to encourage reflection on the nature of change expected within different policy contexts and how both urban narratives and policy strategies must evolve to drive the transformative change needed.

Science increasingly reminds us that moving away from narrow and siloed thinking and practice and addressing the complexity, non-linearities and cascading effects of our socio-economic and wider ecosystems is paramount to successfully addressing our socio-economic and environmental crises (IPCC 2022). Delivering on the needed transformation of the built environment, and urban areas more generally, would require following the same logic. Indeed, current (unsustainable) urban lifestyles and the deep and persistent inequalities created within and across urban centres are the product of having created built environments based on narrow and siloed perspectives and narratives. Current perspectives and framing on the built environment and the socio-economic and environmental outcomes that a successful city would achieve, are too narrow, restricting our understanding of the broader systemic and holistic issue. Among other biases, the narrative around cities and the built environment has often focused on the means- e.g. GDP growth, increased productivity, mobility, housing- rather than the ends- creating livelihoods, provisioning access to opportunities and services, and creating a secure and healthy place to live (OECD, 2019) (OECD, 2021). Narratives for cities have also failed to fully reflect the environmental constraints and imperatives, including the need for a balanced focus on emissions and resources, and for rethinking the use, allocation, and design of space, to enable urban living within planetary boundaries.

Unsurprisingly, a narrow and siloed framing of the wider problem has also led to narrow, siloed and linear approaches to developing solutions, including, for designing the built environment. As various respondents to the questionnaires and interviewees highlighted, policies and planning often operate within narrow, siloed frameworks to guide the development and design of the built environment, which fail to account for the complex, interconnected nature of the urban system. Policy instruments frequently focus on optimising individual components of the built environment or related problems without addressing the broader systemic relationships in the larger complex and interdependent system, e.g. between the physical human-made structures, the natural environment and the cultural (non-material) aspects of societies that are behind unsustainable outcomes (Moffatt, S., & Kohler, N. 2008). The existing focus lacks emphasis on the built environment's role in serving people and fostering conviviality.

The blind spots produced by such poor understanding of unintended consequences, long-term impacts and cascading effects throughout the wider system (Williams L.,2013) have resulted in a built environment that is not only resource intensive per se (Fini, Elham, 2024); (Moffatt & Kohler, 2008; Gallego-Schmid et al. 2020), but which generates unsustainable spatial organisation, promotes highly consuming urban lifestyles and compromises life quality (Williams, 2013) (Frumkin, Dannenberg, & Botchwey, 2022; Williams, 2013). This ultimately constitutes a key barrier impeding cities to enable people to thrive while keeping within planetary boundaries. Among other things, traditional planning has failed to account for the profound effects of land use decisions, including zoning and urban planning, on resource efficiency and the overall sustainability of urban areas, (Frumkin, Dannenberg, & Botchwey, 2022), including the wide and long-term impact of urban expansion on local ecosystems and species, leading to habitat loss and reduced biodiversity (Levy & Patz, 2015). Urban planning and construction sectors are closely interconnected and interdependent. Often, however, the two operate in silos due to differences in goals, priorities, and communication. Together they shape to an important extent the built environment, urban planning by providing the blueprint for how cities

should be developed in the long-term, and the construction sector by executing those plans. Some of the most relevant differences are timeline and stakeholders' scope. While the construction sector is influenced by private industry with short-term economic returns, urban planning is influenced by public administrations and has a longer-term objective.

Overall, there is limited understanding of the complex ways in which the built environment influences human behaviour and cultural norms, and thus the opportunities for urban design to encourage practices like energy conservation and sustainable transport at scale (Frumkin, Dannenberg, & Botchwey, 2022). The focus is also often on the direct functions of the materialised built environment (e.g. buildings as housing) without fully capturing its entire societal function (e.g. enabling healthy people in a healthy environment). Lack of proper acknowledgement and understanding of equity impacts generated by policies (e.g. climate action) has also led to unintended exacerbation of existing inequalities, making it harder for vulnerable populations to benefit from policies that should in principle have beneficial outcomes (e.g. policies promoting energy efficiency or sustainable construction) while also hindering broader acceptance and capacity to move forward (Levy & Patz, 2015).

A narrow approach to the built environment has not only impacted the frameworks and tools guiding decisions but has also permeated into the processes within which solutions are designed and selected. The low priority granted to interconnections has also applied to those between actors in the system, resulting in limited engagement, poor spaces for exchange and experimentation, and the promotion of high fragmentation across policy areas, sectors and government levels. The fragmentation across different governance levels—local, regional, national, and global also results in policies at each scale often lacking coordination and coherence (Hurlimann et al., 2021; King et al., 2016). Siloed thinking about the different elements of the built environment, in combination with siloed governmental and budgetary structures also traps policymaking despite the increased discourse on the need for integrated planning (e.g. between transport and land-use). Ultimately, deep change is hindered, as siloed perspectives coming from the focus on individual elements and isolated problems (e.g. decarbonisation separate from biodiversity, health or equity issues) can only see part of the whole system and problem, which makes it impossible to develop effective and transformative strategies and solutions.

Figure 1 provides a framework to guide thinking towards the reframing of the built environment and the approaches that could lead to its needed transformation. The figure shows that different framings of the problem (y-axis) and approaches to finding solutions (x-axis) will lead to policies and actions moving in radically different solution spaces (here divided into four main ones). The y-axis shows the level of awareness in the need to address a wider number of socio-economic and environmental challenges. At the very bottom, policies focus on a restricted number of challenges and tend to have a siloed approach, while moving along the axis features the consideration of a wider number of challenges in an increasingly integrated way. The x-axis shows the type of mindset with which decisions for the built environment are made to meet the socio-economic and environmental challenges addressed. On the left, the predominant mindset is analytical, focusing on isolated elements and means. Shifting to the right moves toward a systemic approach, emphasising the interconnections within the broader ecosystem and how these connections can meet the needs of both people and the planet.

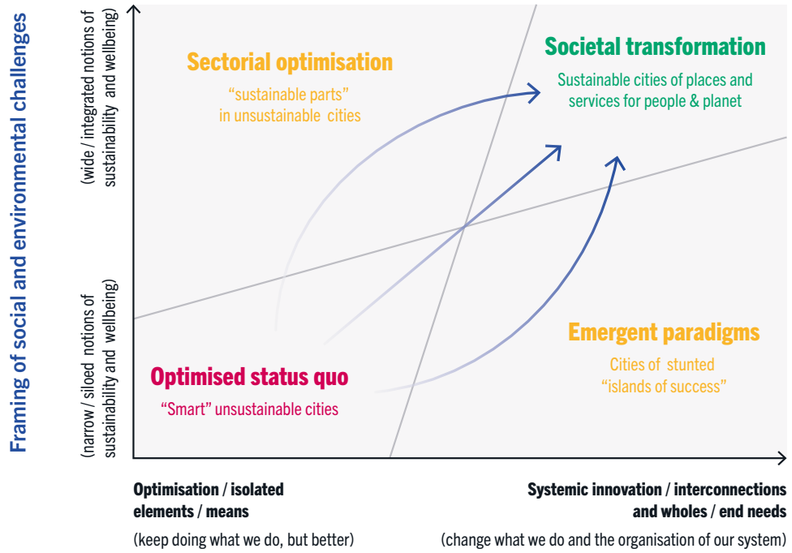


**Figure 1. Different solution spaces for the built environment and resulting city typologies**
The lines that move along the axis are not completely parallel to the axes. This is to show that even within a narrow set of socio-economic and environmental issues considered as a starting point, moving towards a solution space that addresses interconnections and wholes (i.e. moving to the right along the x-axis) will provide more scope to solve a wider set of issues addressed. On the other hand, even when staying within an analytical mindset (left side of the graph), moving along the y-axis to consider a wide set of issues will lead to optimisation at a wider scale (e.g. moving from smaller scale elements to the elements of a sector).

**Source: Hot or Cool Institute**

The solution spaces shaped by varying problem framings and solutions approaches result in diverse types of built environment and cities. Section 2.1 describes in detail the four solution spaces and the resulting city typologies. While having city typologies in mind is useful, it must be noted that the actual shape and landscape of these four city types, and especially of the desired typology (the city of places and services for people and planet), looks different across world regions and within a country. The typologies are therefore meant to indicate some key principles driving policy decisions and outcomes, and characterising the built environment or urban areas, while leaving wide space for cultural and contextual differences.

For instance, Floater et al. (2014) classify 468 cities—projected to account for 50% of energy-related emission growth between 2021 and 2030—into three categories based on income, population size, and urbanisation rates: emergent cities, megacities, and mature cities. They explore how strategies may differ across these city types in achieving compact growth, connected infrastructure, and coordinated governance—three principles aligned with our "city of places and services for people and planet" typology. The same applies when looking at other socio-economic and environmental challenges that would need to be addressed in diverse places and regions. Different urban areas can vary depending on issues such as high levels of informality or conversely can have large portions of land already developed and subject to strict property rights, limiting the potential for physical change. These different conditions will also require different types of solutions. Nonetheless, we argue that expanding the policy framing to integrate socio-economic and environmental challenges and shifting focus to the interconnections and the whole (rather than isolated parts), is a necessity to drive deep societal transformation, regardless of the specific context and characteristics of urban areas.

In addition, the four spaces and the typologies are also indicative of where a city is located today, depending on the type of decisions for its built environment that have been dominant over time and how this has affected its capacity to deliver wellbeing within planetary boundaries. Nonetheless, the evolution of policy frameworks is a heterogeneous process, and frameworks and tools being used to make decisions, even regarding the same city may fall into different categories.

The objective of the framework is therefore two-fold. On the one hand to improve understanding of the type of built environment that has been created in different places, and how this is a key determinant of the type of urban area developed, and its capacity (or limitation) to enable prosperous living within planetary boundaries. On the other hand, to provide a structure for understanding where decision-making is going and capturing divergence and potential contradictions with respect to decision-making. In other words, to assess how today's decisions shape the scope and scale of change they enable—while driving reflection on how tools and decision-making must evolve to truly create cities of places and services for people and the planet. Examining the solution space in which policymaking operates is crucial. We argue that without a broader framing of the problem and a shift toward approaches that prioritise changing connections over merely improving individual parts, decisions will overlook the truly transformative solutions needed to enable thriving lives within planetary boundaries.

Section 5 explores how to operationalise the framework, detailing how a new Cities LOOP initiative can embed systems thinking into mainstream practice. It examines how this shift can reshape decision-making in the built environment, enabling cities to identify, prioritise, and scale innovative solutions for transformational change


Photo by Pascal Denis



## 2.1 The four solution spaces and city types in a nutshell

**The optimisation status quo** space describes a highly restricted policy space, characterised by a narrow and siloed perspective regarding the challenges and priorities that cities, and the built environment as part of these, would need to enable. Such priorities are primarily focused on economic aspects (e.g. productivity, economic growth, etc) which are importantly detached from and prioritised over social and environmental outcomes. Where sustainability concerns appear (going up the y-axis) these tend to be limited and rooted especially on direct effects (e.g. direct sources of emissions and air pollution) and based on narrow definitions. At the same time, policy for the built environment (x-axis) focuses on the different elements of infrastructure and overlooks the complex links and feedback loops between them, as well as between the physical human-made infrastructures and the natural ecosystems, social structures, and economic processes. Focus is also primarily on means, as these tend to coincide with the break-down of the infrastructure elements (e.g.mobility, housing, etc.), rather than ends, (e.g. access to services, opportunities and healthy living environments), which are more associated with, and are enabled by, the way in which different infrastructure and other elements interact. This policy space describes the solution space that policy was in when creating the built environment characterising many urban areas, or at least large portions of them. The design of the built environment resulting from decisions taken within this space and mindset is one that by design fosters overconsumption beyond the limits of our planet while at the same time is poorly equipped for enabling us to provide life quality for all. For instance, transport and housing infrastructure has been guided by a focus restricted to enhanced mobility and meeting housing gaps, while systematically ignoring the need for proximity, the unintended consequences of road expansion (e.g. induced demand) and poorly connected development. In this way promoting and locking-in car-dependent systems, with related mobility and carbon intensive travel patterns, sprawled and single-used development, and pressures on the ecosystems (OECD, 2021).

Remaining within this policy space restricts the ability to transform the built environment, leading primarily to policy that optimises the elements at the smallest scale (e.g. vehicles, individual buildings or housing units, or even appliances within them) mainly via technology without changing the key interconnections that could lead to a qualitatively different and improved system (e.g. shifting away from car-dependency and accelerated sprawl). As such, solutions can at most result in the transition from unsuitable cities to **"smart" or high-tech unsustainable cities**, as indicated in the diagram. Getting out of this space is difficult because a vicious cycle or reinforcing loop is created, where narrow views of sustainability reinforce the idea that optimisation is good enough. For example, focusing solely on pollution or carbon emissions can create the illusion that one-to-one vehicle electrification, while maintaining car dependency is a solution. This perspective overlooks resource consumption, persistent accessibility inequalities, and the excessive space allocated to mobility at the expense of proximity and quality urban spaces. It also overlooks the extent to which efforts to replace vehicles are undermined in a car-dependent system in which fossil-fuel fleets are large and still growing; overestimating the speed and effectiveness of strategies that focus on this objective (OECD, 2022).

Nonetheless, as negative socio-economic and environmental impacts grow, the limitations of solely optimising or "fixing" current systems, and the need to trigger deeper change becomes increasingly evident. This can push policy framings to evolve along different pathways (as depicted in Figure 1) and indeed this has been the case in many urban areas. One direction in which policies can evolve is toward the **sectorial optimisation** space. This space depicts the solution space that policy arrives in if moving upwards along the y-axis, i.e. towards the consideration of a wider set of interlinked socio-economic challenges that the built environment and urban areas need to address. However, this is done while remaining in the left-hand side of the x-axis. In other words, without changing the paradigm towards an increased understanding of the built environment as part of a complex system. As such the focus remains on isolated parts (even if at sectorial scale) rather than on interconnections and non-linearities of the whole (inclusive of the ecosystem), which are more related to how the city enables provisioning services for end needs. In this case policy options and solutions may go beyond

technological change or upgrades at the smallest scale but will remain within the boundaries of economic sectors and their corresponding infrastructure. For example, to better address social inequalities and larger environmental impacts (e.g. life-cycle emissions) upgrades for transport may go beyond "improve" type measures that electrify vehicles to reduce their environmental impacts or introduce real-time parking charges to optimise car flows. Policy may start prioritising larger changes that allow optimising the use of transport infrastructure with the aim of increasing modal shift towards vehicles that are more space efficient (e.g. mass transit). Policy focus might also shift from a focus on vehicle travel to the movement of people. Nonetheless, changes do not transcend sectoral siloes and a focus on means (e.g. mobility). As such they do not have the scope to radically change the interconnections. For instance, to shift away from mobility intensive systems via increasing proximity between people and places, and organisation of the whole of the system in a significant manner to deliver improved end needs (e.g. accessibility) (ITF, 2018); (ITF, 2024).

The shift towards this solution space has been quite common, although we argue that most action has not necessarily gone all the way to the top of the y-axis to acknowledge the wide range of socio-economic and environmental outcomes that would be in line with living well within planetary boundaries. The move in this direction has often guided discussions around terms such as "sustainable mobility", "sustainable buildings", "sustainable energy", with a large list of strategies from across cities and countries taking these titles. Working within this space has led to an important mismatch between efforts and outcomes, due to the complexity and interconnectedness of the system. The persistent segmentation of the different areas of the built environment hinders the achievement of the expected results (and this would continue to be the case even if moving higher up in the y-axis). For example, achieving sustainable mobility patterns with a central role for active and public transport is impossible when solely using the direct levers of mobility policy, as what people can access and how, and therefore the mobility choices they make depend on the interaction between decisions with respect to mobility, land-use and other trip-generating sectors (e.g. health, retail, etc). As such, cities become trapped in the pursuit of **sustainable parts or sectors**, within the misleading assumption that the sum of the parts can lead to a sustainable whole. While this could happen if dealing with simple problems and systems it is not the case when dealing with wicked problems and complex systems, where ultimate outcomes are not determined by the sum but the interactions of the parts (Systems Innovation, n.d.).

