Chapter 1
The Challenge of Sustainable Urban Development and Transforming Cities

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Abstract Our quickly changing world faces great challenges when it comes to the sustainable provision of energy, food, shelter, water and welfare to a growing urban population. These grand challenges are increasingly taken up by cities that become the places where sustainable futures are emerging. This chapter introduces the theoretical and practical transition perspective taken in this book and describes its structure and outline. It frames the dynamics in urban development from the perspective of sustainability transitions: deep systemic transformations that are the result of destabilising unsustainable 'regimes' and emerging sustainable 'niches,' driven by transformative agencies and networks. This perspective highlights on the one hand the complexities, uncertainties, and resistance that come along with urban transitions as well as the mechanisms and patterns that enable and accelerate them, and provides the basis for new types of governance. We then describe the structure of the book. It first elaborates upon the theoretical ideas and governance approaches related to sustainability transitions. It then draws upon empirical evidence from applied transition management in European and Japanese cities. In the final part of the book, the authors reflect upon these experiences, to what extent they are comparative, and what can be learnt in general with regard to implementing urban transition strategies.

Keywords Cities • Urban sustainability • Sustainability transitions • Governance

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1.1 Urban Sustainability

It is increasingly argued that cities are at the frontline of sustainability: not only are cities most vulnerable to ecological, socioeconomic, and political crises, but they are also hotbeds of innovation and experimentation. Cities are entities in transition themselves as much as that they are the spaces within which novelties emerge. Cities themselves, however, do not constitute a monolithic agency: rather, they are composed of various agents, the organisations and the networks that build and make cities by continuously reshaping, redefining, and reenacting the urban milieu. The greatest part of all the daily actions, innovations and decisions, policy measures, and business strategies, aim to improve existing urban fabrics, economies, and (infra)structures. But the collective impact of urban life is persistently unsustainable, creating negative ecological impacts, social tensions and economic crises. In spite of decades of attention to sustainability, human development is locked into an inherently unsustainable pathway. Taking the perspective of sustainability transitions (Grin et al. 2010), it is argued that deeper and more fundamental shifts are required towards different cultures, structures, and practices that are *inherently sustainable* rather than *less unsustainable*.

There are increasingly strong signals of the emergence of such deeper changes. Sustainable technologies are maturing after decades of experimentation. Across the globe 'translocal' networks of transformation are emerging, developing inherently sustainable alternative systems such as complementary currencies, renewable energy and food collectives and transition towns. Driven by the possibilities of the internet, the availability of open access data and knowledge, and with transformative entrepreneurial capacities, individuals all over the world are linking up in transformative networks. This emerging network society is changing the world collectively in a fragmented, decentralised, and self-organising way—without global negotiations, local agendas, or top-down planning, but through dedication, creativity, persistence, patience, hard work, failure, and recovery. We argue that this transformative human energy could be the most promising development to accelerate towards sustainability. But also that the modern cities with their top-down institutions, hard infrastructures, unsustainable energy systems, dependence on external resources, and unsustainable levels of consumption will not give way easily. This is what we call transforming cities: the uncoordinated yet globally emerging movement in cities where innovative new sustainable solutions are being experimented with, shared, scaled and translated at increasing speed.

Confronting this new reality requires new approaches to governance and change, to help accelerate and guide these emerging sustainability transitions. As we have known for decades, our current pathway of development is not sustainable, and regular policy so far seems unable to shift course. Developed countries are increasingly crossing the ecological, social, and economic boundaries within which production and consumption patterns can be sustained, leading to a variety of problems, crises, and tensions. Rather than addressing these tensions through efficiency increases, technological innovation, and regulatory interventions, transition studies (Rotmans et al. 2001; Grin et al. 2010) suggest that inevitably more

unpredictable and chaotic structural changes will take place. As much as such transitions could lead to less desirable futures and collapse, such transitions also offer the possibilities for the relatively rapid breakthroughs that are deemed necessary to achieve global sustainability goals. Actively anticipating and adapting to the dynamics of transitions, transition management (Loorbach 2010) is therefore considered as a way to increase the chances for sustainability transitions.

