

## CHAPTER 2

# The challenges to urban sustainability and resilience

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*Peter W. Newton and Peter Doherty*

### 2.1 Introduction

Perhaps the single most important challenge for the twenty-first century is to work towards a more resilient and sustainable urbanized world. In this global strategic urban context, *resilience* concerns the capacity of an urban system – including its natural, built, social and economic elements – to manage change, learn from difficult situations and be in a position to rebound after experiencing significant stress or shock, while *sustainability* questions whether or not certain aspects of our daily activities, and the systems within which they operate, can be continued indefinitely into the future, again from a social, economic and environmental perspective.

With a prediction that by 2050, around 75 per cent of an estimated global population of 9 billion will live in urban environments (UNDESA 2012), cities will clearly play a large role in determining whether the world will be a more sustainable place. An ever-growing catalogue of reports (UNEP 2012; UNCSO 2012; Franklin and Andrews 2012) highlights a list of critical issues for cities that will inevitably intensify by mid-century. The need is to start confronting these now with a process of concerted, well-considered actions.

In this chapter we seek to highlight briefly some of the pressures – both exogenous (external origin) and endogenous (local origin) – that impact urban areas and what might be done as a context for framing the urban challenge: *what cities need to prepare for*. Other sections of the book will focus in more detail on specific interventions designed to enhance resilience and sustainability.

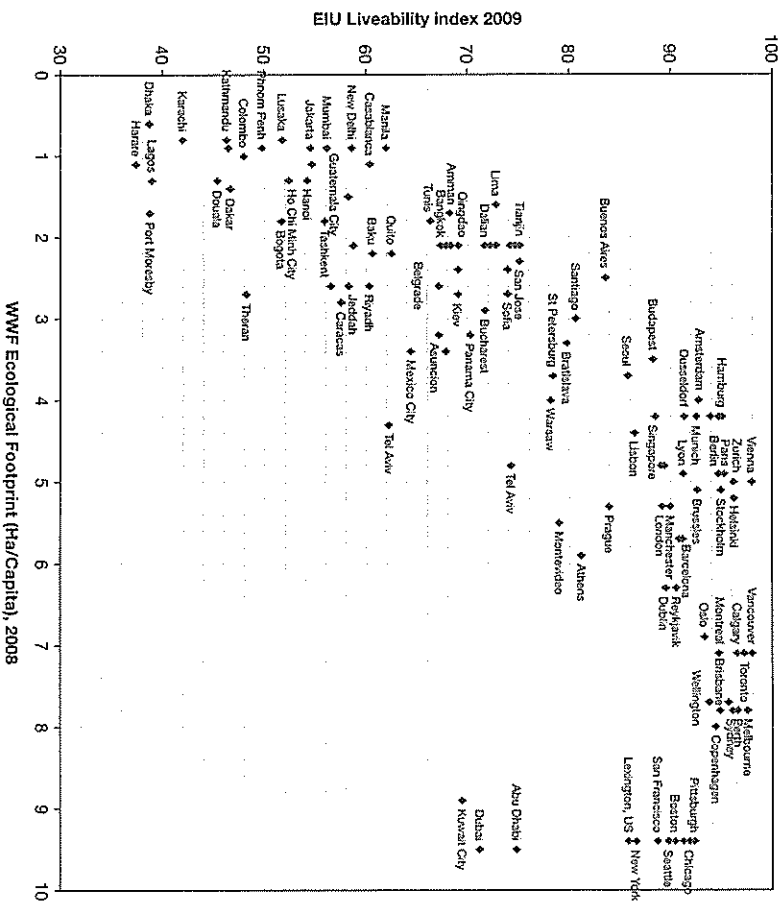
### 2.2 Exogenous pressures

As cities become increasingly connected in a globalized world, sets of exogenous pressures are likely to exert greater impact than has been the case in even the recent past. Pressures can also be categorized along a 'slow burn' versus 'fast moving' continuum. For example, climate change, ageing infrastructure, ageing population, resource consumption and quality of human capital can be seen as slow-burn issues that change almost imperceptibly year by year and are often ignored by short-sighted planning, but have significant cumulative impact over decades. In contrast, sudden, fast-moving events such as a financial crisis, earthquake, any extreme weather event, breach of biosecurity, unexpected surge in population, as well as a

major infrastructure disruption, to name a few, have immediate impact. How well a city's long-term planning strategies, management processes, urban system efficiency and redundancy and emergency response capacities are developed for a particular jurisdiction will be key indicators of local resilience and sustainability.