An important issue is that the term systemic has often been associated with the move towards this area, i.e. moving along the y-axis, without undergoing the key mindset shift that allows understanding the interconnections and re-organising the system (i.e. without moving along the x-axis). Indeed, in the two areas characterised by optimisation (the left side of the graph), scaling up actions that optimises elements or portions of the built environment has often given the impression that large scale change is happening. Changes are however mostly incremental and often further lock-in unsustainable dynamics, as most action is not transformative in nature, i.e. they do not push on high-leverage points for systemic change. Infrastructure designed and developed within an optimisation space also tends to make an important lock-in of the urban system into carbon and resource intensive functioning of cities, which also makes the transformation difficult in the long term, even when a more systemic approach may be adopted.

The **emergent paradigms** space depicts another plausible pathway for evolving policies and decisions for the built environment. This change of space does entail a key mindset shift away from an analytical approach. Decisions can result in new emerging paradigms based on a more systemic understanding of the built environment as part of the larger and evolving system and which aim to change key interactions and functions. However, the space is also characterised by relevant discontinuity and a mismatch between the policy effort and the achieved results. In this case, the mismatch is not due to a lack of methods to solve the problems addressed per se, but a failure to consider important contextual dynamics that would enable scale-up, expansion, as well as permanent and cross-cutting changes in policy approaches. For example, due to an incapacity to build alliances with key actors that could ensure continuity and expansion of emerging planning models or paradigms. Another example could be limited mechanisms to address deeply engrained mental models that persist in society and key potential trade-offs between social and environmental outcomes because of the proposed changes to ensure acceptance and prevent social resistance and backlash. Without ensuring this, many urban areas have fallen into what could be called cities of **"stunted islands of success"**. In this case large scale change is hindered by the opposite problem than in the sectorial optimisation space, as deep systemic change is triggered but cannot overcome barriers to be replicated and scaled up. This is the case of master plans or urban projects without adequate integration into the existing urban context. Systemic integration of sustainable and green solutions may be achieved within the project itself, bringing together and connecting smart buildings, nature-based solutions, efficient energy and water management, and even services for sustainable mobility, etc. However, these are urban spaces decontextualised, without continuity with the rest of the city. This type of case often occurs when cities opt for new developments to cover international events (exhibitions, Olympic Games) that are then intended to become neighbourhoods of the city and take a long time to consolidate, running the risk of becoming isolated urban areas of low activity. The same happens with decontextualised technology parks or ecovillages segregated from the urban continuum. Although the case responds to an urban system approach, the lack of connectivity, limits the capability to be consolidated.

The **societal transformation** space depicts a solution space that would enable deep transformation at scale. Policies for the built environment would, as in the "stunted islands of success", undertake the key mindset shift to focus less on the elements and more on the interactions of the system (moving along to the right on the x-axis). In this case, however, a systemic lens is also used with an emphasis on creating local ownership and shared visions and understanding of a wider set of social, economic and environmental challenges (moving along the y-axis); allowing for the new paradigms emerging to be better integrated into the social context and gain enough support to be expanded and scaled up. Within this space, policies could help transform the built environment and the whole of cities, understood as complex urban systems organised in ways that can **provide services and produce places that allow people and planet to thrive**[3] (Jones et al., 2018). These cities would be designed and organised to operate within the safe and just boundaries for human and planetary wellbeing, as illustrated by the doughnut model (Raworth, 2017).

Policy decisions being made in the different spaces depicted often coexist in the same city. The framework presented helps increase understanding of the wider spectrum of policy decision areas. It helps to set clarity on what a systemic approach would entail and to recognise that **approaches that stay within an optimising space (left hand side), which are currently dominant, are incapable of stirring transformative change**. The different spaces depicted also show that holistic approaches are needed not only to rethink solutions per se, but also as a means of transforming the decision-making and engagement process so that transformative action can be embedded into a process of societal transformation where deep changes to the status quo are accepted. Better identifying the location of different policies, initiatives, programmes, etc. in the spectrum of solution spaces can help identify their limitations in terms of the scope and nature of change that they can trigger, and spur reflections on how they would need to evolve to effectively contribute to the desired transformation for a city. The exercise may also draw attention to some initiatives that might already be in a transformative space and that would need to be better supported, learnt from and connected to wider policy frameworks and social processes, to move into the societal transformation space.

Table 1 summarises the type of solution spaces depicted, and the resulting objectives, types of policies and city typologies associated.

[3] The typology "cities of places and services for people and planet" is inspired by the CREATE project described in (Jones et al., 2018).

| Solution space | Perspective on challenges | Policy approaches | Policy focus | Main levers of action used | Nature and scope of change | City typology |
|---|---|---|---|---|---|---|
| **Optimised status quo** | Narrow and siloed; biased towards economic challenges; focused on direct effects | Focus on the different elements of infrastructure; Means (coinciding with different parts of the built environment) | Optimising the smallest elements (e.g. housing units/ appliances, vehicles, etc.). | Improve | Scaling up actions that optimises elements | "Smart" unsustainable city |
| **Sectorial optimisation** | Increased awareness of wider set of interlinked socio-economic and environmental challenges | Focus on the different elements of infrastructure but at sectorial scale; Means (coinciding with different parts of the built environment) | Optimising sector-wide infrastructure | Improve and shift | Scaling up actions that optimises portions of the built environment | "Sustainable parts" in unsustainable cities |
| **Emergent paradigms** | Towards increased awareness of integrated challenges but limited consideration of important contextual dynamics for triggering systemic change at scale | Systemic understanding of the built environment as part of the larger system; aim to change key interactions and functions; shift from means to ends | Transforming planning models and trialing in specific areas | Improve, shift, avoid (limited scale) | Deep systemic change is triggered but cannot overcome barriers to be replicated and scaled up | Cities of "stunted" islands of success |
| **Societal transformation** | Wide, integrated and with emphasis on addressing contextual dynamics and trade-offs to ensure ownership and scale-up | Systemic understanding of the built environment as part of larger system; aim to change key interactions and functions; focus on ends, and emphasis on creating local ownership and shared visions and understanding of challenges | Transforming planning models and embedding them in a process of societal transformation | Improve, shift, avoid (at scale) | New systemic paradigms emerging and integrated into the social context and gain support to be expanded and scaled up. | Cities of places and services for people and planet |

**Table 1. Summary of solution spaces, key objectives, types of policies and resulting city typology**

## 2.2 Unpacking the framework: insights from a co-creation exercise

The framework described in Table 1 is meant to provide guidance and inspire new thinking on how policy and practice for cities and the built environment need to evolve to guide a societal transformation towards thriving lives within planetary boundaries. Some exploratory exercises undertaken during the workshop used the framework to spur reflection among participants and gather some first insights on the required evolution for policy in the built environment. Divided into groups, participants were asked to use the framework to discuss what moving towards the societal transformation solution space entailed in the context of four key policy areas: urban energy, urban development, mobility and buildings. While breaking participants into such policy siloes could appear contra intuitive, the exercise was precisely an invitation to explore how shifting towards a transformative policy space could help avoid siloed thinking even when the starting point was a particular area of the built environment.

Participants were asked to think about the key goals and characteristics that describe dominant thinking and practice in their specific policy area, and then discuss how these would change if policy was located in the transformative solution space; i.e. if policy was guided by a holistic view of challenges, a focus on ends rather than means, and a systemic approach that embraces complexity and focuses on interactions rather than parts. In a second part of the exercise, participants were asked to reflect on how the shift in thinking identified would allow to: a) better meet global, EU, national, and local commitments, and b) improve existing policy instruments or create new ones.

Table 2 summarises the key findings. Among the most relevant cross-cutting findings is that none of the groups believes dominant thinking is currently located in the **societal transformation space** that could lead to **delivering cities of places and services for people and planet**. On the contrary, there was consensus that, across policy areas, a significant gap exists between prevailing policy frameworks and the thinking and practice needed to transform cities and the built environment to support thriving lives within planetary boundaries. Participants raised the point that creating spaces to (re)imagine how the built environment in these **'cities of places and services for people and the planet'** would look is an important step towards further advancing discussions on the necessary shifts in policy thinking and practice across the policy areas (see more on this in section 4 and 5).

Different groups identified concrete actions and policies that would gain attention if policy was aligned with the societal transformation solution space. A key objective of the proposed initiative (see section 5) is to work with cities, using qualitative and quantitative systems mapping to further advance thinking and practice in this direction, helping to identify transformative policies, actions and investments (see section 5).

Another key finding from the workshop is that shifting the policy mindset toward a **Societal Transformation Solution Space** would better equip cities to achieve existing goals, such as those in the Paris Agreement, UN Convention on Biodiversity, and Sustainable Development Goals (SDGs) (at global level), EU Green Deal (EU level) , Nationally Determined Contributions, social climate plans goals (national level) and net-zero missions (local level) among others . Additionally, some groups noted that goals aligned with regenerative thinking (currently absent) could also be achieved with this shift in policy thinking and practice

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| Policy area | Goals and guiding principles in dominant thinking and practice | Goals and guiding principles in the *Societal Transformation Solution Space* | Example of policies/actions, new instruments (or improvements) that would receive attention with new framing |
|---|---|---|---|
| **Urban Energy**[4] | ▪ Overriding focus on affordability and energy security<br>▪ Dominance of private sector and profitability<br>▪ Attention at single building level and no neighbourhood perspective<br>▪ Action focused on regulation of individual consumption | ▪ Energy doughnut: energy poverty, affordability, health, security, resilience, while staying within planetary boundaries (including material perspective) | ▪ Exploring energy sharing<br>▪ Identify cross-cutting actions: e.g. minimise night-time lighting (also helps biodiversity)<br>▪ Ground for creating material consumption targets<br>▪ Shifting to multi-benefit and wellbeing analysis<br>▪ Improved building design standards<br>▪ Exploring energy clouds |
| **Urban development** | ▪ Cities as machines for producing money and attracting investment<br>▪ Making cities available for those who invest<br>▪ Heavy focus on technofixes<br>▪ Profit and (short-term) returns led<br>▪ Disconnected from public participation<br>▪ Sectoral and siloed approaches | ▪ Sense of stewardship of shared resources and of ownership of public goods<br>▪ Ecological base, ecosystems and metabolism of cities<br>▪ Democracy, fairness and wellbeing<br>▪ City as co-owned place<br>▪ Regeneration of nature as part of citizenship<br>▪ Making cities available for everyone and nature having a key role<br>▪ Eco-socio approach to make the city | ▪ Pushing market actors towards investment in public goods<br>▪ Circular public procurement open to actors that demonstrate understanding the public good<br>▪ Prioritise co-owned spaces and regeneration<br>▪ Explore models that allow citizen led urban planning decisions<br>▪ Explore business models with participation of organisations<br>▪ Strong support to cultural activities<br>▪ Move from consultation to participation requirements<br>▪ New principles for planning |
| **Buildings** | ▪ Focus on individual buildings<br>▪ Goals are output based: e.g. $CO_2/m^2$<br>▪ Buildings seen as financial assets<br>▪ Focus is on ownership and profit<br>▪ Land-use treated as fixed<br>▪ Bias towards decarbonising new buildings rather than existing stocks<br>▪ Bias towards consumer rather than collective responsibility | ▪ Focus on communities<br>▪ Building as providers of housing services and connected social infrastructure<br>▪ Principle of avoiding building new and in new land<br>▪ Regenerative thinking<br>▪ Value to the intangible and not only the materials<br>▪ Health, wellbeing, basic needs<br>▪ Concept of use and creation rather than construction<br>▪ Affordability rather than cost<br>▪ Value created and not only efficiency<br>▪ Not about construction but use | ▪ Sufficiency: repairing and reusing buildings<br>▪ Explore alternative business models<br>▪ Establish carbon budgets for the built environment as well as city carbon budgets<br>▪ Establish Science Based Targets<br>▪ Financial instruments lined to a new taxonomy for the built environment (SDGs- based for instance) and improved Sustainability Reporting Standards<br>▪ Improved Energy Performance for Building Directive |
| **Mobility** | ▪ Mid 20th century vision: car is innovation and progress is technological specialisation<br>▪ Affordable transport: allowing cheap polluting cars in cities<br>▪ Optimisation and fixing problems 1 by 1<br>▪ Key assumptions: more space for cars will solve the problem; technology will solve each problem created separately<br>▪ Reaching transport efficiency<br>▪ Monocentric cities<br>▪ Focus on mobility and transport with no link to public spaces and broader infrastructure<br>▪ Model that strengthens dominant companies in the existent ecosystem and which stop change<br>▪ Citizens have the right to drive | ▪ Focus on connections between mobility, urban fabrics and ways of living<br>▪ Mobility infrastructure follows citizen´s right to liveability and life-quality<br>▪ People and nature rather than people above nature<br>▪ From mobility ownership to usership | ▪ Emphasis on generating variety of choices and appealing narratives<br>▪ Shift to collective thinking and collective design<br>▪ Incentive structures push for using better alternatives<br>▪ Improved EU directives<br>▪ Improved infrastructure and planning codes<br>▪ Instauration of participatory planning and shared governance arrangements<br>▪ Local level climate budgeting |

**Table 2. Key insights from the workshop using the solution space framework**

[4] In discussions about urban energy, the group identified themes that aligned with all solution spaces. They pointed out that many cities still operate under a model where they do not benefit financially from energy production, as the market is dominated by large producers who focus only on maintaining the current system. The main focus is on reducing grid congestion without addressing wider issues nor rethinking models, and this often favours the incumbent. Some cities have started to adopt self-production of electricity, but this approach still falls within the narrow framework of optimising certain "sustainable" parts of an otherwise unsustainable city model. This way of organising things can result in better optimising energy use (e.g. through time), and enable a different equilibrium between distinct types of actors in the market. However, participants considered it does not necessarily lead to rethinking models (e.g. energy sharing). The shift towards innovative solutions was, in their view, further limited by an overemphasis on solar and wind energy, that has been part of the path towards new emerging paradigms but which fails to explore alternative spatial models like district heating.

## 2.3 Systems thinking as a catalyser for change

Triggering deep, wide-scale societal transformation in urban areas to ensure they deliver prosperity within planetary boundaries requires navigating a highly complex system. Systems thinking offers a distinct advantage in addressing this complexity, providing a way of thinking and concrete tools to guide the transition toward the solution space illustrated in the top-right corner of Figure 1.

Systems thinking can be described as a holistic approach that embraces complexity by focusing on the structure and connections within a system, rather than simplifying problems by identifying a single, isolated cause (Systems Innovation, n,d,). It differs from traditional, analytical methods in three keyways:

- **Focus on the whole and interconnections:** Instead of analysing disconnected parts (roads, houses, green areas, etc.), systems thinking emphasises the relationships and interactions within the entire system.
- **Avoidance of reductionism:** Rather than breaking systems into hierarchical elements, it highlights how different components interact to make patterns emerge, such as rising emissions, biodiversity loss, or shifts in mobility and food choices.
- **Feedback loops:** Systems thinking moves beyond direct, linear causes, seeking out the non-linear relations and feedback loops that define complex systems (SI, n.d.). These loops often explain the unintended consequences that arise from interventions designed using traditional approaches.

All these characteristics make systems thinking an approach that can support policymakers in revisiting and identifying transformative solutions. It holds the potential not only to generate innovative policies but also to reshape the policymaking process itself. This allows for a more comprehensive and shared understanding of complex issues, enabling the development of a unified vision. In turn, this helps ensure that new solutions are more accepted by society, while also gaining the necessary buy-in from key stakeholders for implementation. Systems thinking clarifies the relations between systems components for involved actors. It also encourages policymakers to change "the nature and quality of their thought processes regarding complex situations, widen their mental boundaries, and consider issues interconnectedly and holistically" (Nguyen, L.-K.-N., Kumar, C., Jiang, B., & Zimmermann, N., 2023).