1.2 Sustainability Transitions in Urban Areas

In this millennium, the global urban population exceeded the rural population for the first time in history (Seto et al. 2010); at present, more than half the world's total population lives in cities (Crosette 2010). As a consequence of the global urbanisation trend, the greatest demand for energy, food, water, buildings, waste management, healthcare, education, and other basic services is concentrated in and around cities. Along with the problem of satisfying increasing demand, through the unwanted by-products of the unsustainable sociotechnological systems in place, cities are responsible for the largest proportion of environmental impacts. Worldwide, cities are responsible for almost 75 % of total resource consumption (Madlener and Sunak 2011) and the primary source of greenhouse gas (GHG) emissions (Grimm et al. 2008). Overall, cities account for at least 70 % of energy-related GHG emissions. Sustainability problems can be found in almost all sociotechnological systems needed to "run cities." As such, cities are the locations where most of the (un)sustainability issues find their origin. In contrast, cities are also locations for sustainability innovation and societal progress; cities can even be considered as potential 'drivers' for sustainable development (Rotmans et al. 2000) or 'hubs' for radical sustainability innovation (Ernston et al. 2010; Bulkely et al. 2012). Instead of seeing cities as centralised bureaucracies or static entities, we follow the more recent conceptualisation of cities as multifaceted 'municipalities' behaving as self-governing entities on sustainability issues (Burstrom and Korhonen 2001). In this view, cities take the lead in sustainability solutions. And although they might not be the exclusive locations to advance sustainability transitions, cities can at least play an important role on two levels: as 'actors' with regard to (re)developing sociotechnological systems and as facilitators of locations for sustainability innovations (Geels et al. 2011). Agents, in general, can "push policy" towards promoting sustainability on the street level, along with (re)structuring the city's infrastructure, and facilitating larger-scale environmental, social, and economic innovations throughout the world.

This insight that cities are 'actors and locations' of sustainability transition is not new. Many ambitious sustainability initiatives have already emerged at the level of cities and metropolitan regions, such as the Covenant of Mayors and C40 climate coalition. From a transitions perspective, we argue that although indeed the potential for accelerating towards sustainability is there, cities are not automatically able to proactively anticipate and adapt to such possibilities. More important, when

cities do take up their role as actors, the available 'development' policies so far seem insufficient to guide and accelerate deeper systemic change towards sustainability. Although development policies have added to economic and technological improvements in many cities around the world, simultaneously global consumption and the waste and emission levels stemming from these improvements have continued to increase. In this view, regular urban policies and cities' governance structures focus too much on "straightforward" economic development and standard technological solutions, whereby adaptive and transformative strategies for sustainability are needed. Sustainability is too often considered as a separate domain of secondary policy concern, mainly because it is dominantly perceived in the realm of short-term economic calculus. Thus, its advance is perceived as very costly and uncertain. Clearly, it takes massive investments to (re)structure cities' sociotechnological systems towards sustainable functioning. Still, the transition perspective suggests that no matter the high costs and level of uncertainty, the costs of inaction are in the longer run always higher. Because sociotechnological systems are embedded in societies, which in turn are embedded in their environment (Giddings et al. 2002), the persistent unsustainability inevitably will lead to a deep crisis in the current systems and their possible collapse. The primacy of short-term economic concerns in policy making is shortsighted, as the operation of economic systems is dependent on the sustainable functioning of sociotechnological systems as well as their societal and environmental surroundings.