**Resource constraints**

The social and economic repercussions of living in a finite world are increasingly evident. Cities in high-income societies have built their acknowledged profiles of liveability on what are now known to be unsustainable and inequitable levels of resource consumption (see Figure 2.1). As developing countries industrialize and modernize, and developed countries maintain their consumption patterns, these resource pressures are intensifying. Current estimates indicate that natural resources are being consumed annually at a rate 50 per cent higher than the planet can replenish (WWF 2012). If our vision for twenty-first-century living is limited simply to



continuing down the present path, there are obvious resource constraints that will influence future urban development. Principal among these are:

- Petroleum: globally, the growth in demand for oil is exceeding that of new supply from readily accessible sources (see Newman et al. 2009 for a discussion on peak oil) – a looming challenge for urban populations that are car dependent (Dodson and Sipe 2008). The uptake and/or development of alternatives to the internal combustion engine (ICE) vehicle in the form of hybrid, electric and hydrogen cars remains some way off (in Australia, petrol/electric hybrids comprise less than 0.5 per cent of all new vehicle registrations). Used in combination with the more active transport (walking, cycling) being redesigned into cities, such initiatives provide some optimism for a more resilient and sustainable future for urban travel.
- Arable land: land on the urban fringe of cities, often among the most productive for intensive agriculture, continues to disappear under slabs of concrete and bitumen in all continents, often at a rate exceeding that of population growth (Roberts 2007; European Environment Agency 2011; Sobels et al. 2010). The negative consequences for a range of ecosystem services such as fresh food, biodiversity, recreational green space, air quality and heat island effects seem blindingly obvious to all except the less sophisticated property developers and local politicians. A new logic for more intensified forms of urban development is now emerging in response to demands for more compact cities (Newton et al. 2012b).
- Water: the supply of water, especially where dependent on diminishing (and increasingly contaminated, e.g. with arsenic or salt) aquifers, also looms as a threat to urban development in low/variable rainfall regions unless augmented by integrated urban water systems (recycling of stormwater and wastewater) and desalination or inter-basin transfers, each having a different triple-bottom-line (TBL) outcome (Hoekstra and Chapagain 2007).

**Climate change**

Significant and sustained growth in anthropogenic greenhouse gas (GHG) emissions has long been scientifically linked to climate change at a global level, ushering in a new source of instability for twenty-first-century society linked to the challenges posed by severe and unpredicted weather events, increased incidence of both extreme heat and cold, rainfall variability and rising sea levels due to both temperature-related expansion of the oceans and the melting of land-based ice masses. Impacts on food production and low-lying human settlements are of particular concern. A recent Australian government report (Department of Climate Change and Energy Efficiency 2011), for example, identifies more than \$226 billion of coastal commercial, light industrial, residential and road and rail assets potentially at risk by 2100. Insurance companies have begun to factor these risk elements into their premiums.

Until quite recently, human settlements have not been required to take account of the effects of rapid climate change on either their location or their design.

That was understandable in the past, but it is unforgivable if we now ignore the growing potential for catastrophic economic and human displacement from vulnerable regions. The whole march of civilization from the beginnings of agriculture to the industrial age has occurred through the relatively mild weather systems of the Holocene. Before that, the small numbers of hunter-gatherers who were our distant ancestors would simply relocate to more hospitable regions. Now, both the human population size and our reliance on the 'hard' infrastructure of ports, housing, roads and the like make any such move extraordinarily difficult, if not impossible.

Responsible for more than 80 per cent of the world's GHG emissions (Zaellick 2011), cities are both the current villains and the future white knights as they hold the key to GHG mitigation (Newton et al. 2012b). Currently, the application of the precautionary principle (in this context, adaptive planning and urban redesign in response to climate change scenarios) is highly variable for different regions, as reflected in the diversity of municipal government practices identified in recent surveys (Doogue and Bardsley 2012). This lack of awareness and commitment, combined with a culture of denial, constitutes a major impediment to developing community resilience and sustainability in the event that GHG emissions are not capped at present levels.

