Planning for Climate-Neutrality Beyond the City Borders

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1. Introduction

Climate neutrality has become a central objective of European spatial and development policy, reflecting growing recognition of the scale and urgency of climate change mitigation and adaptation (European Commission, 2019; European Environment Agency, 2023). While cities are often positioned as the main engines of decarbonisation, the spatial, functional and infrastructural realities shaping greenhouse gas emissions extend far beyond municipal borders. Energy systems, mobility networks, logistics chains, land-use dynamics and ecological processes operate across wider functional territories that include peri-urban and semi-rural areas (OECD, 2023; UN-Habitat, 2019). Planning for climate neutrality therefore cannot be related to dense urban cores; it must address the broader territories that support, enable and are transformed by urban life.

Peri-urban areas occupy a decisive position within this transition. They host a significant share of transport infrastructure, logistics platforms, energy facilities, industrial activities and agricultural land, while also accommodating a growing residential population (Iaquinta and Drescher, 2000; Ravetz, Connelly and Karvonen, 2020). At the same time, these territories frequently fall between established planning and governance frameworks. They are neither fully urban nor rural, governed through fragmented institutional arrangements and shaped by competing land-use pressures. As a result, sectoral or city-focused climate strategies struggle to respond effectively to peri-urban dynamics, often overlooking functional interdependencies and cross-scale impacts (UN-Habitat, 2019; Wilzing et al., 2023).

This case study explores how planning for climate neutrality can be approached beyond city borders by focusing on peri-urban territories as complex, multi-scalar systems. Drawing on an extensive review of peri-urban characteristics and a broad set of transition frameworks, it analyses how existing approaches conceptualise and operationalise systemic change in contexts characterised by functional interdependencies, polycentric spatial structures and governance fragmentation (Geels, 2002; Loorbach, 2010). Rather than presenting a single blueprint or solution, the case study synthesises insights from multiple frameworks to underline emerging patterns, innovative practices and strategic principles that can support climate-neutral transitions at the scale of functional urban regions.

The overarching aim is to demonstrate that effective climate-neutral planning requires integrated, adaptive and participatory approaches that align long-term climate ambitions with concrete action across administrative boundaries (European Commission, 2018; OECD, 2023).

2. Peri-Urban Characteristics

Peri-urban areas are commonly described as transitional territories situated between urban and rural contexts. Rather than constituting clearly delineated spatial units, they are understood as evolving interfaces where urban and rural functions coexist and interact through processes of spatial expansion, infrastructural development and socio-economic transformation (Iaquinta and Drescher, 2000; Ravetz, Connelly and Karvonen, 2020).

A key characteristic of peri-urban areas is their predominantly functional organisation. These territories are typically shaped by labour markets, commuting patterns and service catchments that extend beyond administrative boundaries. As a result, functional delineations, such as Functional Urban Areas or wider rural–urban regions, often provide a more accurate

representation of peri-urban dynamics than municipal borders alone (OECD, 2023). Spatially, this functional logic is frequently reflected in polycentric structures, where multiple centres of activity coexist and are connected through infrastructure corridors rather than organised around a single urban core (UN-Habitat, 2019).

Land-use patterns in peri-urban areas are generally mixed. Residential development often coexists with agricultural activities, industrial and logistics zones, large-scale infrastructure and areas of environmental value within the same territorial context. This coexistence gives rise to conflicts over land allocation and resource use, particularly between housing expansion, agricultural production, environmental protection and economic development objectives (Ravetz, 2020). Agricultural land is especially affected, as peri-urbanisation processes and increasing land values contribute to fragmentation and declining economic viability, frequently shifting agricultural activity towards residual or landscape-oriented functions (Iaquinta and Drescher, 2000; Ravetz, Connelly and Karvonen, 2020).

Peri-urban territories also play an important role in metropolitan and regional flows of people, goods, energy and resources. They often function simultaneously as production zones, consumption areas, transit corridors and exchange spaces within wider territorial systems (OECD, 2023). Major transport infrastructures, logistics platforms and energy facilities are frequently located in peri-urban areas due to spatial availability and accessibility advantages. However, these infrastructures are often only partially integrated into local planning and development strategies, resulting in limited local benefits relative to their spatial, environmental and social impacts.