Awareness of the unsustainability of our current developments pathways reached the global stage with the introduction of the notion of *sustainable development* by the so-called Brundtland commission in the 1980s; they defined it as "Meeting the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987). The report concluded, in line with studies such as the "Limits to Growth" report, that there is an inherent unsustainability in the dominant development pattern. We are still locked into an unsustainability pathway, even after three decades of research, policy, and debate seeking to define, operationalise, and implement sustainable development. It can therefore be argued that sustainable development in its current institutionalised forms has become part of sustaining systemic unsustainability (Loorbach 2014) and that we need to fundamentally reconsider this notion and how it should be operationalised in practice. To do so, we start from identifying common ground as well as seek to identify seeds of transformative social change towards inherent sustainability rather than incremental change leading to reduced unsustainability.

A common ground is found in that it encompasses social, environmental, and economic prosperity, here and in other places, now and in the future. What this exactly means differs from situation to situation, as the needs of people vary, depending among others on historical, political, economic, social, and ecological circumstances and developments. The many forms of unsustainability in Western societies are visible in the form of what we call persistent problems. Examples of such problems at different scale levels are climate change at a global level; the agricultural problem at a continental scale, with animal diseases such as bird flu, mad cow disease, and foot-and-mouth disease; and the mobility problem at a

national level with traffic congestion and air pollution from increased mobility (Rotmans et al. 2007). These problems are complex, as they are deeply embedded in societal structures and institutions. They have multiple causes and consequences, and their reach extends beyond a wide range of societal domains, people, and scale levels.

A clear example of this is the unsustainability of our current energy systems and how this impacts urban life. Most modern cities that historically had their own energy supply now depend on national energy grids and power plants running on fossil fuels in a liberalised market. Cities experience the effects of pollution, price volatility, and dependence upon foreign supply but often do not have the position or instruments to change this. Alternatives have for long been considered as politically contested or too small in scale to replace current options. The interests, investments, and stakes in the current fossil-based regime are high, so that structural change cannot be expected to be initiated by the vested parties, also called regime, which is defined as the dominant constellation of structures, culture, and practices in a certain societal system. But now many cities are putting substantial efforts into developing new urban energy solutions, which range from stimulating energy efficiency, to diffusing renewable technologies, to developing waste-heat systems or smart grids. Cities are in this way providing space for radical alternatives to the dominant fossil fuel-based and centralised energy system, thereby becoming important change agents in transitions. It is, however, in practice a rather chaotic and uncoordinated process in which different cities explore different strategies, solutions, and technologies, depending on their local context, challenges, and potential. In terms of transition governance, developing a sustainable energy system thus is not a process of planning and control but requires clever organisation and facilitation through creating room for self-organisation, experimentation, and learning.

A transition, then, is a structural change in a societal system or subsystem that is the result of a co-evolution of economic, cultural, technological, ecological, and institutional developments at different scale levels. A transition consists of a number of system changes, which are organisation-transcending innovations that fundamentally alter the relationships between companies, organisations, institutions, and individuals in a certain field or domain (a subsystem). Transitions at this societal level could take up to two generations to materialise and thus require concerted efforts that go beyond the time horizon and possibilities of individual organisations or even the government alone. To direct transitions towards sustainability, new modes of governance are needed that take into account the long time horizon, the uncertainties and complexities, and the multitude of persons and interests involved. Transitions therefore imply different roles and practices from individual factors involved, such as companies, scientific institutes, governmental organisations, or NGOs.

Transition studies as a scientific field have during the past years developed five important perspectives for analysing sustainability transitions in urban areas:

1. *The niche perspective:* a focus on microlevel innovations that have the potential to radically change the urban fabric and social practices towards sustainability even when these changes are costly, novel, and spatially segmented.
2. *The multi-phase perspective:* a holistic and dynamic understanding of the multiple phases (i.e., pre-development, take-off, and lock-in) and the associated dynamics that a transition process can display.
3. *The co-evolution perspective:* the conceptual tools to understand what contributes to evolutionary interactions between environment and societal transformations happening over a long period of time in an incremental way.
4. *The multi-pattern perspective:* the different patterns of processes in which transitions can proceed when considering policy, institutions, technology, and agency dynamics.
5. *The multi-level perspective:* the different levels of dynamics in which interlevel and intralevel interactions influence the transition as a whole.