#### *Extreme events*

Some categories of extreme events – such as prolonged drought, flash flooding, cyclones (hurricanes), storm surges, coastal inundation and megafires – can be seen as harbingers of more frequent (than has historically been the case) return periods under projected climate change scenarios. Other extreme events, such as earthquakes, can have equally devastating consequences. To minimize the consequences to life and property that follow when an extreme event impacts a city (given the scale effect), or a smaller settlement for that matter, it is necessary for *planning* to limit the extent of built environments in high-risk areas and *design* to ensure codes and standards for building are aligned to the level of threat identified. We need to change the rules, but there are strong pressures against both from the property development and property owning sector. Governments should legislate now to ensure that there is no future taxpayer-funded commitment to cover insurance, replacement or adaptation costs for those who insist on building in vulnerable areas. Those who deal with such matters might also look at establishing a legal framework for ensuring that those who do foster such developments will, at a minimum, be financially liable in the very long term.

#### *Population change*

Population change can be reflected in fast-growing cities such as those in the Asia-Pacific (including Australia and some US regions) versus the shrinking numbers in some European, Japanese and other US cities. Both create challenges for future urban planning, as outlined by Roberts and Kanaley (2006) and Hollander (2011),

respectively. For fast-growing cities, the problem is that the planning and delivery of accessible housing and urban infrastructure increasingly lag demand. Greenfield developments continue to be viewed by both government and industry as an easier option compared to brownfield and greyfield redevelopment. Consequently, the increasing blight of treeless, car-dependent suburbs with 'zero lot mega-mansions' represents a measure of our collective unawareness. Similar trends have been observed in Asian (Roberts and Kanaley 2006) and European cities (European Environment Agency 2011). Ireland, Spain and the US, for example, are currently dealing with the consequences of massive over-building in greenfield sites, with the likelihood that some of these developments will have to be bulldozed. Signs are emerging that mortgage stress and collapse of the housing sector could become more widespread in an uncertain global financial climate.

Where the numbers of (particularly young) people are decreasing, the challenges lie in dealing with distressed neighbourhoods, an ageing population and how to (re)direct investment in infrastructure and services to these areas. The sustainability of urban development in either setting will depend significantly on the extent to which principles of *green urbanism* can be encapsulated in the process and practice of metropolitan planning – in particular, the regeneration of inner- and middle-ring suburbs (Newton et al. 2012a).

#### *Urbanization and intensification of urban development*

Cities are the principal demographic absorbers of global population growth. For many developed countries, the urbanization process (i.e. population shift from country to city) has matured, but for others, particularly in Asia, the process is highly active, resulting in the rapid growth of megacities. Urban growth in the developed countries continues to occur, fuelled by high levels of immigration which, as global population pressures grow and vulnerable cultures are overwhelmed by events, can be expected to increase in the future (south to north, east to west). As a consequence of this continued urban growth, intensification processes are being explored in the context of urban redevelopment, with the objective of building more compact cities (OECD 2011a). The most recent phase of urbanization and city building (i.e. post-1950), which has found expression in North American, South American, Asian, Australian and a selection of Gulf State cities (but less so in Europe), unfolded in an era when planning practitioners, politicians and populations alike acknowledged few, if any, resource or environmental constraints on urban development (Rees and Roseland 1991). This era has now ended – liveable cities must also be sustainable and have a globally equitable ecological footprint (Newton 2012). Here again, green urbanism has been advanced as a new paradigm for sustainable city planning (Lehmann 2010; Beatley 2000).

#### *Biosecurity*

Crowded urban environments are more vulnerable to various forms of biosecurity attack as a consequence of malevolence (bio-terror, military action) or from natural events. Indeed, 'The question is not whether a new pandemic will emerge, but

when and how the world will respond' (Howard 2012, p. 27). The most recent pandemic to sweep the globe (H1N1/swine flu in 2009) is thought to have caused around 1,600 deaths in Australia, more than eight times the number officially recorded (Cresswell 2012). According to recent estimates from the US Centers for Disease Control and Prevention, as many as 570,000 people may have succumbed globally, despite the fact that the elderly (normally the most vulnerable group) were apparently protected by prior exposure to a similar virus that circulated prior to 1950 (Dawood *et al.* 2012). In this relatively mild pandemic, however, there was still a problem with metropolitan emergency rooms being crowded by the 'worried well', an ideal situation for maximizing transmission. Furthermore, critical care beds are generally at a premium even when the more familiar 'seasonal' influenza strikes.