Governance arrangements represent another defining characteristic of peri-urban areas. These territories are typically managed through fragmented institutional structures, involving multiple municipalities, regional authorities and sector-specific bodies with differing responsibilities and capacities. Coordination mechanisms between these actors are often weak or informal, which can limit the ability to address cross-sectoral challenges in an integrated manner (UN-Habitat, 2019). Although interdependencies between urban cores and peri-urban areas may be recognised in strategic frameworks, they frequently remain difficult to operationalise, particularly where planning competences for land use, transport, energy and economic development are distributed unevenly across governance levels.

Finally, peri-urban areas are increasingly shaped by global and supra-local drivers. International logistics corridors, energy transition infrastructure, climate mitigation and adaptation agendas and global investment processes exert significant influence on peri-urban development trajectories, often through decision-making at national or international levels (Ravetz, Connelly and Karvonen, 2020). Local authorities frequently have limited capacity to influence these external dynamics, reinforcing asymmetries between local impacts, local responsibilities and decision-making power.

3. Analysed Transition Frameworks

To examine how climate-neutral transitions can be planned and governed beyond city borders, a broad range of transition frameworks has been analysed. These frameworks originate from different policy, planning and research domains, including climate action planning, sustainable mobility, energy systems, industrial decarbonisation, governance innovation and socio-technical transition theory (European Commission, 2018; Loorbach, 2007). Together, they form a long list of approaches that reflect the diversity and maturity of transition thinking.

The analysed frameworks range from comprehensive, place-based transition models to more sector-specific planning and governance tools. Some focus on transforming entire urban or regional systems through integrated, cross-sectoral portfolios of interventions, while others address specific domains such as sustainable mobility, community energy systems, industrial transition pathways or climate resilience (C40 Cities, 2018; OECD, 2022). The long list also includes analytical and conceptual frameworks that primarily support system understanding and transition diagnosis, even where they are not designed as fully operational planning instruments (Geels, 2002; Voß and Bornemann, 2011).

Despite their methodological and thematic diversity, the frameworks share a common ambition: to enable systemic change in response to complex and interrelated societal challenges. Many explicitly move away from linear planning and implementation logics, instead emphasising governance innovation, multi-actor collaboration and iterative, learning-oriented processes (Loorbach, 2010; Climate KIC, 2019). Other frameworks place stronger emphasis on structured action planning, monitoring and evaluation, and the alignment of local interventions with internationally recognised climate targets and policy commitments (C40 Cities, 2023; European Commission, 2019).

Importantly, the scope of the analysis extends beyond frameworks that are explicitly city-focused. Several approaches explicitly or implicitly operate at the scale of functional territories, regions or urban–rural systems. These perspectives are particularly relevant for peri-urban contexts, where administrative boundaries rarely correspond to functional realities and where effective transition pathways depend on coordination across multiple jurisdictions and sectors (UN-Habitat, 2019; OECD, 2023). Frameworks that integrate real-world experimentation, living lab approaches, mission-oriented innovation or regional transition pathways provide insight into how systemic change can be organised beyond individual municipal boundaries (European Network of Living Labs, 2025; TRANSFORMER Consortium, 2024).

Rather than evaluating each framework in isolation, this case study treats the franeworks as a shared analytical reference. The intention is to identify recurring patterns, gaps and transferable elements across the full range of frameworks, thereby supporting a synthesis that goes beyond identifying individual “best practices”. This enables a broader understanding of how different approaches collectively inform the planning and governance of climate-neutral transitions beyond city borders.

4. Emerging Patterns in Transition Frameworks

A first set of emerging patterns becomes visible when comparing transition frameworks across different sectors and spatial scales. One of the most consistent findings is the strong emphasis on systemic transformation. Across the analysed frameworks, climate neutrality is rarely approached as a challenge that can be addressed through isolated projects or single-sector interventions. Instead, transition is conceptualised as a process that simultaneously engages governance arrangements, economic systems, infrastructures, social practices and behavioural change (Geels, 2002; Loorbach, 2007).