In combination, these five (non-exclusive) perspectives make up the basis for transition analyses and provide valuable insights when trying to discover possible management strategies for transitions in specific urban areas. One of the key characteristics of the transition perspective is that it focuses on the niche experiments and incremental multisectoral co-evolution rather than transformation based on top-down initiative. The perspectives are also based on generic concepts, which allow for adaptation in context-specific circumstances. The concepts of niches, multi-phases, co-evolution, multi-patterns, and multi-levels acquire different meanings along with the characteristics of the sociotechnological and societal system under study (Frantzeskaki and Loorbach 2010), which makes them applicable in various situations (e.g., resource scarcity, pollution, climate change, loss of biodiversity, and waste management), especially those wherein the transition dynamics are still developing and underdetermined at the time. The five perspectives provide concepts for innovation and "stepping stones" for crossing theoretical gaps to an adaptable framework for proactive transition management of specific sustainability problems in a certain urban area.

1.3 Governance of Urban Sustainability Transitions

Cities are perhaps the most suitable level of application of transition management in many ways: because of the multiple dynamics occurring at this level and the concrete level of application, but also because of the close relationship between those participating in transition programs, transition arenas, and transition experiments. It is argued that cities are simultaneously the places confronted with the impacts of unsustainability and therefore also a proper context for experimentation with new solutions. In that sense cities are 'transition machines,' producing the innovations driving and accelerating larger-scale transitions. It is a level where

results can be concrete and accessible to a broader group: if these are missing, this will also not go unnoticed. On the other hand, we need to remain critical whether cities are the actual level where a lever for system change can be enacted.

The transition management perspective suggests that, in cities, a number of (often interwoven) economic, technological, and institutional barriers exist to act and invest in sustainability innovation. These barriers create a lock-in not only of unsustainable systems already in place but also in the problem solving of future developments. One of the main characteristics of this lock-in is the managerial focus on merely addressing sector-specific and "manageable" problems through formalised policy-making processes (Loorbach and Rotmans 2010). From a transition management perspective, we perceive cities as complex adaptive systems; namely, that to a large extent cities are self-organising systems with emergent properties and adaptive capabilities that add to the sustainability problems or both solutions. Therefore, they can defy tightly structured top-down control (Nevens and Roorda 2014). In this view, the problems that regular policies try to solve, such as pollution, emissions, and congestion, are often only the symptoms of underlying systemic problems.

The complexity and persistence of the challenges we are facing are indeed pervasive and severe at a city level. But here we should not disregard the city's global impact. To contribute to solving sustainability issues, the view on cities needs to transcend the (perceptive) barriers of spatial scale, because global issues do not immediately relate to action at the street level. Global sustainability problems caused on the city level imply that (multi)national, regional, and local governance structures cannot tackle them alone. The different levels of scale require a multiscale approach that can zoom in and out from the macro- to the meso- to the microlevel, and vice versa. Solutions require broadly carried "bottom-up" initiatives and innovations that can connect and interact with governance structures and "top-down" policies on higher levels. In this way, cities can act as a facilitator of sustainability transitions, in terms of committing to long-term investments in sustainable sociotechnological (infra-)structures that create space for the emergence of more sustainable alternatives (Loorbach et al. 2010). However, because global issues go beyond classic terms of local policy cycles, and the long-term investments span multiple terms (perhaps even generations), the temporal scale (i.e., "not in my term") of policy making should be extended. In addition, the institutional scale should be more prominently addressed, as global problems are easily considered 'not my personal business,' and local autonomy is often too restricted by central governance to act effectively against global problems on a local scale (Bai 2007).