In this context, it is essential that the responsible public health authorities are appropriately resourced from the tax base (this can never be covered primarily from the private sector) and that their emergency planning is regularly updated in ways that lead to awareness at the grassroots level. During the recent 'bird flu' scare, for example, planning in the US went down to the level of local municipalities and school districts. In some ways we are better off when it comes to this type of emergency than in the past, because modern mechanisms of communication (mobile phones, the internet) allow greater physical separation combined with the benefits of telepresence. Communication delivered by electronic means is obviously safer in a biosecurity context than face-to-face interaction.

Apart from planning, improving the capacity for rapid vaccine development and production, and increasing awareness on the part of the broader population, the economic realities are such that there is no sure-fire strategy for minimizing the consequences of a novel pandemic. Previous experience tells us that people in the poorer countries will be most vulnerable, particularly those living in crowded conditions with many underlying health problems. Such issues relating to poverty and under-development need to be addressed in other contexts, and are not restricted to the present topic (Doherty 2013).

#### *Financial uncertainty*

The volatility in international financial markets that has characterized the period since the global financial crisis of 2007–08 appears likely to continue in the short to medium term. As the recent (July 2012) Libor scandal in the City of London has shown, there is still much that needs to be put right. Government rescues of key financial and business organizations and massive pump-priming of national economies have combined to expose sovereign risk and its tentacles as a major threat to a wide spectrum of supply-side private and government investment. From the demand side, high household indebtedness that existed prior to the crisis, combined with significant reductions in returns from property, equity and super-annuation investments and stalled employment opportunities in many countries, mirrors anxieties on the supply side. It all adds up to a difficult environment for investment in sustainable development, where the business case for achieving TBL outcomes remains a challenge for most firms.

### **2.3 Endogenous pressures**

Many of the endogenous stresses of a city emerge as a result of the (in)adequacy (quantity and quality) of key urban stocks: physical infrastructures such as housing, energy, water, transport and communication; and social infrastructures such as health and education, as well as social and human capital. The performance in each of these urban domains across cities is difficult to assess and generalize within one nation, much less internationally. There are, however, a number of persistent challenges for the built environment professions globally.

#### *Vulnerable infrastructure*

Significant components of the physical infrastructure of cities in developed, developing and under-developed societies are nearing the end of their design life performance, and, with increasing demand, pressure is mounting on the standard of service they are meant to provide. The low ratings now being reflected in 'infrastructure scorecard' studies testify to their decline. Given both the national and local significance of infrastructure (typically a nation's greatest asset) in delivering economic and social benefits, continued under-investment in capital works is a common feature in many urban economies (Regan 2008). The idea prevalent among, for example, much of the US electorate that infrastructure can somehow be provided in the absence of tax revenue (or some appropriate system of charges for use) is clearly unworkable, though attractive to political ideologues. Another class of threat to critical urban infrastructure elements like energy, water, transport and telecommunications (in addition to obsolescence and climate change) is cyber-terrorism and cyber-crime (Brenner 2011). The level of vulnerability to malevolent or natural (earthquake, floods) disruption is also greatly enhanced by the reliance that all infrastructures now have on increasingly integrated computer-communications networks.

#### *Socio-demographic change*

A raft of issues related to population demographics and change are represented in cities. Each major age cohort ('generation'), for example, tends to introduce a different set of demands. The 'baby boomers' have been a classic example as they have redefined demand for a wide range of urban services since the late 1940s, spanning health (maternity) care, primary–secondary–tertiary education, housing and leisure. As they age, this cohort continues to exert a major impact on urban cityscapes via new demands on housing, transport and health services geared to the needs of a more elderly population. What might be the housing and locational preferences of the cohorts that follow? Will they favour different living and working environments? The preferences held by particular population segments will also be influenced by the impact of the increasing income inequalities (between rich and poor, young and old) that are characterizing wealthy societies and the extent to which they can be constrained or redressed (OECD 2011c). Financial inequality translates into spatial inequality (segregation) via the operation of urban housing

markets and is reflected in the variability in neighbourhood amenities evident in today's cities. The greater social complexity of twenty-first-century cities adds to the challenges and costs of urban service delivery and is ultimately reflected in the levels of wellbeing among resident populations.