Experts and practitioners who responded to the questionnaire emphasised the significant advantages of systems thinking, with many stating that it is the only approach capable of addressing the complexity of the built environment and its transformation. Key benefits mentioned include breaking down silos, focusing on connections, accessing more leverage points, and preventing unintended consequences and contradictory actions. Respondents also highlighted how systems thinking enhances stakeholder engagement, co-creation, and a sense of ownership by fostering a more participatory, interconnected, and cross-sector approach through its rigorous thinking process. There was also mention of the enhanced capacity to address the core, underlying causes of the problems. Additionally, respondents noted that systems thinking enables a deeper understanding of the root causes of problems. They stressed the importance of embedding this approach in the co-creation process with all relevant actors—such as residents, people in poverty, policymakers, builders, and housing companies—arguing that this has a greater impact than a purely technocratic, expert-driven method.

However, they also cautioned against using systems thinking merely because it is currently popular. It should be applied rigorously, using specific tools that facilitate its proper implementation. Box 1 outlines some of these tools, which are also applied in several cases presented in Section 3.

We argue in line with the above that the Cities LOOP initiative created will aim at utilising systems thinking to improve the type of decisions but also with the aim of helping transform policy process and engagement between key stakeholders.

### System thinking tools

System Mapping, Causal Loop Diagrams, Stock and Flow Analysis, Meadows' Leverage Points Framework, The Iceberg Model, System Dynamics Modelling

Systems thinking employs a range of tools to analyse complex, interrelated policy issues. Among the most used are systems mapping, causal loop diagrams (CLDs), stock and flow analysis and system dynamic modelling. These tools help policymakers and stakeholders understand the dynamic interactions within systems, identify leverage points, and design more effective interventions (Meadows, 2008; Stroh, 2015).

- **Systems Mapping** visually represents the key components of a system and how they interact, making it easier to grasp the relationships and feedback loops that influence system behaviour. It enables a holistic view of challenges by revealing connections between policy areas that might otherwise be treated in isolation (Stroh, 2015).
- **Participatory Systems Mapping** engages a wider range of stakeholders—such as local communities, businesses, and policymakers—in the mapping process. This collaborative approach captures diverse perspectives and increases the likelihood of identifying hidden dynamics, ensuring that proposed solutions are inclusive and comprehensive (Kim, 1999).
- **Causal Loop Diagrams (CLDs)** are a specific type of systems map that focuses on identifying feedback loops, which can either reinforce (positive feedback) or balance (negative feedback) changes within a system. A positive feedback loop increases the effect of change and amplifies the system. For instance, a reinforcing or positive loop in urban development could show how increasing property values drive investment, further escalating prices. A balancing, or negative feedback loop reduces the effect of change and helps maintain balance. For example, it could demonstrate how policy measures such as affordable housing schemes can counteract this trend (Kim, 1999).
- **Stock and Flow Analysis** examines the state of stocks (e.g., population, resources) and the rates of inflows and outflows that change these stocks. It helps identify how policies can influence these flows and stocks, revealing potential long-term impacts and transformative potential. Stock and flow models help policymakers understand accumulations, delays, and tipping points within systems (OECD, 2022).
- **Meadows' Leverage Points Framework** identifies where to intervene in a system for the most transformative impact. This tool focuses on high-leverage interventions—points in a system where small changes can lead to significant shifts in outcomes. The framework develops 12 categories of leverage points and helps policymakers and system designers evaluate where their efforts might produce the most significant and lasting effects (Meadows, 2008).
- **The Iceberg Model** is an analogy that emphasises how surface-level problems (e.g., traffic congestion) are often symptoms of deeper systemic issues (e.g., car-dependent infrastructure, land-use policies, engrained mental models in the policy sphere as well as in society). Addressing these deeper layers can lead to more sustainable and effective policy outcomes (OECD, 2022).
- **System Dynamics Modelling** is an approach that allows understanding of nonlinear behaviour of systems over time, using stocks, flows, internal feedback loops, and time delays. System dynamic models can show how different policies are likely to affect human wellbeing, societies, and ecosystems in both the short and long term. They examine quantitative and causal interactions between environmental variables and socio-economic variables, such as investments, energy use, taxes, savings, education, inequality, and social trust. These models help answer questions like: What happens if a country adopts policies to redistribute health more fairly? What happens if energy efficiency or circular economy policies are implemented locally? For more information and examples, see Earth4All (2022).

# 3. Case studies: triggering change by embracing a systemic perspective

While practical application of systems thinking in policymaking is evolving and is not yet widespread, there are several examples that highlight its transformative potential in shaping policy decisions. These examples, many of which are being developed across the UK and Europe, demonstrate how systems thinking can provide deeper insights into complex, interconnected issues that traditional policy approaches often struggle to address, all while helping shift priorities toward more holistic and sustainable solutions (Nguyen et al., 2023).

The set of cases presented touch on different areas of the built environment, illustrating the increased capacity different tools used can bring for focusing and understanding the interconnections within and beyond the built environment.  Many of the featured examples make use of diverse systems thinking tools, such as causal-loop diagrams and systems mapping to visualize complex relationships and address root causes that have locked in cities into unsustainable pathways. A significant aspect of these examples is also the emphasis on identifying unintended consequences, ensuring that future policies are designed with a broader understanding of their potential impacts in the wider system. In line with discussions in section 2, the cases also illustrate that applying a systemic view does not mean that every aspect and connection in the system needs to be addressed. The different examples set boundaries on the challenges or sub-systems addressed. Nonetheless the way of addressing these various issues and sub-systems is consistent with the mind-set shift described in section 2 and the key characteristics or aspects of systems thinking listed there.

Several examples presented show the potential of systems thinking to enable deep and scalable transformations that goes beyond changing the physical structures, placing also particular focus on how to fundamentally transform the process of policymaking. Several cases presented combine the use of systems thinking tools, including system modelling, combined with participatory approaches and stakeholder engagement. Examples show how this can help to broaden perspectives, redefine how challenges are perceived, and, consequently, reshape the ways in which they are addressed. By engaging diverse stakeholders, encouraging collaboration, and promoting a culture of inquiry and reflection, systems thinking enables policymakers and stakeholders to approach challenges with a broader and more integrated perspective, helping to build shared understanding and visions. This shift in mindset helps redefine problems, consider the broader implications of decisions, and develop more holistic and sustainable shared solutions. Ultimately, these examples demonstrate that systems thinking is about transforming how we approach complex issues—shifting from isolated, reactive measures to integrated, proactive strategies.

## 3.1 Leveraging systems thinking to rethink the UK's buildings and heat strategy for net zero

A successful application of systems thinking tools, particularly Participatory Systems Mapping (PSM) and causal loop diagrams, was seen in the UK government's approach to developing a Net Zero Systems Tool (NZST). The Net Zero Systems Team at the Department for Energy Security & Net Zero (DESNZ) developed the NZST to map out the interdependencies within complex systems of land use, buildings, energy, industry and transport. In this case, the goal was to explore the interconnections within the complex net zero system, which includes interdependencies. Traditional policy approaches often focus on isolated components, but the use of PSM enabled the team to visualize how changes in one area, such as energy-efficient building retrofits, could have ripple effects throughout the broader system (BEIS, 2021).

The objective of the tool was to uncover how interventions (such as energy-efficient building retrofits) could lead to broader systemic impacts, such as the rebound effect, where initial energy savings could result in increased energy use in other areas (Carbon Brief, 2021; BEIS, 2021). The process involved several workshops where government officials and academics collaboratively developed the tool. These workshops allowed participants to map out critical variables and explore how different elements within the buildings and heat systems interact. The result was a proof-of-concept tool that policy officials can now use to simulate different scenarios and better understand the wider impacts of their decisions. This tool helps policy teams not only visualize current system behaviours but also project potential future outcomes, making it an invaluable asset in the decision-making process.

One of the key benefits of the approach was its ability to facilitate systemic discussions across different policy areas. By engaging diverse stakeholders, the system maps developed were more reflective of the true complexity of the net zero system, ensuring that different perspectives were integrated into the final tool. As a result, the NZST has potential applications beyond its initial scope, such as feeding into delivery reporting, evaluation processes, and even theories of change for policy interventions. (Department for Business, Energy & Industrial Strategy [BEIS], 2021).

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## 3.2 Balancing increasing public access to natural spaces with preserving and enhancing biodiversity

Urban policymakers are increasingly confronted with the challenge of balancing greater public access to natural spaces while promoting biodiversity. Traditional policy approaches tend to address these issues in isolation, focusing on either the usage of green spaces for public health or biodiversity conservation. However, such approaches often fail to consider the complex interactions and feedback loops between human activities and the environment, leading to unintended consequences such as habitat degradation or reduced biodiversity.

For example, in the study Interrelationships and Trade-Offs between Urban Natural Space Use and Biodiversity (Prioreschi et al., 2024), Causal Loop Diagrams (CLDs) were used to reveal feedback loops between human activity and environmental outcomes. The study focused on the Thamesmead regeneration project, providing actionable insights into urban green space design and management. The Thamesmead regeneration project, led by the social housing association Peabody, aimed to improve both the usage and biodiversity of natural spaces in Thamesmead, London, by implementing new design and maintenance techniques that promote green and blue infrastructure. The project also focused on developing various types of buildings, particularly residential and social housing, while ensuring that these constructions were integrated with the enhanced natural environment.

The Thamesmead case study underscores the importance of participatory systems mapping, where stakeholders—including residents, policymakers, and environmental experts—collaborate to identify these trade-offs. This approach ensures that policies are designed with a deeper understanding of their potential long-term impacts, identifying hidden feedback loops and trade-offs.

Using Causal Loop Diagrams, the researchers uncovered several feedback loops that revealed complex interdependencies between factors such as vegetation density, perceived safety and biodiversity. The study found that while denser vegetation could increase biodiversity, it also decreased the perceived safety of the space, leading to fewer visitors.

Additionally, the study showed that off-trail trampling was a significant cause of habitat degradation. Visitors stepping off designated paths damaged vegetation, which reduced the overall biodiversity. This feedback loop created a cycle of degradation: the more people trampled off-trail, the lower the vegetation density became, which, in turn, made off-trail walking easier for others, perpetuating the damage.

The study highlighted that without taking a systemic lens, urban planners might miss the root cause of this degradation, opting for general maintenance strategies like increased mowing or weeding, which would fail to address the larger issue of off-trail trampling. Also, traditional policies might focus on increasing visitor numbers by making spaces more open and "manicured," thereby sacrificing biodiversity. Bringing systems thinking allowed for rethinking solutions to strike a better balance between wellbeing benefits of natural space use with ecological preservation.

### Outcomes

The application of systems thinking in this case led to several recommendations that might not have been considered otherwise:

1. **Incorporating "Orderly Frames":** One way to balance biodiversity with perceived safety was to create "orderly frames"—design features like well-maintained edges along trails and signage that inform visitors that the "messy" areas are intentional for biodiversity conservation. These cues increase visitors' sense of safety and reduce their impulse to venture off-trail.
2. **Modifying Maintenance Techniques:** Instead of intensifying traditional maintenance strategies, the systems approach revealed that reducing the frequency of mowing and encouraging denser vegetation could protect biodiversity while improving the space's restorative qualities for visitors. Planting dense, trail-side vegetation would also create a natural barrier that discourages off-trail trampling.
3. **Biodiversity Education:** By increasing visitors' understanding of the importance of biodiversity, urban planners can foster greater public support for "wild" spaces. This education encourages more environmentally friendly behaviours, such as staying on trails and supporting local conservation efforts.

## 3.3 Superblocks, an ecosystemic approach to uban planning: the case of application in Barcelona

Many cities have made progress in developing urban plans based on environmental sustainability criteria. However, publications and experts' opinions indicate that traditional mental frameworks still dominate, lacking a systemic vision in addressing urban challenges. In some cases, a systems approach in urban planning integrates environmental, social and economic dimensions. As discussed in section 2, cities can also be viewed as ecosystems. An urban ecosystem examines the ecological relationships within an urban area, where natural and human-made elements interact. This includes features such as parks, green roofs, urban forests, rivers, wildlife, and the metabolic flows of energy, water and materials, as well as issues like pollution and air quality. Urban ecosystems emphasise balancing nature with the built environment, promoting sustainability, biodiversity, and the health of urban habitats.

This ecological approach has been explored and tested through the urban model based on superblocks. The theoretical model follows to the principles of ecosystemic planning (BCNEcologia, 2020) and establishes holistic criteria for urban design and planning, with living systems as the central focus. It envisions a future where urban ecosystems are balanced and healthy, addressing key aspects such as a) morphology (spatial function), b) complexity (economy and biodiversity), c) metabolic efficiency (energy, water and materials) and d) social cohesion (inclusiveness).

The strength of this model as a planning tool lies in its coherent integration of parameters and design criteria from various sectors, including mobility, urban design and public spaces, biodiversity and green space networks, housing and facilities, waste management and energy transition.

### Superblock's model

A superblock is a minimal spatial unit of an urban ecosystem, typically covering around 16 hectares, that allows organising the built environment through a systems approach. By grouping multiple blocks, it gathers a critical mass of people and activities, allowing for the establishment of integrated planning parameters for buildings, streets and facilities, creating a cohesive urban unit based on proximity (Rueda et al. 2010). The aim of the model is to achieve the maximum complexity of the ecosystem with the minimum use of energy and resources. The focus on living systems relies on ensuring the conditions required for liveability and healthy urban ecosystem such as: quality of air, acoustic levels and thermal comfort, but also peoples' accessibility and proximity to public services, access to affordable housing, and contact with nature by ensuring connectivity among green spaces. The first leverage point of superblocks model is public space regeneration by changing the hierarchy of roads adapting mobility networks, and urban greening structure by increasing green areas, trees, and permeable pavements. To this end, the superblock establishes a new code for urban design to set-up an alternative functional logic that enables to reorganise spatial planning in a systemic pattern. The superblock units allow to set-up metabolic efficiency strategies such as green communities linking energy transition, circular economy and digital transition.

The aspects that distinguish the application of systems thinking in the design and implementation method of the superblock model are the following:

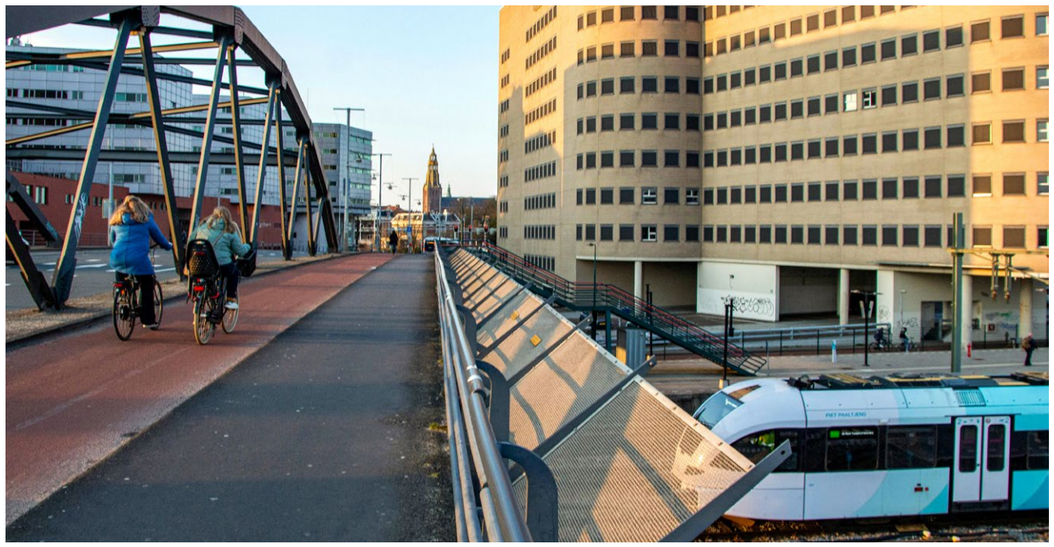

Photo by Denis Jans on unsplash.com

**Transformative mindset:** the model turns things around and redefines a new logic of design and urban planning based on a new road hierarchy and the adaptation of services per unit of superblock. This makes it possible to establish rules of the game for different sectors that coexist in the planning of cities.