This is where the approach of transition management, translated to the urban context, is increasingly seen as promising to help guide and accelerate the emerging transitional dynamics in cities (see Wittmayer and Loorbach, Chap. 2, this volume; Frantzeskaki and Loorbach 2010; Frantzeskaki et al. 2012; Jefferies and Duffy 2011; Loorbach et al. 2009; Vergragt and Brown 2010; Wittmayer et al. 2015; Nevens and Roorda 2014). The transition management approach provides a number

of basic governance starting points, a governance framework and specific policy instruments applied in the specific context of urban areas. It provides a way to analyse, describe, and reflect upon emerging transformative governance processes and networks, and as well it can be used to proactively develop transition arenas, experiments, and network building on present activity. Although in its early years transition management (Rotmans et al. 2001; Loorbach 2007) was mainly applied on a sector level or a (subnational or) regional scale, cities seem perhaps an even more natural context in which to apply transitionmanagement.

Since 2001, experiments have been emerging in the Netherlands (and to some extent in other Western European countries) with the approach of transition management. Basically, this approach starts from the conceptualisation of structural societal change as a transition: a long-term, multilevel process of change in which distinctive phases of changes can be distinguished. The transition concept (Rotmans et al. 2001; Geels 2002; Berkhout et al. 2004; Elzen et al. 2004; Meadowcroft 2005; Van der Brugge and Rotmans 2005), which has been evolving over time, is used to analyse and understand the dynamics of structural change in societal systems. Based on insights in the dynamics of change, transition management offers a basic starting point for influencing the speed and direction of such ongoing transitions towards sustainability.

Key elements in the transition management approach are frontrunner networks that develop an integrated understanding of their common transition challenge and a desirable future perspective; a shared transition agenda as a roadmap for social innovation; transition experiments as innovation icons to implement parts of the future agenda; and monitoring, evaluation, and adaptation. By together developing such activities and constantly deepening the collective understanding of the societal transition of which the actors are part, reflexive and strategic capacity is being built up within an evolving network. Over time, this enables participants to engage in direct competition with existing regime actors and networks.

The point of transition management is that urban governance—from the (inter) national to the street level—can only advance a global sustainability transition by developing alternative means, strategies, and instruments that acknowledge the problems that come along, managing highly complex processes on different scales, but also the opportunities present in the self-organising dynamics. Transition management experiments show that such "new modes of governance" can influence the speed and direction of transitions in a subtle and indirect way, namely by facilitating location and stimulating actor dynamics across sectors that move towards sustainability, and in the process come up with innovative ways to get there eventually. These dynamics include different perspectives, addressing several aspects of the transition in multiple phases, domains, and on multiple levels. It is also important to note that tensions in incumbents can be drivers for transition, synchronising with the dynamics in wider society.

References

Bai X (2007) Industrial ecology and the global impacts of cities. J Ind Ecol 11(2):1–6

Berkhout F, Smith A, Stirling A (2004) Socio-technical regimes and transition contexts. In: Elzen B, Geels FW, Green K (eds) System innovation and the transition to sustainability. Edward Elgar, Cheltenham

Bulkely H, Broto VC, Edwards G (2012) Bringing climate change to the city: towards low carbon urbanism? Local Environ 17(5):545–551

Burstrom F, Korhonen J (2001) Municipalities and industrial ecology: reconsidering municipal environmental management. Sustain Dev 9(1):36–46

Crosette B (2010) State of world population 2010: from conflict and crisis to renewal. United Nations Population Fund, New York

Elzen B, Geels FW, Green K (eds) (2004) System innovation and the transition to sustainability. Edward Elgar, Cheltenham

Ernston H, Van der Leeuw S, Redman C, Meffert D, Davis G, Alfsen C, Elmqvist T (2010) Urban transitions: on urban resilience and human-dominated ecosystems. AMBIO 39(8):531–545