#### *Social and human capital*

Stocks of human and social capital play significant roles alongside natural capital, financial capital and built environment capital as key pillars of a resilient and sustainable society. 'Bowling alone' (Putnam 2000) became the metaphor symbolizing a decline in social capital within the world's wealthiest nation, marked by a reduction in active engagement in civil society and social/community networks. These findings have been mirrored elsewhere (Ferguson 2012). There are complexities associated with measurement of social capital that inhibit spatial and temporal comparison, but there is broad agreement regarding its significance in the social and economic functioning (especially resilience) of cities and society (Allen Consulting Group 2002). Human capital is more readily defined in terms of attributes involving level of education and training and human health (critical social infrastructure linkage) and their connection with workforce productivity and income (Banks 2010). International league tables (such as the United Nations' Human Development Index) indicate how particular countries perform (see Figure 2.2), with clear implications for national economic and social wellbeing.

#### *Urban economic base*

The green economy has been advanced as the sixth major socio-technical transition to emerge in human history, with a capacity for major urban transformation to create the eco-cities of the future (Newton and Bai 2008; OECD 2011b). This follows logically in the wake of earlier post-industrial transitions: to a service economy, information and knowledge economy and creative economy, each of which displays a different spatial logic in its operation compared to its predecessor. These different

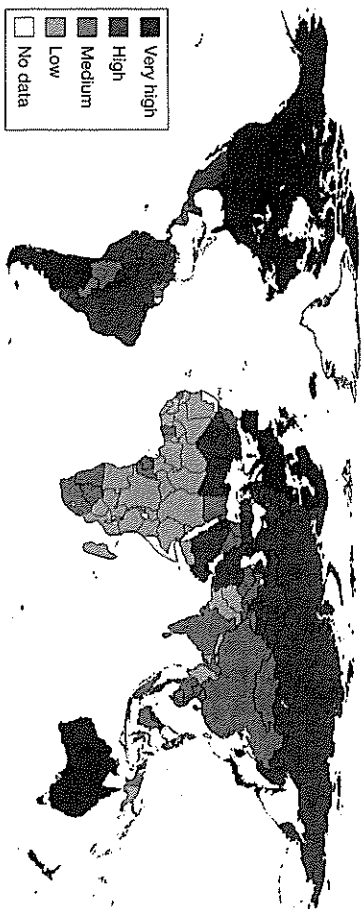


Figure 2.2 Human Development Index 2011  
Source: UNDP (2011)

locational preferences by both employer and employee groups need to be understood on an industry-by-industry basis by those charged with the responsibility for shaping the future of metropolitan regions. To enable this latest major sectoral and spatial transformation – to a green economy and eco-cities – there needs to be an associated critical mass of new enabling technologies capable of being linked to a clearly recognizable and pressing need in the marketplace. In this instance, the challenge of sustainable urban development. Part of the problem in instituting such advances is that old, powerful interests can be threatened and act to inhibit the necessary process of change. A major challenge can be to get the business community to think in terms of new opportunities.

#### *Urban environmental quality*

Urban environmental quality – an aggregate of ambient air quality, water quality, noise levels and the provision of open space – is a major contributor to a city's *liveability* as well as its economic competitiveness in attracting international capital and skilled labour. There is a significant difference between cities in developed, developing and under-developed societies in relation to urban environmental quality – what some see as the Kuznets effect in operation: 'cities start poor and clean, then they industrialize and get rich and dirty, and then they are rich enough so that they can afford pollution control so that they ultimately end up rich and clean' (von Weizsäcker 2005, p. 1). Transition to a green economy and green growth is being strongly promoted as an opportunity for emerging and established economies alike. The former have the opportunity to adopt clean technologies as a mechanism for avoiding the 'dirty industry' phase, while the latter are seeking to be innovators in clean technology development.