**System integration:** the model proposes a comprehensive model for planning the city understood as an ecosystem, where mobility is one of the components. The superblock is conceived as the minimum unit of this ecosystem from which networks and functions are ordered.

**Leverage:** the superblock becomes an instrument that allows us to address interrelationships from transformative purposes, the superblock becomes an instrument that allows us to address interrelationships while having a transformative purpose. Therefore the  relevance of the different parts is established based on the interdependence with the rest of the elements, and the role they play in helping the system achieve people's wellbeing and nature's health.

The model completely flips the logic of mobility planning from being a goal in itself (as in the sustainable mobility paradigm) to being part of a new model that sets a cross-cutting and higher priority to allocate and design urban space as a key leverage point to reorganise the system and achieve in this way increased social (e.g. proximity, physical activity, air quality, reduced noise, etc. ) and environmental (e.g. green areas) outcomes. Embedded in an ecosystem urban approach, the model enables the integration of several components of the built environment with a common transformative objective focused on the needs of communities and the natural ecosystem.

### Outcomes

The Superblock model has been implemented in various cities across Europe and Latin America, with Barcelona as one of the most notable cases. Its phased application began in 2005 and has evolved over 18 years, adapting to shifting economic, social, and political contexts—factors that have also shaped public perception and acceptance. A major policy milestone came in 2013, when the model was integrated into Barcelona's Sustainable Urban Mobility Plan.

Prospective scenarios on the benefits at city-wide implementation of superblocks are promising. If fully adopted across Barcelona (503 Superblocks in total), the model could reduce GHG emissions by 45% by 2030 (compared to 2005 levels) (Barcelona Energy Agency & BCNecologia). Additionally, pedestrian space would increase from 16% to 67%, and 667 premature deaths—valued at EUR 1.6 billion—could be prevented annually due to improved physical activity, green spaces, and reductions in heat, noise, and air pollution (Mueller et al., 2020).

Despite its benefits, the model faces challenges, particularly in its implementation process. Effective participation and communication—both across government departments and with citizens—are essential to securing broad support. Furthermore, Barcelona's growing economic appeal and the pressures of mass tourism, compounded by the financial crises of 2009 and 2020, have influenced decision-making and city-wide adoption.

The key lesson from Barcelona's experience is that Superblocks exist at the intersection of an emerging paradigm and broader societal transformation. While resistance and misinformation persist, the model has helped shift mindsets around urban street design[5] and sparked deeper reflection on tackling systemic urban challenges to build a shared, sustainable future.

## 3.4 Applying a systems approach to energy refurbishment in the Metropolitan Region of Barcelona

Until now, the social focus of energy transition policies has been on mitigating energy poverty by focusing on the vulnerability of households in achieving adequate and comfortable temperatures during the winter and summer. The arrival of European Green Deal funds at the local level for the energy renovation of buildings has led to a new social focus on vulnerability and risk of social exclusion in the face of a hypothetical increase in the price of rented housing for low-income families. This is one challenge related to the energetic renovation that emerged in some municipalities at the Regional Metropolitan Region of Barcelona (RMB).

In Spain, 55% of the building stock predates 1980, and 21% is more than 50 years old (INE, 2021). Although energy renovation strategies address interventions to tackle energy poverty, the side-effect of energy transition policies on social impact is still underestimated. In the case of the RMB, 42% of the population lives in rented housing and the economic effort to pay rent for low-income families is more than 50% of salaries (Pla Sectorial d'Habitatge; 2021). Large-scale building renovation represents challenges especially in those neighbourhoods with a higher proportion of vulnerable and low-income populations. The potential risk of social exclusion of the vulnerable population due to energy refurbishment actions is a complex issue. On the one hand there is the need to accelerate the renovation wave for meeting the decarbonisation 2030 and 2050 targets, but on the other hand, there is a strong financial dependence on public funds to make housing affordable for the low-income population. The complexity requires a systemic approach with the collaboration of multiple actors involved in the housing sector, the public sector, construction companies, financial institutions and citizens.

During the first half of 2024, the Barcelona Metropolitan Strategic Plan together with the AuS group of the Architects' Association with the active participation of  and the Institut Metropoli (Observatori de l'Habitatge de Barcelona, n.d) launched an initiative to address this challenge under a systemic approach, within the framework of transformative innovation research encouraged by the smart specialisation strategy of the region of Catalonia RIS3CAT 2030 (see more in Box 2). The initiative is conceived as a process that will last until the end of 2025. The objective of the process is to cocreate actions by involving researchers and the university community to work on the generation of scientific evidence to advance the identification of preventive mechanisms of social exclusion or risk of gentrification, and financial instruments for fostering refurbishment). This initiative aims to be linked as well with other RIS3CAT initiatives e.g. initiatives related to bioconstruction industry in Catalonia, or initiatives tackling urban mental health as part of community health challenges. The RIS3CAT strategy develops system maps to analyse the causes and effects of the current system dynamics. Two system maps are currently under development with the aim of identifying challenges involving housing. The entry point and focus are on community health or territorial revitalisation.

## The RIS3CAT 2030 in Catalonia

The RIS3CAT 2030 smart specialisation strategy addresses transformations on seven socio-technical systems: food, energy and resources, mobility, health, education, industry and culture. The strategy is implemented through transformative innovation initiatives and shared agendas (Government of Catalonia, 2023) focused on place-based challenges identified by entities and institutions on the ground. The overall aim of the RIS3CAT strategy is to achieve a greener, more resilient, digital and fair socio-economic model in Catalonia. Different transformative innovation initiatives are meant to become part of a system of initiatives, that can allow all together to accelerate progress towards the desired model for the region.

A common characteristic of this system of initiatives is that they respond to complex problems detected by the actors in the territory. In the case of the socially inclusive energy efficiency renovation initiative, it addresses the potential risk of social exclusion generated by energy transition policies, a complex problem identified by some municipalities in the metropolitan region of Barcelona. The shared vision for the future is focused on ensuring affordable and environmentally fair access to housing. A systemic approach is present when setting up the ecosystem of actors involved in each one of the transformative innovation initiatives and shared agendas, seeking synergies between multiple actors from business, public administration, research, civil society, and citizens, with the aim of ensuring that the process counts with a multiple perspective. In the co-creation sessions and innovation camps, the challenges are worked on considering a systemic vision of the problem, which helps to understand contrasting positions. This is not what happens normally in the development of projects.

The methodology followed by the RIS3CAT strategy is a challenge placed-based approach oriented to transformative policy innovation (Government of Catalonia, 2024). The aim of the strategy is to evolve innovation from a siloed perspective which follows competitiveness and technological approaches, into a systemic vision that puts people, communities and nature wellbeing at the centre. To this end, the strategy works identifying key challenges based on existing cases and needs at territory and encourages the cocreation process among the stakeholders involved through systemic and transformative innovation lens.

The methodology applied takes as main references the theoretical framework of multi-level perspective of the socio-technical transition framework (Transformation Innovation Policy Consortium, n.d) applied to policy innovation (Geels & Schot, 2007), exploring the forces that create resistance to change in terms of mental models and behavioural patterns through five dimensions: 1) science and technology; 2) policies and governance; 3) financing and investment; 4) markets; and 5) society and cultural frames. A theory of change is defined for the initiative gathering contributions from the ecosystem of key stakeholders through interviews, meetings and innovation camps (Government of Catalonia, 2024). Within this theoretical framework, three points of leverage are identified in which the public policies to accelerate systemic transformations: a) promotion of spaces for experimentation (niches) that develop alternatives that contribute to the desired changes; b) connection, integration, alignment and expansion of experimentation spaces to achieve critical mass necessary for systemic changes and for these changes to be become dominant; c) action on the rules, norms and practices of the regime that hinder the changes in the desired directions (changes in incentives, regulations, narratives, etc.) (Fernandez & Romagosa, 2020).



### Outcomes

The initiative focused on energy efficient and socially fair housing refurbishment and has carried out first steps gathering key stakeholders including some municipalities within the region that are interested in the challenge. The first innovation camp focused on three-stage dynamic through working groups. The first stage focused on framing the problem, driving the discussion to understand the causes and effects of the problem at this moment and identify which are the potential collaborative actions for the stakeholders. The second stage, focused on prioritising the actions, according to their impact in terms of effectiveness and viability. Some of the most relevant included encouraging talent and entrepreneurship training, exploring citizen science and co-creation spaces, communication to users, technical support to communities of owners, and innovative financing schemes. The first innovation camp brought together actors from different backgrounds who are involved in the issue from different fields, even with opposing positions, such as researchers and state businesses. This made it possible to diversify perspectives and to go deeper into the causes and effects of the problem in a more objective way, which is essential so that the facilitation of the process is inclusive and at the same time always oriented towards focusing on the challenge posed. Some of the highlights from the first session were associated with the renovation culture in older multi-family buildings, the complexity of dealing with the socio-economic composition of the tenants and the financial capacity of the owners.

A second session focused on three challenges identified in Session 1. Its goal was to define key actions for each topic. Working groups were formed with entities committed to further exploration and collaboration on demonstration cases. The planned actions include: 1) identifying healthier, low-emission materials for sustainable energy renovation, 2) developing models to support citizens in the renovation process, and 3) exploring financing models and social impact assessments for energy renovation.

In the coming months the initiative will work on the definition of demonstrators where the collaboration of researchers and research centres will be sought. During this first quarter of the year, the demonstration cases to be analysed within the framework of the initiative have been identified.  The aim is to address the complexity of affordable and inclusive housing and liveability conditions both in buildings and at neighbourhood level with the involvement of municipalities and universities.

## 3.5 Understanding unintended consequences and limitations of technological change: the case of the UK's electric vehicle policy

Systems thinking tools like Participatory Systems Mapping (PSM) can be essential in helping policymakers reveal the complexities within a policy environment and understand unintended consequences of policies that are not immediately obvious through traditional, linear approaches. These tools allow for a more comprehensive understanding of how different components within a system interact, how feedback loops are formed and persist over time, and how unintended consequences may emerge from policy decisions.

For instance, in the UK, the government introduced policies to accelerate the adoption of electric vehicles as part of its broader climate goals. This included ending the sale of new petrol and diesel cars by 2030 and requiring all new vehicles to have zero tailpipe emissions by 2035. These measures were supported by financial incentives for electric vehicle buyers as well as the expansion of a charging network to facilitate widespread electric vehicle usage. Participatory Systems Mapping was used to evaluate wider impacts of the policy and uncover potential hidden dynamics. This approach included: a) mapping the components and their interactions within a system; b) engaging a diverse group of participants to incorporate multiple perspectives; and c) examining feedback loops and interactions to assess system behaviour (Penn et al., 2022).

The evaluation of the UK's electric vehicle policy through PSM involved several key steps:

- **Setting Objectives for the assessment:** The primary goal was to assess the environmental, social, and economic impacts of the electric vehicle policy.
- **Stakeholder Workshops:** A diverse group of stakeholders, including government officials, transport policy experts, environmental advocates and community representatives participated in workshops.
- **System Mapping:** Participants collaboratively identified and mapped the key elements of the transport system and their interrelations. This process involved iterative discussions to refine the maps and understand dynamic interactions.
- **Analysis:** The maps were analysed to uncover feedback loops and interactions within the system.

### Outcomes

The PSM evaluation revealed several crucial insights into the UK's electric vehicle policy. Firstly, it showed that the shift to electric vehicles could lead to increased vehicle mileage, which might counterbalance some of the environmental gains achieved through reduced tailpipe emissions. Additionally, the transition to electric vehicles could result in higher non-exhaust emissions, such as brake wear, potentially diminishing the policy's overall effectiveness in improving air quality.

The evaluation highlighted concerns about public health and equity, which were illustrated in the system maps created during the assessment. While electric vehicles lower tailpipe emissions, the maps indicated that their increased usage could lead to poorer air quality in urban areas due to non-exhaust emissions and heightened traffic congestion. Moreover, the emphasis on private vehicles in the policy was shown to disproportionately affect marginalised communities, especially in areas where public transport options are limited. This is because they often lack the financial resources to afford private cars, making them reliant on public transport. As investment in public transport declines due to the focus on promoting private vehicle use, these communities face reduced access to essential services and increased travel times, exacerbating existing inequalities. The maps also demonstrated that without substantial improvements to public transport infrastructure, the rise in private vehicle use could threaten the viability of public transport, resulting in decreased service levels and reduced accessibility for those most in need.

The insights gained from the PSM process indicated the need for a balanced approach that combines electric vehicle promotion with improvements in public transport and active travel infrastructure. The emphasis on collaboration and dialogue helped refine the policy by suggesting a more integrated strategy to avoid potential pitfalls and maximise benefits. Additionally, these insights are reflected in adjustments aimed at ensuring more equitable policies, including increased investment in public transport and active travel infrastructure, along with targeted support for vulnerable communities. The PSM process underscored the importance of considering equity in policy design: this focus on inclusivity has guided mechanisms for community engagement and regular equity assessments to gather feedback and ensure fair distribution of benefits from electric vehicle adoption. (Penn et al., 2022)

## 3.6 Applying systems thinking in redesigning Ireland's transport system

Ireland has set ambitious climate targets, including reducing greenhouse gas emissions from the transport sector by 50% by 2030 compared to 2018 levels. This commitment comes in response to the broader goal of achieving net zero carbon emissions by 2050. In 2021, after recognising an important gap to target, the Irish government engaged in a collaboration with the OECD to take a systemic approach to revisit the climate strategy for the transport sector.  The project was set out by the Irish Climate Change Advisory Council, with the aim of informing its recommendations. The project was set up following a three step process developed by the OECD:



**1) Envision** the goal(s) and the patterns of behaviours a properly functioning system fosters, and challenge ingrained mental models underlying poorly functioning systems; **2) Understand** why the current system is not achieving envisioned goals and patterns of behaviour, and determine whether implemented and planned policies have the potential to redesign the system; **3) Prioritise** and scale up the policies which can redesign systems to foster desirable patterns of behaviour (OECD, 2022). The project involved active engagement with stakeholders, including government departments, local authorities, academic institutions, and community representatives. Interviews, and site visits were conducted across different regions (Dublin, Cork, Sligo, and Kildare) to gather diverse perspectives and insights. A 1.5 days' workshop was organised in April 2022, bringing together a group of stakeholders from government, private sector and NGOs. The workshop opened as a space for participants to understand and discuss the analysis developed based on systems thinking and experiment themselves with using the tools in different exercises.

One of the key outputs was a methodology that applied four systems thinking tools to categorise policies from the Climate Action Plan, the Sustainable Mobility Policy, and other policy documents based on their transformative potential. The tools used included the iceberg model, Donella Meadows' 12-leverage point framework, stocks and flows concepts, and causal-loop diagrams (Box 1, Section 2). The assessment revealed that most policies focused on low to medium transformative potential (e.g., carbon pricing, road pricing, and brownfield development targets), and that some policies. (e.g. incentives for electric private cars) would need to be revisited as they increased lock-in into car-dependency.

A key recommendation from the final report was to reprioritise policies toward those with high transformative potential, such as: road space reallocation and redesign, communication strategies to shift car-centric mindsets, and mainstreaming shared and on-demand sustainable mobility services. The report also outlined tailored strategies to scale up these policies. It emphasised the need to revisit sectoral targets—including those related to electrification—to ensure they align with a broader vision for systemic change towards sustainable accessibility.

### Outcomes

The Irish Department of Transport, a key actor participating in the project, revisited earlier targets in the Climate Action Plan in alignment with the OECD recommendations. The earlier target to reduce internal combustion engine kilometres travelled by 10% by 2030 was replaced for a target to reduce 20% of total car travel (regardless of its type of engine) by the same year. As part of the national demand management strategy, for example, the Department of Transport has started defining sub-targets based on journey purpose to specify how the overall reduction of 20% vehicle kilometres should be achieved. An electric vehicle target - in terms of the total car fleet - was also set to complement an earlier target that solely looked at the share of electric vehicles in car sales and did not track the impact on the fleet. A target to increase walking, cycling and public transport to account for 50% of total journeys and a target for 70% of rural population to have buses that provide at least three trips to a nearby town were also included in the Climate Action Plan 2023. In addition, the three policies identified as having a high transformative potential were given centrality in the Climate Action Plan 2023 and 2024, and even further emphasised in the Sustainable Mobility Policy. A working group focused on the optimal use of space was also set out specifically in the context of the newly developed Demand Management Strategy. Moreover, several participating stakeholders have continued using systems thinking tools in other parts of the administration (NESC, Dublin City Council). As expressed by a Department of Transport government official, the project also contributed to changing the narrative for the sector, including changes in the coverage of media, as well as communication from government to the public (Swedish Government, 2022).