Closely linked to this systemic orientation is the widespread adoption of iterative and non-linear transition processes. Transition pathways are seldom presented as fixed sequences moving linearly from analysis to implementation. Instead, the frameworks emphasise recurring cycles of system diagnosis, co-design, experimentation, implementation, monitoring and revision

(Loorbach, 2010; Climate KIC, 2019). Learning and reflection are embedded as integral components of transition processes rather than treated as ex-post evaluation steps. This iterative logic reflects recognition of the uncertainty, complexity and path-dependency that characterise climate-neutral transitions, particularly in multi-actor and multi-level governance contexts.

Another prominent pattern is the frequent use of portfolio-based approaches. Rather than relying on individual flagship projects or single instruments, many frameworks encourage the design of interconnected sets of interventions that act in combination across sectors and scales (Climate KIC, 2019; European Commission, 2018). Such portfolios may include policy reforms, pilot and demonstration projects, infrastructure investments, capacity-building measures, financial mechanisms and initiatives targeting behavioural change. The underlying assumption is that systemic transformation emerges from the interaction and mutual reinforcement of multiple actions over time, rather than from the isolated success of individual solutions.

Multi-level and multi-actor governance also emerges as a foundational principle across the analysed frameworks. Nearly all approaches recognise that climate-neutral transitions depend on coordination between local, regional, national and supranational levels, as well as collaboration among public authorities, private actors, civil society organisations, research institutions and citizens (UN-Habitat, 2019; OECD, 2023). Governance is typically framed as collaborative, adaptive and distributed, rather than hierarchical or command-and-control based. Several frameworks stress the importance of aligning decision-making, resources and responsibilities across governance levels in order to overcome institutional fragmentation and implementation gaps.

Participation and co-creation form another recurring pattern. Stakeholder engagement is not approached merely as consultation or information exchange, but as an integral component of shaping, implementing and adapting transition pathways (European Network of Living Labs, 2025). Frameworks emphasise collective problem framing, shared visioning and joint experimentation as mechanisms to enhance legitimacy, build shared ownership and support long-term commitment among stakeholders. These participatory approaches are particularly relevant in contexts characterised by diverse interests, contested land uses and limited formal authority, such as peri-urban territories.

Finally, a shared concern can be observed with linking long-term climate ambitions to short- and medium-term action. While ambitious objectives such as climate neutrality or resilience are typically defined as long-term goals, the frameworks consistently seek to operationalise these ambitions through concrete implementation instruments. These include action plans, investment strategies, implementation roadmaps and monitoring systems that translate strategic goals into sequenced and actionable steps (C40 Cities, 2018; C40 Cities, 2023). Across the frameworks, considerable attention is given to bridging the gap between vision and delivery, ensuring that long-term objectives remain connected to ongoing decision-making and resource allocation.

Taken together, these emerging patterns indicate a high degree of conceptual alignment across transition frameworks, despite differences in scope, sectoral focus and level of operationalisation. They provide a common methodological foundation for understanding and structuring climate-neutral transitions, particularly in complex territorial contexts that extend beyond traditional city boundaries.

5. Innovative Practices and approaches in Transition Frameworks

Across the analysed transition approaches, several innovative practices can be identified that provide concrete advances for planning climate-neutral transitions beyond city borders. These practices reflect a shift away from static planning instruments towards more adaptive, system-oriented and collaborative modes of action.

One prominent innovation concerns the use of agreement-based governance instruments that connect commitment with implementation logic. These instruments typically combine shared objectives with coordinated action portfolios and dedicated investment components, and are updated through iterative cycles. By being jointly endorsed by multiple stakeholders, they help align long-term ambition, delivery mechanisms and financial planning across fragmented institutional landscapes (European Commission, 2018; C40 Cities, 2023).

Another important practice relates to the scaling of real-world experimentation. Several approaches extend experimentation beyond neighbourhood or city scale to encompass regional or functional territories. This requires coordination of multiple pilot actions, governance processes and innovation pathways operating in parallel. Such region-wide experimentation embeds collaboration between public authorities, private actors, research institutions and civil society, creating structured learning environments that address systemic interactions across sectors and spatial scales (European Network of Living Labs, 2006; TRANSFORMER Consortium, 2024).

Innovation is also evident in the creation of protected strategic spaces for long-term orientation. Some approaches establish dedicated arenas where selected actors from government, business, science and civil society engage in structured dialogue on long-term sustainability challenges. These spaces operate outside routine political processes and are designed to support shared problem framing, vision development and learning, rather than formal decision-making. This contributes to continuity and strategic coherence in complex transition processes (Loorbach, 2007; Voß and Bornemann, 2011).