### 2.4 Conclusion

While all these exogenous and endogenous drivers have been recognized by academics, informed communities, industry leaders and governments for years, little has been done to truly manage their emerging impact. Delay in transition to more sustainable and resilient cities and regions will be reflected in future cost to the environment, the economy and societal wellbeing. Achieving sustainable, resilient cities requires a commitment to innovative long-term planning and design, appropriate regulation, nation building, global cooperation and community engagement – things that currently bedevil governments in both pluralist liberal democracies and the more controlled, rapidly industrializing societies in regions such as Asia. There are entrenched regimes from the twentieth century and myriad powerful vested interests that will resist change. Foremost among these are the massive energy companies that control fossil fuel resources.

A number of urban change initiatives are emerging that have potential for progressing the sustainability and resilience of cities. One of these involves the Dutch experiment in transition management (illustrated in Grim et al. 2010). This represents a process that devises alternative routes for future urban, industrial and community development by engaging with thought leaders in 'shadow arenas' that

mirror the traditional operating environments of key stakeholder groups to the point of creating implementable solutions without being prematurely torpedoed by regime gatekeepers. Does this represent a viable way forward?

Another quite different initiative involves the 'spontaneous interventions' recently catalogued by the United States Institute for Urban Design (<http://www.spontaneousinterventions.org/>) involving hundreds of innovative 'bottom up' projects undertaken by individual citizens or local communities to enhance fragments of their built environments. Can they muster room to achieve the necessary impact more broadly?

Respective of the innovative pathway followed, urban transformation also requires the assignment of targets capable of being used in performance assessment of cities across the set of challenging domains outlined in this chapter. Peter Drucker's management dictum for business, 'what's measured improves', demands wider application beyond some of the pioneering attempts of local communities (Seattle), NGOs (WWF), major corporations (Siemens) and governments (OECD), to name but a few. Measuring progress in our cities requires that we understand the rate at which they are decreasing their non-renewable resource use, reducing their waste and emissions, improving urban environmental quality, implementing more effective and efficient urban systems and processes, delivering enhanced livability and creating greater resilience to exogenous and endogenous pressures. Having a clear understanding of the magnitude of the challenge provides the context within which informed, responsible and visionary leadership – wherever it resides – can contribute towards achieving a sustainable and resilient future for the world's population that lives in cities.

To quote former US Republican President Teddy Roosevelt in 1916: 'The "greatest good for the greatest number" applies to the number within the womb of time, compared to which those now alive form but an insignificant fraction' (Roosevelt 1920: 300–301). That is clearly a big ask for the unimaginative, narcissistic and self-indulgent trajectory that seems to dominate much current human activity. The challenges of the *anthropocene* must be confronted if humanity is to have a bright, long-term future.

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# **Resilient Sustainable Cities**

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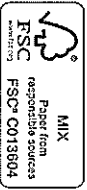
A future

Edited by Leonie J. Pearson, Peter W. Newton,  
and Peter Roberts



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Urbanization is occurring at an unprecedented rate; by 2050 three-quarters of the world's people will live in urban environments. The cars we drive, products we consume, houses we live in and technology we use will all determine how sustainable our cities will be. Bridging the increasing divide between cross-disciplinary academic insights and the latest practical innovations, *Resilient Sustainable Cities* provides an integrated approach for long-term future planning within the context of the city as a whole system.

Over the next thirty years cities will face their biggest challenges yet, as a result of long-term or 'slow-burn' issues: population growth will stretch to the breaking point of urban infrastructure and service capacity; resource scarcity, such as peak oil, potable water and food security, will dramatically change what we consume and how; environmental pressures will change how we live and where; and shifting demographic preferences will exacerbate urban pressures. Cities can't keep doing what they've always done and cope – we need to change current urban development to achieve resilient, sustainable cities.

*Resilient Sustainable Cities* provides practical and conceptual insights for practitioners, researchers and students on how to deliver cities which are resilient to 'slow-burn' issues and achieve sustainability. The book is organized around three overarching themes:

- pathways to the future
- innovation to deliver the future
- leadership and governance issues.

The book includes a variety of perspectives conveyed through international case studies and examples of cities that have transformed for a sustainable future, exploring their successes and failures to ensure that readers are left with ideas on how to turn the places where they live into resilient, sustainable cities for the future.

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# Resilient Sustainable Cities

A future

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Peter W. Newton and Peter Roberts

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