# 4. Barriers and potential for systemic change towards a societal transformation solution space

Despite the growing recognition of the need for integrated, holistic planning, various obstacles have slowed progress and kept policies trapped in an optimisation solution space (Figure 1 in section 2). This section explores some of the critical barriers that hinder the widespread adoption and operationalisation of a systems approach for cities and the built environment. Section 5 builds on this analysis, proposing concrete work to move policy and practice into the **Societal Transformation Solution Space** with the aim of delivering cities of places and services for people and planet.

The analysis presented in this section is based on different inputs and activities held during the scoping phase of this project. First, barriers were identified based on experts' responses to the structured questionnaire (Annex 1) and semi-structured interviews conducted, complemented with insights gathered from existing literature. These barriers were categorised into four different groups. Table 3 presents a summary of the barriers identified while Annex 3 expands on each of the barriers.

Second, these identified barriers were used to develop a systems mapping (Figure 2) that was an input for discussions during the workshop organised in October 2024. The objective of the mapping was to understand the connections between different barriers and how these lock-in policymaking for the built environment into mainstream linear and siloed approaches. Participants provided feedback on the mapping and assessed how the initial list of potential work areas (Annex 4), proposed by The Club of Rome and the Hot or Cool Institute, could help overcome barriers and accelerate the adoption of systems-based approaches. The discussions were used as inputs to develop the final proposal for the work that The Club of Rome and the Hot or Cool Institute have shaped as a way forward (see section 5). Sections 4.1 and 4.2 summarise the key findings from the mapping analysis and workshop discussions.

Photo by Edwin Muller Photography on shutterstock.com

| Main barrier | Sub-barrier | Description |
|---|---|---|
| **Lack of in-depth understanding of systems thinking** | Lack of awareness and limited understanding of systems thinking | Policymakers and stakeholders often use 'systems thinking' as a buzzword without a clear understanding of its core principles, risks diluting its true value and perpetuates traditional, linear problem-solving methods under the guise of innovation. |
| | Limited case studies documenting systems thinking's value and effectiveness | There is a shortage of case studies that demonstrate the real-world effectiveness of systems thinking in urban policy. |
| | Methodological gaps in selecting and using tools | There is limited guidance on the tools for systems thinking, complicating the decision-making process for policymakers. |
| | Lack of proper evaluation methods | The absence of evaluation frameworks makes it difficult to assess whether systems thinking approaches are effective. |
| | Limited local capacity | Local governments often lack the expertise, training, and resources to implement systems thinking effectively. |
| **Inertia within existing governance and institutional frameworks** | Misalignment between long-term sustainability goals and short-term priorities | Short-term political cycles drive decision-making, favouring immediate results over long-term, systemic solutions; Systemic interventions require significant upfront investment, which deters policymakers from adopting them; Existing infrastructure creates resistance to change, making it difficult to implement new systems thinking approaches. |
| | Siloed governance structures with limited coordination between levels of government | Governance structures are often siloed, limiting cross-departmental collaboration and hindering the adoption of systems thinking needed to address complex issues like urban sustainability. Fragmented budgets and poor coordination between different levels of government further exacerbate this, leading to short-term, isolated policies rather than integrated, long-term solutions. |
| **Dominant policy Culture** | Limited culture of experimentation and exchange | Lack of opportunities for experimentation and exchange stifles innovation in systems thinking adoption. |
| | The prevailing policymaking culture favours traditional tools | Traditional tools like cost-benefit analysis dominate decision-making, focusing on short-term economic returns instead of systemic changes. |
| | Lack of financial resources | Resources are often directed toward traditional approaches rather than innovative, systems-based solutions. |
| | Bias towards infrastructure projects | The bias toward large-scale infrastructure projects is often favoured due to their visible, measurable outcomes within political cycles, offering a sense of immediate impact. This focus can divert attention and resources away from systemic changes like cross-sector coordination and governance reforms, which, while less visible, may provide more sustainable, long-term benefits. |
| | Bias toward technological solutions vs. systemic changes | Policymakers often prioritise technological solutions over systemic changes, focusing on quick fixes rather than addressing deeper organisational and governance reforms needed for sustainable urban development. This bias towards technology can result in neglecting critical cross-sectoral interventions like public participation, social equity, and land-use policy, which are essential for achieving long-term, integrated change. |
| **Wider systemic barriers beyond built environment** | Energy sector dependency | The reliance on fossil fuel infrastructure creates resistance to transitioning to more sustainable systems. |
| | Education and skills development | Professional education and training programs focus on narrow expertise, limiting exposure to systems thinking. |
| | Job market fragmentation | Fragmentation in the job market discourages collaboration and holistic approaches to urban development. |
| | Financial system | The reliance on short-term financial metrics in the public and private sectors hinders the adoption of systems-thinking approaches in urban development, as developers prioritise profit maximisation and cost-cutting, and lack financial incentives for sustainable, long-term solutions. |
| | Vested interests | Vested interests in maintaining the status quo resist changes that could threaten existing revenue streams or power structures. |

**Table 3. Summary of main barriers, sub-barriers and descriptions**

## 4.1 Developing a systems mapping to better understand barriers

Earlier sections of this report emphasised the importance of viewing the system as a whole and focusing on the connections between its parts, rather than isolating individual issues. This also applies to understanding the barriers to adopting systems thinking for the built environment. Barriers are interconnected, reinforcing siloed, linear decision-making by default. Addressing these interdependencies is key to shifting policies beyond merely optimising unsustainable systems and toward solutions that drive societal transformation.

A causal-loop diagram was developed from survey responses and interviews to illustrate the dynamics created by the interaction of barriers outlined in Table 3 and detailed in Annex 3. The objective was to facilitate workshop discussions aimed at analysing, revisiting, and refining initial ideas for the next stage of work.

Based on expert insights, the mapping traces relationships between key variables and their direction, allowing to understand how different barriers are linked and what can be priority entry points through which change can be chained to address the wide number of issues listed in the table. Figure 2 presents the resulting system, revealing seven reinforcing feedback loops that sustain dominant linear approaches and hinder the widespread adoption of systems thinking. This subsection presents initial findings from the mapping, while Section 4.2 offers a deeper analysis along with reflections on potential future work based on workshop discussions.

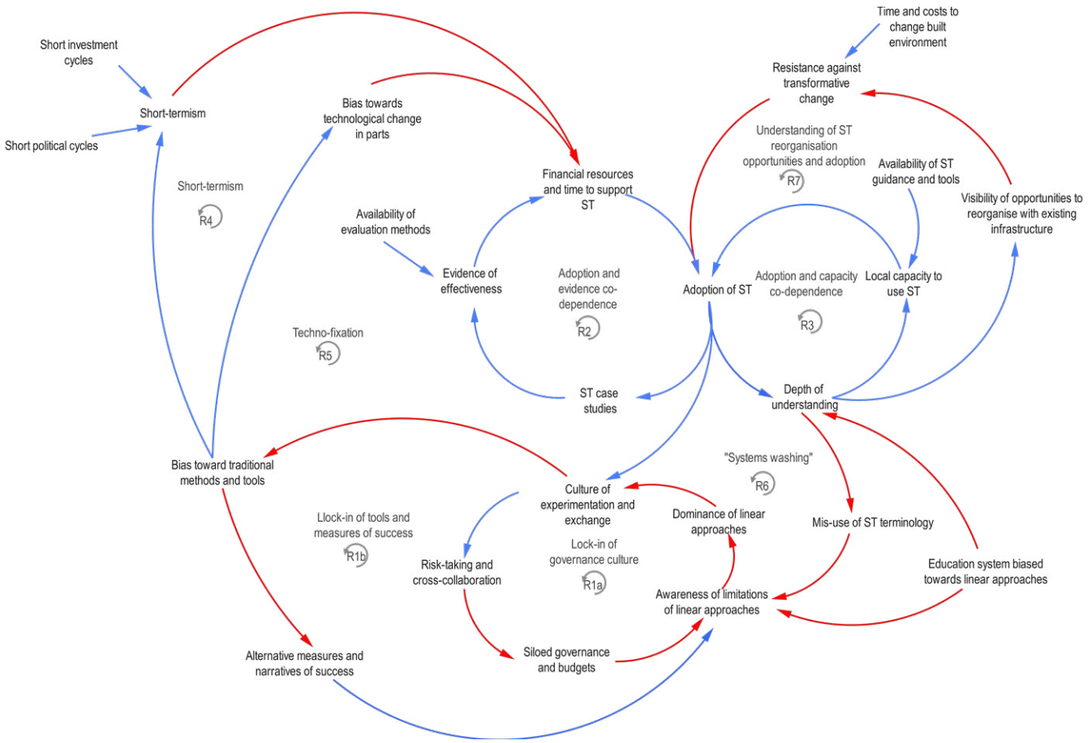


**Figure 2. Systems map of barriers**

Source: authors

The different reinforcing feedback loops are labelled as R1-R7 in the figure. They can be described as follows:

- **R1a and R1b** (bottom left) illustrate how governance culture, policy tools, and success measures become locked into dominant linear approaches. **R1a** shows how the dominance of linear thinking stifles experimentation and policy exchange, discouraging risk-taking and collaboration among decision-makers. This reinforces siloed governance structures and budgets, which, in turn, limit awareness of the shortcomings of linear approaches—preventing actors from recognising system-wide effects and cross-cutting issues, thereby perpetuating the cycle. **R1b** highlights how the lack of experimentation and policy exchange deepens reliance on traditional decision-making tools and methods, blocking the development of systemic measures and narratives for success. Conventional narratives and measures of success further obscure the limitations of linear thinking, reinforcing its dominance and preventing the shift to holistic approaches.

- **R2 and R3** (middle and right hand side) highlight the interdependence between the adoption of systems approaches and two key factors: the generation of evidence demonstrating their benefits (R2) and the development of local capacity to implement them (R3). **R2** illustrates how greater adoption of systemic approaches would generate case studies showcasing their effectiveness, building evidence that, in turn, would justify increased financial and institutional support for their development. Currently, however, this feedback loop operates in reverse—limited adoption prevents the accumulation of a critical mass of case studies, leaving insufficient evidence to attract funding and policy attention. As a result, systemic approaches remain underutilised. The development of better evaluation methods was identified as an external factor that could help strengthen this loop by improving the evidence base. **R3** demonstrates how adopting systems approaches would deepen decision-makers' understanding of systems thinking, fostering local capacity and further encouraging adoption. However, like R2, this loop is currently trapped in reverse: low adoption limits awareness and expertise, constraining the development of local capacity and reinforcing the status quo. The availability of practical guidance and tools was identified as a key external factor that could strengthen this loop by facilitating capacity-building and accelerating adoption.

- **R4 and R5** (upper left) shows how short-termism and techno-fixation can further inhibit the adoption of system thinking. **R4** reveals how short-termism impacts the financial resources and time allocated to develop and adopt systems-based approaches. **R5** highlights how techno-fixation narrows focus to technological changes in isolated parts, diverting attention—and resources—from systemic reorganisation. This limits the financial and temporal investment in systems-based approaches. Moreover, short investment and political cycles were identified as wider systems factors that reinforce short-termism, further obstructing the adoption of systems thinking in the built environment.

- **R6** (lower right) examines how the depth of understanding of systems thinking influences its misuse and, in turn, awareness of the limitations of siloed approaches—fuelling a "**systems washing**" effect. It links R3 with R1a and R1b, illustrating how a shallow grasp of systems thinking leads to its widespread misapplication in policymaking for the built environment, reinforcing mainstream practices rather than challenging them. Experts highlighted that the current education system plays a key role in this issue, as most curricula fail to put forward systems approaches. This gap further perpetuates the systems washing effect, limiting the adoption of genuine systemic change.

- **R7** (upper right) captures a final dynamic from interviews and questionnaire responses. Experts noted that, particularly in Europe—where much of the necessary urban infrastructure is already in place—the high costs of altering the built environment create resistance to transformative action. Systems thinking can help overcome this resistance by revealing opportunities to reorganise urban systems and subsystems via rethinking the use of existing infrastructure. However, as with other dynamics, the limited adoption and understanding of systems approaches mean these opportunities remain largely unseen, reinforcing resistance to change in the built environment.

Mapping these dynamics, rather than looking at barriers independently, provides a foundation for analysing how and what targeted efforts can help shift policy away from its current lock-in to dominant linear approaches (i.e. the dominant outcome in the system). It offers a way to explore how future work can be set up to alter the direction of reinforcing loops and restructure key dynamics, facilitating to identify priorities. The goal is to move from perpetuating linear approaches—the prevailing norm—to fostering the adoption of systems thinking, which remains an exception in the current decision-making landscape.

A first finding of the mapping is that the dynamics described create significant barriers to shift decision-making in the built environment because they impede reaching the **critical mass of systems thinking adoption** that would be needed to trigger fundamental changes in policymaking thinking and practice. If a critical mass of adoption is reached, many of the loops described would work in the opposite direction; turning from obstacles into drivers of systems thinking adoption by default while also helping shift away from other vicious dynamics represented in the diagram (e.g. system washing). Work that can "exogenously" accelerate the pace of system thinking adopters can thus help accelerate and propagate change by contributing to reaching this critical mass earlier.

The map identifies key leverage points for doing so. For instance, it highlights that **creating spaces for experimentation and exchange is crucial** as this is at the root of various dynamics that are preventing change. The dominance of linear approaches limits the culture of experimentation and exchange, reinforcing the lock-in of governance and decision-making tools (R1a and R1b). Simultaneously, this lack of experimentation exacerbates short-termism and techno-fixation. The creation of spaces for experimentation and exchange can raise awareness of the limitations of linear approaches by accelerating the development of alternative narratives and indicators for success, also promoting more integrated governance and budget structures. By challenging the bias toward conventional decision-making tools, these spaces can help reduce techno-fixation and short-termism, ultimately freeing up time and financial resources for systems-based approaches.

Another critical leverage point where multiple pathways converge is the allocation of **financial resources and time** to systemic approaches. Many of the identified feedback loops work against these investments to happen within administrations, creating in turn a bottleneck that prevents systems thinking from reaching the critical mass needed to shift resource allocation in its favour. New work could help break this vicious cycle by securing dedicated funding and enabling policymakers and key stakeholders to invest time in developing and adopting systems-based perspectives and strategies.

The map also highlights that new work must prioritise building **local capacity** and developing **concrete case studies**—both essential for transforming loops R2 and R3 from obstacles into drivers of systems thinking uptake. As discussed in the workshop (see section 4.2), compelling case studies can serve as tangible proof of systems thinking's effectiveness, helping to break self-reinforcing barriers and generate momentum for broader adoption. Strengthening capacity through **guidance, tools, and clear evaluation frameworks** will further amplify impact.

The proposed work in Section 5 builds on these and other insights that were generated by participants during the workshop, which explored in more detail the map produced and used it as a basis to provide feedback on initial ideas proposed as potential work to follow the scoping phase.



## 4.2 Key insights from the stakeholders' workshop

The mapping outlined above served as a catalyst for workshop discussions on how to mainstream systems thinking and steer policy decisions toward the societal transformation solution space. Participants used the systems mapping as a foundation to assess whether the proposed areas of work in the initial draft of this document (Annex 4) were well positioned to shift policymaking away from current practices and embed systems thinking more broadly. They also explored whether any additional areas of work were missing. These discussions took place in breakout groups.