Frantzeskaki N, Loorbach D (2010) Towards governing infrasystem transitions: reinforcing lock-in or facilitating change? Technol Forecast Soc Chang 77(8):1292–1301

Frantzeskaki N, Loorbach D, Meadowcroft J (2012) Governing transitions to sustainability: transition management as a governance approach towards pursuing sustainability. Int J Sustain Dev 15(1/2):19–36

Geels FW (2002) Understanding the dynamics of technological transitions: a co-evolutionary and socio-technical analysis. Universiteit Twente, Enschede

Geels F, Kemp R, Dudley G, Lyons G (2011) Automobility in transition? A socio-technical analysis of sustainable transport. Routledge, New York

Giddings B, Hopwood B, O'Brien G (2002) Environment, economy and society: fitting them together into sustainable development. Sustain Dev 10(4):187–196

Grimm NB, Faeth SH, Golubiewski NE, Remand CL, Wu J, Bai X, Briggs JM (2008) Global change and the ecology of cities. Science 319(5864):756–760

Grin J, Rotmans J, Schot J, Geels F, Loorbach D (2010) Transitions to sustainable development. Part 1. New directions in the study of long term transformative change. Routledge, New York

Jefferies C, Duffy A (2011) The SWITCH transition manual. University of Abertay, Dundee

Loorbach D (2007) Transition management. New mode of governance for sustainable development. PhD thesis. Erasmus University, Rotterdam

Loorbach D (2010) Transition management for sustainable development: a prescriptive, complexity-based governance framework. Governance 23(1):161–183

Loorbach D (2014) To transition! governance panarchy in the new transformation. DRIFT/EUR, Rotterdam

Loorbach D, Rotmans J (2010) The practice of transition management: examples and lessons from four distinct cases. Futures 42(3):237–246

Loorbach D, Frantzeskaki N, Meadowcroft J (2009) Discovering sustainability: a transition approach towards sustainable development. IHDP conference on governance and sustainability. Bonn, Germany

Loorbach D, Frantzeskaki N, Thissen W (2010) Introduction to the special section: infrastructures and transitions. Technol Forecast Soc Chang 77(8):1195–1202

Madlener R, Sunak Y (2011) Impacts of urbanization on urban structures and energy demand: what can we learn for urban energy planning and urbanization management? Sustain Cities Soc 1(1):45–53

Meadowcroft J (2005) Environmental political economy, technological transitions and the state. New Polit Econ 10(4):479–498

Nevens F, Roorda C (2014) A climate of change: a transition approach for climate neutrality in the city of Ghent (Belgium). Sustain Cities Soc 10:112–121

Rotmans J, Kemp R, Van Asselt M, Geels F, Verbong G, Molendijk K (2000) Transities & transitiemanagement: de casus van een emissiearme energievoorziening. ICIS/MERIT, Maastricht

Rotmans J, Kemp R, Van Asselt M (2001) More evolution than revolution: transition management in public policy. Foresight 3(1):15–31

Rotmans J, Loorbach D, Kemp R (2007) Transition management: origin, evolution, critique. DRIFT/Erasmus University Rotterdam, hdl.handle.net/1765/37240

Seto KC, Sánchez-Rodríguez R, Fragkias M (2010) The new geography of contemporary urbanization and the environment. Annu Rev Environ Resour 35:167–194

Van der Brugge R, Rotmans J (2005) Towards transition management of European water resources. Water Resour Manag 21(1):249–267

Vergragt PJ, Brown HS (2010) Managing urban transitions: visioning and stakeholder collaboration. A case study in transforming residential housing in Worcester. George Perkins Marsh Institute, proceedings of Sussex Energy Group conference: energy transitions, Sussex

WCED (1987) Our common future. University Press, Oxford

Wittmayer JM, Rok A, Roorda C, van Steenbergen F (2015) Governing sustainability: a dialogue between Local Agenda 21 and transition management. Local Environ. Online first. doi:10.1080/13549839.2015.1050658