Several approaches further introduce portfolio-based intervention models. Instead of isolated projects or conventional action plans, transformation is pursued through curated systems of interconnected interventions that act on multiple leverage points simultaneously. Individual actions are not expected to generate change independently; rather, systemic effects emerge from their interaction and mutual reinforcement across governance, infrastructure, finance, innovation and behavioural domains (Climate KIC, 2019; European Commission, 2018).

Governance innovation is also reflected in cross-level and whole-of-government coordination models. These approaches frame governance as a co-production process, bringing together public authorities, private organisations, academia, civil society and communities as co-creators of transition pathways. Dedicated coordination structures and clearly defined roles are used to ensure continuity and implementation capacity across all phases of transformation, often embedding principles of equity and just transition (UN-Habitat, 2019; Ravetz and Connelly, 2020).

Further advances can be seen in monitoring, evaluation and learning frameworks that combine quantitative indicators with qualitative analysis of governance and implementation processes. Detailed documentation of contextual conditions enables learning and intentional transfer of practices between territories, supporting adaptation rather than direct replication (C40 Cities, 2018; Climate KIC, 2019).

These practices illustrate how transition frameworks address complexity, uncertainty and fragmentation. They provide practical entry points for planning climate-neutral transitions beyond city borders, particularly in peri-urban and functional territories.

6. Implementation status of the frameworks

The analysed transition frameworks show considerable variation in their degree of real-world implementation. Based on available evidence, four broad levels of implementation maturity can be identified: full implementation at scale; piloting or partial implementation; conceptual validation with limited operationalisation; and primarily theoretical or analytical development.

The highest level of maturity is associated with approaches embedded in large institutional programmes and formal policy processes. These are operational across multiple territories and supported by structured instruments that integrate long-term commitments, action planning, governance arrangements and financial mobilisation, thereby strengthening implementation credibility and investor confidence (European Commission, 2024; European Commission, 2025).

A second group comprises approaches that have been piloted through demonstrations, roadmaps and living lab environments. While coalition building, strategy development and pilot actions have been achieved in several regions, evidence remains stronger on process design and learning than on end-to-end implementation and outcome evaluation (Climate KIC, 2023; TRANSFORMER Consortium, 2024).

Other approaches have been applied selectively, with individual tools or components implemented in specific territories or experiments. In parallel, several transition approaches primarily operate as analytical or process-oriented frameworks, shaping governance thinking and policy design without functioning as standardised operational models (Loorbach, 2010; Schot and Geels, 2008).

Overall, the review highlights a diverse implementation landscape, reflecting differing objectives, institutional contexts and roles within climate-neutral transition planning.

7. Conclusions

Planning for climate neutrality beyond city borders requires a fundamental shift in how territories, governance arrangements and transition processes are understood and addressed. Peri-urban areas, characterised by functional complexity, mixed land uses and fragmented institutional landscapes, make this requirement particularly evident. They illustrate that climate neutrality cannot be achieved through city-focused, sectoral or linear approaches alone, but must instead engage with wider functional territories where key infrastructures, flows and land-use dynamics are located (UN-Habitat, 2019; OECD, 2023).

This case study has shown that existing transition frameworks provide a substantial body of principles, tools and practices for addressing complex and interdependent transformations. Recurring patterns such as systemic thinking, iterative and learning-oriented processes, portfolio-based intervention logics and participatory governance offer a strong methodological foundation for climate-neutral planning (Loorbach, 2010; European Commission, 2018). At the same time, a peri-urban perspective highlights the need for contextual adaptation, capacity

building and explicit attention to functional territories, land-use conflicts and external drivers influencing local and regional development (Ravetz and Connelly, 2020).

Innovative practices, including real-world experimentation at scale, governance instruments linking ambition to implementation, systems mapping and adaptive monitoring all indicate promising directions for future planning (Climate KIC, 2019; C40 Cities, 2023). Taken together, these insights underline that planning for climate neutrality beyond city borders is not a simple concern, but a central challenge for achieving collective climate objectives, requiring integrated, adaptive and collaborative approaches aligned with the realities of how territories function, connect and transform.

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