Discussions underscored the need for funding to support local policymakers and key stakeholders in exploring systems thinking, its tools, and developing cross-cutting solutions for transforming the built environment. Participants identified **the next phase of work as an opportunity** to create a framework through which **dedicated funding** from diverse sources could be channelled toward this purpose, thereby contributing to shifting the system away from entrenched linear and siloed decision-making. Relevant funding sources discussed included philanthropy as well as existing EU funds.

A key challenge highlighted by the mapping—and strongly agreed upon by participants—was the lack of case studies demonstrating the value of a systemic approach in solving the complex challenges of the built environment across diverse contexts. This reinforced the importance of **working with specific city authorities** and key stakeholders, as proposed in the draft paper. As case studies showcasing systems thinking are developed and expanded, participants suggested that the initiative could **compile success stories**, focusing on key findings related to wellbeing outcomes. This would be an important step toward fostering a culture of experimentation and exchange, as illustrated in the mapping. Participants emphasised the importance of developing concrete projects where **policymakers can dedicate time to building capacity**, engaging with systems thinking, and demonstrating the value of prioritising staff time for this purpose. Moreover, there was strong support for **incorporating systems mapping into cities as a tool to redirect policies and actions**, as proposed in the initial draft of the paper (see Annex 4, item on identifying high leverage point/unusual suspects policies). Additionally, participants highlighted the value of using these tools to **facilitate a co-creation process**, allowing actors to arrive at their own solutions and conclusions.

In terms of new proposed work, participants identified the creation of shared visions and the reimagining of alternative futures as a significant gap in the proposed ideas. They emphasised that developing a collective vision of a sustainable future—especially one that **reimagines the built environment in a "city of places and services for people and the planet"—is essential to countering the dynamics of short political cycles and short-termism** captured by the mapping. City councils must play a central role in developing these shared visions, in collaboration with a diverse range of stakeholders, including grassroots organisations. Several participants also highlighted **the importance of citizen involvement**, particularly at the neighbourhood level, and the inclusion of immigrants in urban planning efforts. Discussions pointed out that such visions would provide a crucial foundation for systems mapping and modelling exercises. Participants agreed that while systems mapping and modelling can yield valuable insights, they must be grounded in clear wellbeing and sustainability goals to be relevant.

While there was consensus on the need to counter short-termism, it was noted that short-term investments are not inherently problematic. In fact, when channelled toward systemic transformation, even investments that yield short-term results can serve as a catalyst for broader change—especially if they help create momentum for longer-term impacts. As a result, it was agreed that future work with cities should focus on **identifying opportunities to generate and demonstrate short-term benefits, alongside the longer-term outcomes needed for systemic transformation**.

While there was support for the development of tools, as proposed in the initial paper, participants noted that a wide range of tools and toolkits are already being offered to cities. They emphasised that any tools developed in the next phase should be streamlined, targeted, and practical, providing resources that can

genuinely accelerate local capacity. A key objective for these tools should be to establish **clear criteria** and make it easy for cities to understand what it means to adopt a systems approach. This would help **counter the "systems washing" dynamic** and ensure that systems thinking is applied effectively. Participants also agreed that materials with an educational purpose, such as short videos, booklets, and courses, would be valuable in challenging the dominant approaches. These resources would help shift narratives of success, deepen understanding of systemic approaches, and contribute to moving away from the lock-in of traditional practices.

Finally, the workshop discussions provided insights into specific focus areas for the work. One of these was **institutional innovation**. Participants suggested that the work could explore innovation in incentives, budgeting, and the allocation of human and financial resources. It was proposed to identify successful examples of innovative institutional setups, such as Wales' Commission of Future Generations, and seek pilot cities with favourable conditions for innovation (e.g., Limerick, which recently appointed Ireland's first directly-elected mayor).

Another important topic was transformative finance. Participants emphasised the need to question the status quo and reassess current values, particularly in relation to investments driven by a shift in focus toward environmental and social returns. Additionally, participants highlighted the importance of shifting the cultural focus from mobility to place-making and urban planning. They proposed that the work could focus on building administrative capacity, working with cross-departmental teams, and creating new narratives around co-benefits. Emphasis should be placed on generating short-term wins that demonstrate the value of systems approaches, ultimately contributing to broader transformative change.

The discussions and inputs from participants helped refine and reshape how The Club of Rome and the Hot or Cool Institute can collaborate to integrate systems thinking into reshaping the built environment. The following section outlines the planned work, building on these insights. The aim is to accelerate action towards more resilient cities and healthy communities that can thrive within planetary boundaries.

# 5. Moving forward: the Cities LOOP initiative

This section introduces a new initiative, the Cities Living On One Planet (Cities LOOP), proposed by The Club of Rome and The Hot or Cool Institute as the next step to the scoping phase. This work aims to operationalise the framework outlined in Section 2, making systems thinking practical for cities and helping them to shift policy from sector-based optimisation to a holistic approach where policies and investments drive systemic transformation. The section outlines the Cities LOOP initiative's objectives, strategic goals, and key activities. Annex 4 details the preliminary focus areas which were presented in the draft version of this paper. These initial ideas laid the foundation for discussions with key stakeholders during the workshop, which allowed shaping the final initiative as described below. By launching this initiative, we aim to help transform urban policy, governance and planning through the integration of systems thinking; empowering cities to navigate complexity and enhance resilience.

## Objectives and strategic goals

The aim of our initiative is to support cities to explore and test a more innovative and adaptive approach to decision-making; building on systems thinking to reprioritise action, reshape the built environment, and open the door to more sustainable and equitable urban futures. Our work will help cities, in collaboration with citizens and key stakeholders, to challenge the status quo, reimagine what different futures could look like and drive necessary change; moving beyond siloed dominant practice while embedding policy decisions into constructive dialogue and co-creation.



By working with different cities our work aims to create new narratives of success. By equipping local decisionmakers with **practical tools, evidence, and cross-sector strategies**, our approach provides a practical way forward to take policy towards the societal transformation solution space described. By combining systems thinking with participatory and co-creation methods, the Cities LOOP initiative fosters innovative thinking and collaboration with the aim to bridge the growing disconnect between decision-makers and society; making bold and innovative policy implementation more socially and politically feasible and helping accelerate the transition to cities of places and services for both people and the planet.

This work aims to achieve four strategic goals, identified during the scoping phase and shaped by insights from experts and practitioners.

1. **Reframe urban narratives** by challenging entrenched assumptions and fostering a deeper understanding of: i) the built environment as a complex, interconnected system, encompassing physical structures across sectors, ecosystems, and social dynamics; ii) cities as urban systems that must be reorganised to provide places and services for people and planet; making low-carbon and nature-positive lifestyles affordable, appealing, and accessible and thus the norm.
2. **Demonstrate the value of collaborative systems thinking** in transforming cities by helping policymakers and key stakeholders (including citizens) from across cities to: i) uncover the root causes of unsustainable outcomes, ii) assess previous interventions and why they did not manage to achieve the needed change at the necessary scale; iii) identify leverage points for change, and iv) co-design actionable solutions that go beyond optimising unsustainable systems toward long-term, holistic and deep societal transformation.
3. **Enable and empower urban actors** to implement transformative change by: i) creating spaces to reimagine cities and the built environment and test innovative citizen and stakeholder engagement methods; ii) enhancing their capacity to apply systems thinking and its tools; and iii) exploring new institutional arrangements, governance models, and financial mechanisms needed to operationalise emerging narratives and solutions.
4. **Bridge divides, foster depolarisation and create new alliances**. By creating opportunities for open dialogue, visioning, and co-creation this initiative can bridge the growing disconnect between decision-makers and society. By integrating systems thinking tools—such as mapping and modelling—with participatory processes, cities can collaboratively navigate complexity, build consensus, and make transformative policies more feasible and acceptable. The pilot projects will demonstrate how inclusive engagement can depolarise urban discourse, bring diverse perspective together to explore innovative action, and accelerate the transition to cities that serve both people and the planet.

## Key stages and activities

To achieve these four strategic goals, we propose launching an initial work programme in collaboration with 2-3 pilot cities and a *Learning and Sharing Network* (10-15 cities). Pilots will serve as a testing ground to launch and pilot an innovative process that builds on qualitative and quantitative systems thinking tools in combination with innovative engagement methods. In this way offering a tangible and practical methodology to help cities shift policy towards the societal transformation solution space and drive transformation towards cities of places and services that can meet the needs of people and planet. The *Learning and Sharing Network* allows us to involve a wider set of actors (beyond those in pilot cities) into the process and reflect on the replicability in a variety of contexts.

The pilot design combines background research including desk research and interviews, as well as participatory activities, involving diverse groups of policymakers, stakeholders (local community groups and NGOs, academia, private sector, etc.) and citizens in a series of workshops including deliberative visioning and participatory systems mapping and modelling. Depending on the scope of different pilots, targeted trainings may also accompany the activities with the selected pilot city. To ensure scalability and broader impact, knowledge sharing, especially with the *Learning and Sharing Network* cities will be facilitated through webinars, working sessions, trainings, and cross-city learning exchanges.

Each pilot city, in partnership with its local stakeholders, will identify a specific challenge or issue that needs to be addressed systemically in order to achieve the overarching goal of creating cities where both people and the planet can thrive. A series of activities will be organised in each pilot along the following 4 steps , adapted to each city challenge:

1. **Envision and Reframe** (vision – setting): Develops a shared vision for an alternative low-carbon, sustainable and resilient future; and helps reframe the measures of success in alignment with the vision, combining expert knowledge and citizens perceptions on what a "quality" built environment would look like and how this would help address the selected challenge.

**Key Questions: What city do we need for tomorrow? What city do we want our children and grandchildren to live in?**

To establish a shared vision, deliberative visioning sessions will be conducted with key stakeholders, including policymakers and a diverse group of citizens. These sessions aim to create alternative urban future narratives rooted in an understanding of ecological limits as well as social imperatives. By fostering inclusivity and ensuring proper representation, the process will allow confronting and reconciling diverse perspectives and opinions; reflecting the aspirations and needs of diverse city populations. The co-created vision also allows creating trust among participants and provides the foundation for collaborative next steps. Based on the co-created vision, indicators of success to monitor progress towards the co-created vision will be developed.

2. **Understand and Question** (analysis): Facilitates questioning the status quo by creating shared and improved understanding of the current system and how it creates the mismatch between current and envisioned results. Also, of the way in which current policies, planning, design, and management of the built environment lock-in the system into unsustainable dynamics and hinder deep transformation. This step allows to understand the root-causes behind multiple interconnected challenges.

**Key Question: Where is the current system taking us? Why is our current system not taking us to the future we want?**

Through participatory system modelling workshops, policymakers, stakeholders and citizen representatives will develop a shared and comprehensive system understanding, using tools such as causal loop diagrams and stock-and-flow diagrams. The process leads to a common language and allows understanding how if different perspectives are combined, we can unveil the system structure that currently drives undesirable results. Through quantification of the system maps we can explore short and long-term trends of indicators identified in stage 1.

3. **Identify and Refocus** (strategic intervention): Supports identification of leverage points to shift away from vicious dynamics (identified in stage 2) and explores potential consequences for diverse groups. It helps to refocus policy and investment objectives towards systemic change; identifying intermediary indicators to monitor necessary changes in the built environment (complementing outcome focused indicators in stage 1).

**Key Question: Where do we need to intervene to transform the built environment? What changes could we expect in the short and long term?**



Building on the insights from the systems mapping and modelling, leverage points workshops will be conducted to understand consequences of addressing leverage points, potential trade-offs and synergies. We consolidate intermediate indicators and outcome-based indicator (stage 1) and discuss short, medium and long-term targets; exploring target ranges based on the modelling work.

4. **Co-design and Explore** (implementation & readiness): Co-produces inter-sectoral policy packages with large potential to transform the built environment and trigger deep and wide-scale change towards the envisioned low-carbon, healthy and resilient future. We explore alternative policy scenarios that could help achieve desired changes, potential social-tipping points that if reached could accelerate change, and local knowledge and perceptions to ensure adequate communication and implementation, as well as actors that will be key. This phase aims to create a structured roadmap for change, ensuring that interventions are both strategic and measurable, while ensuring that they are perceived as necessary and acceptable by citizens.

**Key Question: What policies and investments do we need to prioritise to trigger transformation? How can different actors, government levels and sectors work together and form alliances?**

Co-creation workshops will be organised to discuss urban policies and interventions, identifying those that bear large transformative potential by testing different policy scenarios. The identification of transformative policy packages will build on the identified intervention points (stage 3). Policy scenarios will challenge stakeholders to assess the implications of different strategies and policy combinations for making their desired future scenario a reality. Stakeholders will analyse their role in facilitating the required transformation and the adoption and implementation of policies and investments identified.

Findings from pilots will be compiled into dissemination materials, including reports, and policy briefs that highlight key policies, feature co-created strategies and best practices. A comparative analysis of pilot cities will provide insights into common systemic challenges and opportunities, fostering the development of shared solutions, while also helping understand how implementation and design would need to change depending on the context. We are also expecting to expand the work to other pilot cities after this initial stage. Learnings, resources and materials will be expanded and enriched as our work expands to include more and a wider range of cities of different sizes, and presenting different characteristics (e.g. culture, types of infrastructure, demographic characteristics, age composition, etc.). This will make outputs increasingly pertinent to inform EU and international guidance and best practice; in addition to providing expanding evidence on how the methodology can be useful in very diverse contexts and creating material for training activities.

## Key outcomes

The *Cities LOOP* initiative will provide an experimental space for cities to test innovative engagement methods and explore new system-based tools and approaches; helping them to identify cross-sectoral transformative solutions while ensuring that these are tailored to local challenges and needs of citizens and stakeholders.

Beyond the new insights regarding challenges, policies and strategies to realise the desired future gained throughout the process, local authorities and key stakeholders in pilot cities will have developed knowledge of systems thinking methodologies, strengthening their capacity to apply these in future processes. By engaging in the 4-stage process cities will have an opportunity to embed policy decisions into the collective challenging of engrained narratives and the co-creation of new ones; helping them to explore potential new solutions while at the same time gaining acceptance by having stakeholders and citizens being central to the process.

Additionally, the findings will contribute to influencing broader policy frameworks at national and international levels, including EU sustainability strategies and global climate initiatives. This initiative will **also** serve as a blueprint for other cities seeking to innovate in the policy process, **offering concrete examples and resources to facilitate the adoption of** systems thinking **in combination with innovative engagement** to better connect with citizens and key stakeholders, and explore transformative solutions to transition toward sustainable and resilient urban future.

In a nutshell the initiative offers participating cities:

- **Cross-sector collaboration and enhanced capacity to adopt a systems approach:** Cities will be provided with an opportunity to test new ways of engaging and working and to use systems thinking tools practically. They will gain insights and build skills and capacity to work more effectively across sectors within the built environment (e.g., housing, urban planning, transport, and energy) to collectively identify and activate high-leverage points for change and achieve a shared and long-term view of a desired future. This will facilitate more integrated, holistic approaches to urban planning, infrastructure development, and policy design, while also helping to explore innovative governance and institutional set-ups. As such the process will help cities to shift away from predict and provide approaches and current sector-based optimisation; enhancing synergies and reducing trade-offs.
- **Operational tools and concrete priorities for thriving within ecological boundaries:** The initiative will help cities develop concrete cross-sectorial strategies focused on fostering thriving urban life within planetary ecological boundaries. Moreover, it will also allow cities to develop skills and capacity and generate tools (e.g. **long-term vision, system mapping, scenarios, etc.**) that can help mainstream and ground new thinking and practice into wider policy and decision-making frameworks and processes.
- **Root cause analysis for urban challenges:** Rather than focusing on end of pipe solutions that only address symptoms and might lead to adverse effects in the long-term, cities will be supported to identify the root causes of their urban challenges, enabling them to tackle issues such as overconsumption, inefficient spatial use, and high emissions more effectively.
- **Depolarisation and effective citizen and stakeholder engagement:** The 4-step process will facilitate bringing stakeholders, including citizens into the conversation, helping to bridge divides and ensuring that urban solutions identified are inclusive and reflect the diverse perspectives of those directly affected by policies. This participatory and co-creative approach also fosters a sense of ownership and engagement in the transformation process; allowing cities to go beyond technological feasibility and increasing social and political feasibility of identified solutions.
- **Visibility and exchange with other cities:** The initiative will provide visibility to pilot and learning cities; with an emphasis on communicating on their leading role in exploring systems thinking and testing innovative engagement and policy decision methods in order to advance bold social and environmental goals. Moreover, the pilot cities will be brought together to exchange and learn from each other throughout the project, while also leading the way for potential replication and learning by the ***Learning and Sharing network*** of cities and beyond.




Photo by Jahanzeb Ahsan on unsplash.com

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# Annex 1 List of experts and practitioners in interviews, questionnaires and providing comments

List of experts and practitioners who participated in semi-structured interviews or/and completed the questionnaire or/and provided comments to the initial version of the paper.

| First | Last | Title |
|---|---|---|
| **Lewis** | **Akenji** | Executive Director of the Hot or Cool Institute |
| **Lene Rachel** | **Andersen** | Founder of Nordic Bildung |
| **Anja** | **Bierwirth** | Head of Research Unit Urban Transitions at the Wuppertal Institute |
| **Alice** | **Bond** | Policy, Researcher and Engagement Manager at World Green Buildings Council |
| **Sabrina** | **Dekker** | Climate Action Coordinator at the Dublin City Council |
| **Roxana** | **Dela Fiamor** | Senior Researcher at E3G |
| **Joanna** | **Dickinson** | Sustainable Mobility Expert at IVL Swedish Environmental Research Institute |
| **Sandrine** | **Dixson-Declève** | Co-President of the Club of Rome |
| **Cynthia** | **Echave** | Associate Professor Universidad Ramon-Llul, Escula de Arquitectura La Salle |
| **Tatiana** | **Fernandez** | Head of Economic Strategy at the Catalan Government |
| **Giulio** | **Ferrini** | Head of Built Environment at the Institute for Human Rights and Business |
| **Alessandro** | **Galli** | Reasearch Director at the Hot or Cool Institute |
| **Irene** | **Garcia** | Built Environment Lead at Carbon Neutral Cities |
| **Yoshitsugu** | **Hayashi** | Emeritus Professor at Nagoya University and Professor of Chubu University, Japan. Former President of the World Conference on Transport Research Society (WCTRS) |
| **Edel** | **Kelly** | Head of Transportation at the Dublin City Council |
| **Francois** | **Laigret** | Corporate Sustainability Manager at Knauf |
| **Mathias** | **Lara** | Co-Director of the 50 Percent |
| **Adam** | **Mackenzie-Jones** | Head of Net Zero Systems, Net Zero Strategy Directorate, Department for Energy Security & Net Zero in the UK Government |
| **Ted** | **Manning** | President of Tourisk Inc. |
| **Julia** | **Okatz** | Associate at SYSTEMIQ |
| **Sheela** | **Patel** | Founder of SPARC |
| **Blake** | **Robinson** | Lead and Researcher at Urban Futures Studio |
| **Miles** | **Rowland** | Policy Coordinator at World Green Building Council |
| **Yamina** | **Saheb** | Lecturer and researcher at Sciences Po (Paris), a lead author of the IPCC report on climate change mitigation and a Senior fellow at OpenExp. |
| **John** | **Schellenuber** | Director General of IIASA |
| **Paul** | **Shrivastava** | Co-President of The Club of Rome |
| **Anne** | **Snick** | Independent Researcher |
| **Anitra** | **Thorhaug** | Chair of Physiology of the American Botanical Society, Programme Chair and Past President of the US association for the Club of Rome |
| **Anders** | **Wijkman** | Former Co-president of the Club of Rome and EU Parliamentarian, Chairman of the Swedish Association of Recycling Industries, and member of the Board of the Swedish Development Authority (SIDA) |
| **Nici** | **Zimmerman** | Professor on Systems Dynamics at University College London |
| **Jan** | **Willems** | Co-founder of Lever |

# Annex 2 List of participants in the Brussels Workshop

List of participants in the October 14th in-person workshop in Brussels

| First | Last | Title |
|---|---|---|
| **Aimée** | **Aguilar Jaber** | Programmes Director at the Hot or Cool Institute |
| **Emily** | **Bankert** | Researcher for Carbon and Energy at Buildings Performance Institute Europe (BPIE) |
| **Francisco** | **Carvalho** | General and Innovation Coordinator at the Landscape Laboratory |
| **Roxana** | **Dela Fiamor** | Senior Researcher at E3G |
| **Sandrine** | **Dixson-Declève** | Co-President of The Club of Rome |
| **Cynthia** | **Echave** | Associate Professor Universidad Ramon-Llul, Escula de Arquitectura La Salle |
| **Tarek El Azzouzi** | **El Azzouzi** | NetZeroCities Partnership Manager at Climate-KIC |
| **Cécile** | **Faraud** | Technical Lead for Clean Construction at C40 |
| **Nicolas** | **Galudec** | Senior Policy Advisor, United Nations Environment Programme |
| **Noah** | **Kohlmann** | Intern at the Systems Transformation Hub |
| **Florian** | **Kraxner** | Research Group Leader and Principal Research Scholar at the International Institute for Applied Systems Analysis (IIASA) |
| **Serena** | **Lisai** | Project Officer at ACR+ |
| **Laetitia** | **Mairlot** | Programme Manager at The Club of Rome |
| **Beatrice** | **Meo** | Project Manager at the Hot or Cool Institute |
| **Luca** | **Nipius** | Research Assistant at the Energy, Resources & Climate Change Unit at the Center for European Policy (CEPS) |
| **Gemma** | **O'Rilley** | Policy Analyst at the Ireland National Economic and Social Council |
| **Laura** | **Pallares** | Head of Europe at World Green Buildings Council |
| **Blake** | **Robinson** | Lead and Researcher at Urban Futures Studio |
| **Goksen** | **Sahin** | Senior Advocacy Officer at ICLEI Europe |
| **Roxana** | **Slavcheva** | Global Lead for Built Environment at the World Resource Institute |
| **Anne** | **Snick** | Independent Researcher |
| **Tamara** | **Streefland** | Head of Networks at Built by Nature |
| **Mikkel A.** | **Thomassen** | Partner at Smith Innovation |
| **Ivan** | **Thung** | Lead Built Environment at Metabolic |
| **Zsolt** | **Toth** | Team Leader at Buildings Performance Institute Europe (BPIE) |
| **Patricia** | **Urban** | Researcher in the Energy, Resources & Climate Change Unit at the Center for European Policy (CEPS) |
| **Bhavana** | **Vaddadi** | Post-doctoral researcher at the Integrated Transport Research Lab (ITRL) at KTH Royal Institute of Technology |

# Annex 3 Detailed description of barriers

The text below provides further information on the barriers that were identified via the semi-structured interviews and the questionnaire that was sent to experts and stakeholders as part of the scoping phase. The descriptions capture the views of the different experts and stakeholders, which provided a wealth of information about the ways in which different barriers impede the adoption of systems approaches in decision-making for the built environment and how these different barriers are connected to each other. These detailed descriptions where thus taken as the basis for the development of the systems mapping shown and explained in section 4.

## Lack of in-depth understanding of systems thinking principles, tools and their practical value

A major barrier is the limited understanding of the core concepts, methodologies, and practical tools associated with systems thinking among policymakers. Less than half of the existing studies that focus on system thinking explore the real-world application of systems thinking, leading to a significant gap in knowledge and evidence supporting its effective use in public policy (Nguyen et al., 2023). Without concrete examples or well-documented outcomes from previous applications, policymakers often lack the confidence to incorporate these methods into their planning processes. This unfamiliarity leads to resistance, as decision-makers are more likely to rely on traditional, linear approaches to solving complex urban challenges. Addressing this knowledge gap requires targeted training, exposure to real-world case studies, and an emphasis on the practical benefits systems thinking can offer (see more discussion on this in section 5).

### Lack of awareness and limited understanding of systems thinking

There is often a lack of clarity regarding what a systemic approach entails. Policymakers and stakeholders may use the term “systems thinking” because it has gained popularity, rather than applying its core principles in a meaningful way. The term is frequently employed as a buzzword, with little understanding of its theoretical foundations or practical implications. This superficial use not only dilutes the true value of systems thinking but also contributes to confusion and misalignment in policy discussions. Without a proper grasp of the methodologies and objectives that underpin a systemic approach, policymakers risk relying on traditional, linear problem-solving methods while using the language of systems thinking to signal innovation, rather than fostering substantive change (Questionnaire: Systems approach for the built environment, 2024).

### Limited case studies documenting and demonstrating systems thinking’s value and effectiveness

Policymakers are often reluctant to adopt systems thinking due to a perceived lack of clear evidence demonstrating its effectiveness. With the exception of few examples (see the UK platform in section 3) there is a general shortage of well-documented case studies and blueprints for how systems thinking can be applied to solve complex policy challenges. Without robust examples showing how systems thinking has led to measurable improvements in urban environments, there is little incentive for decision-makers to invest the time and resources necessary for its adoption. Real case examples are needed to bridge the gap between theoretical frameworks and practical, actionable results.



### Methodological gaps and difficulty to understand the tools that are available, how to select them and use them

Selecting appropriate systems thinking tools remains a challenge due to limited guidance on their applicability. As noted by Nguyen et al. (2023), there is insufficient justification in many case studies for the use of specific systems thinking tools, and a lack of comparisons with alternatives. This lack of clarity complicates the decision-making process, leaving policymakers unsure of which tools are most suitable for addressing their unique challenges. The diversity of systems thinking tools—such as causal loop diagrams, system dynamics, and scenario planning—requires not only technical expertise but also a clear understanding of how these methods complement or enhance existing approaches. Moreover, the weak amount of comprehensive guidance or toolkits (with some exceptions, such as the UK- see section 3) further exacerbates the challenge, making it difficult for civil servants and urban planners to confidently apply systems thinking in real-world settings.

### Lack of proper evaluation methods is making it hard to measure the impact of systems thinking

The absence of clear evaluation frameworks means it’s difficult to assess whether systems thinking approaches are effective. Nguyen et al. (2023) point out the need for specific criteria to measure success, which would help demonstrate its value and identify areas for improvement. Without well-defined evaluation mechanisms, it becomes difficult to measure the effectiveness of systems thinking in achieving desired outcomes, such as sustainability or improved urban resilience (Questionnaire: Systems approach for the built environment, 2024). Policymakers need concrete evidence of the long-term impacts of systems thinking interventions to justify their implementation. Policymakers often prefer simple, quantifiable results, like those from cost-benefit analysis (CBA), which offer clear numbers but are often limited in capturing the broader, long-term benefits and complexities that systems thinking addresses. This reliance on straightforward metrics makes it harder for systems thinking to gain traction, as its outcomes may not always fit neatly into these conventional evaluation models. Establishing robust evaluation frameworks that include both qualitative and quantitative measures will provide the necessary feedback to refine and optimise systems thinking approaches over time.

### Limited local capacity hinders the adoption of systems thinking

The successful application of systems thinking requires specialised knowledge, skills, and resources that are often lacking at the local level. Nguyen et al. (2023) emphasise that systems thinking is not yet a widely understood or practiced approach, particularly among local policymakers and urban planners. This gap in expertise means that local governments may struggle to implement systems thinking effectively, even if they recognise its value. The lack of training opportunities and access to necessary tools further exacerbates the issue (Questionnaire: Systems approach for the built environment, 2024). Without the proper skillsets or the capacity to acquire them, local actors are unable to fully engage with the complexity of systems thinking, resulting in fragmented or superficial attempts at integration.

## Inertia within existing governance and institutional frameworks

Governments and institutional frameworks often hinder change, showing relevant path-dependency towards established processes that policymakers and other key stakeholders are more familiar with and thus find easier to understand and manage. This makes it difficult to incorporate the holistic, long-term planning that systems thinking requires. Existing policy structures are typically geared towards sector-specific approaches, prioritising short-term objectives over integrated solutions. This lack of alignment between different sectors and levels of governance creates structural barriers that are difficult to overcome, making it harder to secure the necessary support from key stakeholders and decision-makers for adopting systems thinking and further locking-in the siloed focus on different parts of the built environment by different parts of the administration. Without systemic

rethinking of the governance structures and how these could facilitate and foster stakeholder engagement, these barriers will continue to slow progress in creating more sustainable, interconnected urban policies.

### Misalignment between long-term sustainability goals and short-term priorities

A major barrier to the widespread adoption of a systems approach in the built environment is the misalignment between long-term sustainability goals and the short-term objectives that drives many decision-making processes. “Short-termism” is hard to overcome since existing government and institutional frameworks reinforce it in various ways. For example, driven by the pressure of short-term political cycles, politicians and policymakers often seek to demonstrate quick, tangible results within their limited terms of office. This focus on short-term achievements prioritises immediate gains over the long-term, systemic solutions that sustainability efforts require. As a result, there is a strong tendency to favour policies and initiatives that provide rapid, visible benefits, rather than investing in the more complex, gradual changes that systems thinking demands. One of the key challenges to implementing systems thinking is the significant time investment it requires. Immediate results are rare, as systems thinking involves in-depth analysis of the various interconnected elements within urban environments. The benefits of this approach typically take longer to materialise, which discourages policymakers under pressure to deliver quick results within the political cycle. Nguyen et al. (2023) highlight that policymakers are often reluctant to adopt methodologies that require extended timeframes due to this pressure. The absence of short-term rewards makes it difficult to justify the time and resource investment in policy contexts that prioritise immediate outcomes.

§Existing urban environments, often referred to as “sunk assets,” worsen the problem. In European urban areas much of the infrastructure is already built, making it costly and logistically difficult to implement new models based on systems thinking approaches. Respondents also noted that property ownership structures further complicate these efforts, as private owners may resist transformations unless adequately compensated (Questionnaire: Systems approach for the built environment, 2024). Hurlimann et al. (2023) point out that many policies tend to focus on the early stages of development, leaving gaps in how systems thinking can be applied to already built environments and their ongoing renewal. Resistance from both physical infrastructure and ownership interests significantly slows the integration of more sustainable, systemic approaches in urban re-development, reinforcing existing patterns and hindering the adoption of forward-thinking solutions. Additionally, there is a tendency for policymakers to prioritise technological advancements over rethinking the functions of urban environments. This focus on technology can overshadow the potential of land-use changes or reallocation of road space for instance, which could offer more immediate and impactful shifts toward sustainability in some cases than it is generally thought (see barrier ‘*Bias Toward Technological Solutions vs. Systemic Changes*’ below)

### Siloed governance structures with limited coordination between levels of government

Governance structures are typically organised into silos, which restrict cross-departmental collaboration and make it difficult to manage the complexity required for systems thinking. As one of the respondents noted “*Developing a comprehensive urban sustainability approach requires collaboration across multiple sectors, which often face misaligned incentives and conflicting interests.*” However, currently departments often function independently with little coordination, focusing on their own objectives without considering broader, interconnected challenges. This fragmented approach limits collaboration and the ability to address complex, cross-cutting issues like urban sustainability. As a result, policies are often developed in isolation, without accounting for the ripple effects across other sectors. As several respondents noted, policymakers within these structures frequently rely on filtered or incomplete information, reinforcing existing decision-making processes and hindering the adoption of more integrated, systemic approaches (Questionnaire: Systems approach for the built environment, 2024). The lack of institutional incentives for collaboration only exacerbates these challenges, making it difficult to break free from entrenched silos and embrace more holistic, long-term solutions that could better address sustainability and resilience challenges.



Moreover, the structure of budgets within these silos further reinforces this separation. Each department typically operates with its own budget, with little to no cross-budgeting between sectors. This not only restricts collaboration but also reduces the ability to make strong financial cases for systemic, long-term interventions that require cooperation across multiple areas. The lack of integrated financial planning creates a narrow focus on short-term, siloed outcomes, rather than broader, more sustainable strategies. Without mechanisms for cross-budgeting, the financial case for systems thinking becomes more difficult to make, as departments are incentivised to prioritise short-term objectives that fit within their individual budgets rather than long-term, cross-sectoral solutions. Poor coordination between local, regional, and national governments creates another significant challenge for adopting systems thinking approaches. As noted by one of the respondents, effective urban sustainability strategies require housing, transport, energy, and environmental agencies to work together; however, bureaucratic silos and differing mandates often prevent cohesive policy development and execution. The lack of institutionalised platforms for dialogue and experimentation also restricts the potential for revisiting outdated frameworks and integrating innovative, systemic solutions. There is also often a lack of understanding or consideration of local priorities at higher levels of government, which can result in top-down policies that are misaligned with the needs and realities of local communities. This disconnect further hinders the ability to create integrated solutions that are responsive to specific urban challenges.

## Dominant policy culture

The dominant policy culture, poses a significant barrier to the widespread implementation of systems thinking: “*Many of the barriers that prevent transformation are institutional, cultural, and embedded in the way decisions are made over decades.*” Noted one of the respondents. This culture, often resistant to change, discourages experimentation and innovation, which are crucial for adopting more holistic, systems-based approaches to urban development. Policymakers tend to favour traditional, linear methods that align with established processes, rather than exploring new, integrated strategies that challenge conventional thinking. Additionally, as noted by one of the respondents, “*many public institutions are conservative and conflict-averse, resistant to adopting new approaches that might disrupt established power structures within administrations*” (Questionnaire: Systems approach for the built environment, 2024).

### Limited culture of experimentation and exchange

One of the barriers to implementing systems thinking is the lack of a culture that encourages experimentation and the exchange of ideas. Policymakers and institutions are often hesitant to step outside established norms, limiting opportunities to test new methods or share insights across departments and sectors. As one of the respondents noted “*The changes in processes need a real shift in thinking, but there is often a lack of genuine willingness to change.*” This lack of experimentation slows down the innovation and the development of novel approaches that are critical to addressing complex, interconnected challenges. Without a culture that promotes risk-taking and cross-sectoral collaboration, the adoption of systems thinking remains constrained, reinforcing the dominance of traditional approaches.

### The prevailing policymaking culture favours traditional tools, limiting the scope of systems thinking

Hurlimann et al. (2023) argue that the rigid application of traditional policy tools often results in unsustainable development pathways, as these models are poorly equipped to address complex, interconnected challenges like climate change. Shifting the policymaking culture to value broader social and environmental impacts requires

rethinking how success is measured and expanding the scope of what is considered in decision-making. However, as mentioned in some interviews, often these tools are regarded within administrations as holding unquestionable certainties, making difficult the revision of methodologies behind them or the need for other approaches.

### Lack of financial resources limits the adoption of system thinking processes

While the implementation of systems thinking in urban development requires significant time, expertise, and financial resources, these resources are often directed toward maintaining traditional methods rather than supporting innovative, systemic approaches. Nguyen et al. (2023) note that the costs of conducting comprehensive systems-based analyses are seen as prohibitive, as they demand both specialised expertise and extensive data collection. However, the real barrier is the prioritisation of financial and material resources toward familiar, traditional approaches that align with current policy structures.

Systemic approaches, which offer the potential to shift perspectives and create new narratives around sustainable development, require substantial investment to generate the necessary evidence and build broad support. Without reallocation of resources toward more holistic, long-term strategies, the shift to systems thinking will continue to face significant resistance.

### Bias towards infrastructure megaprojects

A significant barrier to the adoption of systems thinking in urban development is the prevailing bias towards infrastructure-focused solutions. Policymakers and decision-makers tend to prioritise large-scale, visible infrastructure projects over more nuanced, systemic organisational changes. This bias stems from the belief that infrastructure projects offer tangible, measurable results within the timeframe of political cycles, reinforcing a preference for traditional approaches. As noted in the questionnaire, there is a tendency to assume that visible infrastructure investments provide more immediate impact, overshadowing the need for strategic shifts in how urban systems are organised and managed.

Additionally, this infrastructure bias can divert resources away from potentially more effective systems-level interventions, which may not offer the same immediate, observable outcomes but can have far-reaching, long-term benefits. The focus on infrastructure often limits the scope for broader systemic changes, such as improving coordination across sectors, enhancing governance structures, or innovating land-use planning.

### Bias toward technological solutions vs. systemic changes

Policymakers often tend to focus on technology as the primary solution for addressing complex urban challenges, which diverts attention from the need for systemic organisational changes. While technology undoubtedly can play a role in addressing sustainability and development goals, relying solely on technological solutions can create blind spots. It leads to underestimating the importance of restructuring urban systems, governance, and collaboration across different sectors to achieve lasting change.

Policymakers often gravitate towards tech-driven “quick fixes” that promise fast results, rather than confronting the more complex, cross-sectoral changes required to enable systems thinking. This technological optimism can lead to overinvestment in specific technologies, while more systemic interventions—such as enhancing public participation, rethinking governance models, or addressing social equity in urban planning—are neglected.

There is also a broader cultural bias within policy frameworks that prioritises technological solutions as the fastest and most effective means of change, even when many cases (e.g. electric vehicle penetration in the fleet) have shown to be much lower than expected (OECD,2022). This bias often skews attention away from non-technological interventions, such as changes in land-use policy or governance reforms. Policymakers may perceive land-use changes as slow, while technological advancements seem more immediate and scalable. This bias towards technology, while valuable in many respects, can lead to an underappreciation of how systemic shifts—like altering urban governance, revisiting land-use planning, or integrating systems thinking across sectors—can produce equally transformative and sometimes quicker results.

## Wider systemic barriers beyond built environment

There are broader systemic barriers beyond the built environment that indirectly generate resistance to change. These obstacles are related to factors outside the physical system itself and act as barriers to shifting mindsets and practices in areas such as energy models, skills development, the job market and international trade policies. These wider systemic barriers create a complex environment that resists change, making it difficult to implement systems thinking in the built environment. Addressing these issues will require not only changes to physical infrastructure but also reforms in education, industry practices and policy frameworks to foster a more integrated and holistic approach.

Energy sector: The reliance on fossil fuel-based infrastructure, such as power plants, refineries, and pipelines, represents a significant financial investment. These assets are designed to last for decades, and industries dependent on them are reluctant to abandon or replace them with cleaner alternatives. Transitioning to renewable energy often requires a complete overhaul of energy infrastructure, which is both costly and time-consuming, creating strong resistance to change.

Education and skills development: The training and education of professionals in the built environment are often highly specialised, with limited exposure to systems thinking. Universities and professional training programs frequently emphasise narrow, discipline-specific expertise, making it challenging to adopt a holistic, interconnected approach to urban systems. This gap in education hinders the widespread understanding and application of systems thinking in practice.

Job market fragmentation: The construction and urban development industries are composed of highly specialised roles, such as architects, engineers, electricians, and plumbers, each focusing on their specific tasks. This compartmentalisation discourages professionals from taking a broader, system-wide approach to projects, limiting collaboration and holistic problem-solving. The fragmented nature of the job market reinforces siloed thinking and creates further barriers to adopting systemic approaches.

Financial system: The reliance on near-term financial metrics in both public and private sectors stifles the adoption of more holistic approaches, leading to incremental changes that fall short of the transformative impact needed. It was mentioned in the questionnaire that without innovative financing models that align economic incentives with long-term sustainability goals, this barrier will continue to hinder the mainstreaming of systems thinking in urban development. The link between short-termism (also mentioned before) and the financial model in the development sector was also mentioned. It was highlighted that developers focus on maximising profits by cutting costs wherever possible, which often results in a reluctance to invest in systems thinking approaches. The additional time, research, and logistics required to customise buildings, source local materials and collaborate with smaller suppliers are seen as unnecessary expenses. Without financial incentives or rewards for adopting more holistic approaches, developers are unlikely to bear the extra costs of systemic solutions, further reinforcing short-term, profit-driven strategies.

Vested interests: A major barrier to adopting systems thinking in the built environment is the influence of vested interests. Many industries and stakeholders benefit from maintaining the status quo, as they have financial or political incentives tied to current practices. Large corporations, developers may resist systemic changes that could threaten their existing revenue streams, power structures, or operational models. The transition to more sustainable, integrated solutions often requires shifts in market dynamics, regulations, and business practices, which can be perceived as risks by these stakeholders.

# Annex 4 Initial work explored and discussed during the scoping phase

Annex 4 outlines key areas of work identified during the preliminary research for this paper as having the potential to support the shift in policy decisions toward a holistic societal transformation. These areas of work served as the foundation for discussions during the workshop, leading to further reflection by The Club of Rome and the Hot or Cool Institute towards the development of the *Cities LOOP* initiative described in section 5.

To structure our thinking, the preliminary work proposed drew on the Systems Change Compass (Club of Rome & Systemiq, 2020) as a conceptual tool. The Systems Change Compass serves as a guide to direct policy decisions beyond narrow, isolated solutions and toward integrated strategies for societal transformation. While the original objective of the Systems Change Compass is to enhance the consistency of the European Green Deal, using the three strategic pillars of the Compass provided a valuable basis to structure work that aims at redirecting efforts in cities and the built environment. Having adapted the three strategic pillars of the Systems Change Compass to the context of urban areas and the built environment, based on the information and insights gathered from the questionnaires, interviews and relevant literature, we proposed structuring new work along three complementary and simultaneous pillars that would allow redirecting efforts in the desired direction.

Following the interviews and questionnaires, and based on the work on the Compass, we developed new principles within each pillar (see table 4). These also took inspiration from the initial compass principles but adapted them to reflect the shift in thinking and practice for the built environment. During the preliminary phase of our research, possible areas of work within the three pillars and guided by the nine principles were also sketched out (see Figure 3). Table 5 describes in a nutshell each areas of work initially proposed.

The three pillars and principles developed initially evolved during the scoping phase to shape the four strategic goals of the Cities LOOP initiative. Similarly, the different areas of work developed into the work, set-up and activities proposed by our initiative. This evolution was based on our findings from the conversations and activities held during the workshop in Brussels. These allowed us to better establish priorities, identify missing activities, and understand how different work could better come together and how it could be the most useful. Conversations also allowed us to shape the desired outputs and outcomes in light of the views and needs expressed by the different stakeholders.

| Pillar | Principles |
|---|---|
| **1. Envisioning sustainable urban systems and mapping progress** | ▪ Redefining prosperous and sustainable cities as urban systems organised to provide places and services for people and planet and to make low-carbon and nature-positive lifestyles affordable, appealing and accessible<br>▪ Redefining the built environment as part of a complex and interconnected system that includes physical structures, ecosystems and non-physical elements of social life<br>▪ Redefining progress in urban areas as changes in urban policy and decision for the built environment that enable reorganising urban systems to deliver societal needs within planetary boundaries |
| **2. Designing and implementing transformative interventions** | ▪ Redefining metrics to measure capacity and track progress to enable thriving lives within planetary boundaries<br>▪ Redefining decision-making tools to support decision-makers in moving away from an optimisation solution space, dealing with complexity, and redirecting attention from parts of the built-environment to the interconnections in urban systems<br>▪ Redefining policy priorities focusing on the identification of high-leverage points for system wide societal transformation and working with key actors to scale up transformative solutions |
| **3. Mobilising and enabling actors** | ▪ Redefining governance: shifting thinking and practice from siloed means to shared and integrated actions that enable provisioning of places and services to make low-carbon and nature-positive lifestyles affordable, appealing, and accessible<br>▪ Redefining policy culture and leadership to embrace exchange, experimentation, revisiting of current tools and frameworks, and support capacity building<br>▪ Redefining finance for the urban areas and the built environment: defining and distinguishing transformative finance that would support systemic change for urban areas and the built environment and identify necessary changes to channel investment in that direction |

**Table 4. Pillars and principles outlined in the work proposed during the preliminary phase of research**

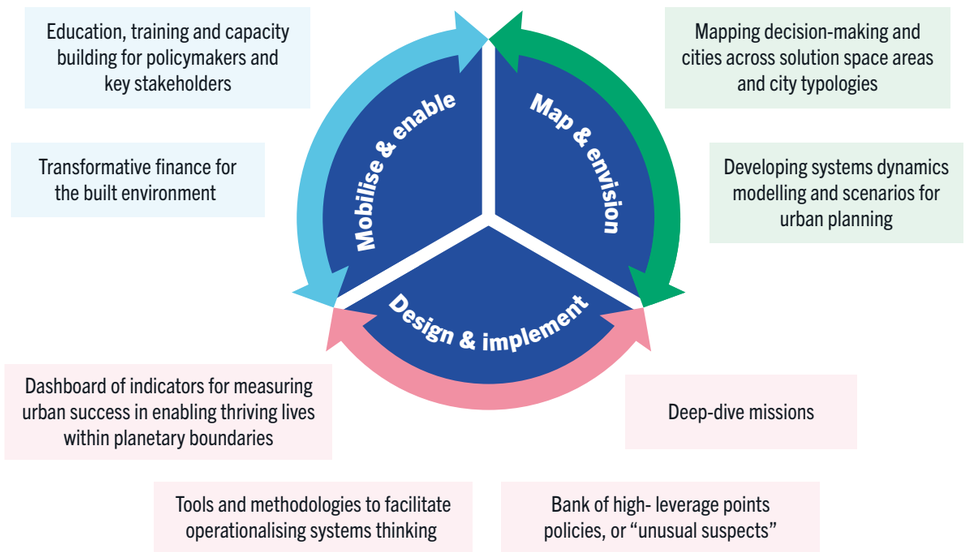


**Figure 4. Pillars and proposed areas of work initially proposed**

| | |
|---|---|
| **Map & envision** | |
| **Mapping decision-making and cities across solution space areas** | Mapping of cities’ current positions and trajectories, taking as reference the solution space framework: what type of built environment and city type can we see today? What trajectory would decision-making tools (e.g. strategies, infrastructure plans) need to take for the future? |
| **Developing systems dynamic modelling for urban planning** | Simulate multiple urban development pathway and scenarios, assessing their environmental, social and economic impacts and capacity to deliver cities of places and services. |
| **Design & implement** | |
| **Dashboard of indicators for measuring urban success** | Outcome indicators: how effectively are cities, and their built environments, delivering wellbeing while staying within planetary boundaries?<br>Intermediate indicators: track and set objectives for transforming the built environment in ways that are conducive to improving wellbeing while reducing environmental impacts. |
| **Deep-dive missions** | Work with specific authorities (and their key stakeholders) to increase understanding of different subsystems and diverse complex challenges linked to the built environment, and how these could be approached using a transformative and systemic logic. Documenting the different case studies. |
| **Tools and methodologies for operationalising systems thinking** | Building on work with cities and other activities, create practical tools to help decision-makers apply systems in their daily practice (e.g. interactive mapping tools integrating emerging narratives, tools to effectively communicate findings to the public, etc.) |
| **Bank of high-leverage points or “unusual suspects”** | Collecting and documenting transformative solutions identified through various missions and activities, creating a repository or bank od high-leverage point policies or “unusuals suspects”: solutions or areas of change that are typically overlooked or not widely adopted but have a significant transformative potential. |
| **Mobilise & enable** | |
| **Education, training and capacity building** | Comprehensive training initiative at both national and local levels, aimed at policymakers, universities, and industry professionals. |
| **Transformative finance for the built environment** | Developing a systems thinking based framework to develop a definition of transformative finance for the built environment and a clear distinction of the types of investments that qualify as transformative. |

**Table 5. Areas of work proposed initially in a nutshell**

**The Club of Rome** is a platform of diverse thought leaders. Drawing on the collective know-how of our members, the organisation provides holistic solutions to global issues such as climate, economics and the wellbeing of humanity. It promotes policy initiatives and action so that humanity can emerge from its self-inflicted planetary emergencies.

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**Hot or Cool Institute** is a public interest think tank working at the intersection of society and sustainability. Its mission is to challenge the status quo, help people reimagine what is possible and enable systemic change towards resilient societies that thrive within ecological limits. Hot or Cool translates science and research into action by providing key organisations and decision makers with tools, narratives and policy options. The organisation is committed to public participation and fairness as they drive systemic change to enable low-carbon nature-positive lifestyles and wellbeing for all.

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