

# 1

## The Context for Building Resilience through Sustainable Change of Use Adaptation

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### 1.1 Introduction

As the 21st century progresses, we are evolving our collective thinking and responses to the challenges of living with a changing climate, increasing global population and changing demographics, mass urbanisation, issues of inequality and instability, issues of food security and increasing scarcity of resources, as well as an increased need for sustainability in the built environment to name but a few (UN 2015; RICS, 2015). Climate change is held to be one of the greatest challenges of our time. The World Bank Group Report (2015) ‘Building Regulation for Resilience: Managing Risks for Safer Cities’ noted that in the last two decades natural disasters have claimed 1,300,000 lives, have affected 4.4 billion people – that is over half the global population, and have resulted in US\$2 trillion of economic losses. They noted that high-income countries with advanced building-code systems experienced 47% of disasters but only 7% of the fatalities and therefore a *prima facie* case exists for rigorous regulation (The World Bank Group, 2015). Significantly, it also called for a shift from managing disasters to reducing the underlying risks. Increases in global temperature, sea level rise, ocean acidification and other climate change impacts are seriously affecting coastal areas and low-lying coastal countries. These are examples of chronic stresses and are defined in this chapter. In summary, the survival of many societies, and of the planet’s biological support systems, are at risk. As a response, in December 2015, the UN published the report, ‘Transforming Our World: The 2030 Agenda for Sustainable Development’ stating that:

The 17 Sustainable Development Goals and 169 targets demonstrate the scale and ambition of this new universal Agenda. They seek to

build on the Millennium Development Goals and complete what they did not achieve. The Sustainable Development Goals are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental. The Goals and targets will stimulate action over the next 15 years in areas of critical importance for humanity and the planet (UN, 2015: 1).

The 17 UN Sustainable Development Goals are shown in Box 1.1. Examining the goals, those that relate most directly to the built environment are;

- Goal 6. ‘Ensure availability and sustainable management of water and sanitation for all’,
- Goal 7. ‘Ensure access to affordable, reliable, sustainable and modern energy for all’
- Goal 11. ‘Make cities and human settlements inclusive, safe, resilient and sustainable’ (UN, 2015).

However, it is also clear that ‘inclusive, safe, resilient and sustainable,’ urban settlements and cities provide the setting for the delivery of many of the other sustainable development goals too. For example, Goal 3 ‘Ensure healthy lives and promote wellbeing for all at all ages’ is clearly related in part to the quality of the buildings in which people live and work. Our role as built environment stakeholders is therefore pivotal and cannot be underestimated.

Set against this background, the principal focus for this book is the role of sustainable change of use projects in buildings – or ‘conversion’ or ‘adaptive reuse’, as the approach is known in some countries – to assist in meeting these sustainable development goals. The concept of resilience is defined and explained and then related to change of use adaptation. The chapter also explains what is meant by ‘sustainable change of use adaptation’ and sets this in the context of related terminology such as adaptive reuse, conversion, refurbishment and renovation. Key terms are defined, such as decision-making for sustainable change of use adaptation: ‘how we identify, model, evaluate and prioritise potential retrofit/reuse, including risk assessment, sustainability and latent conditions’. The costs and benefits of sustainable change of use adaptation are examined alongside a discussion of the property valuation impacts. Social issues covered include housing affordability and quality, changing cities and adaptation. This book covers all commercial land uses (including office, retail, industrial) and includes exemplars from three continents and several global regions.

Within this chapter, a model is presented to show the multiple benefits that can be derived from sustainable change of use adaptation. These accrue to multiple stakeholders on multiple levels (from city scale to building scale). In this book, sustainable change of use adaptation is focused on environmental, social and economic factors. Within these areas, the chapters are presented so that city-scale solutions and research are covered first, followed by building-scale solutions.

### **Box 1.1 UN sustainable development goals.**

- Goal 1 *Zero poverty*: End poverty in all its forms everywhere.
- Goal 2 *Zero hunger*: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- Goal 3 *Good health and wellbeing*: Ensure healthy lives and promote well-being for all at all ages.
- Goal 4 *Quality education*: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Goal 5 *Gender equality*: Achieve gender equality and empower all women and girls
- Goal 6 *Clean water and sanitation*: Ensure availability and sustainable management of water and sanitation for all.
- Goal 7 *Affordable clean energy*: Ensure access to affordable, reliable, sustainable and modern energy for all.
- Goal 8 *Decent work and economic growth*: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
- Goal 9 *Industry, innovation and infrastructure*: Build resilient infrastructure, promote inclusive and Sustainable industrialisation and foster innovation.
- Goal 10 *Reduced inequalities*: Reduce income inequality within and among countries.
- Goal 11 *Sustainable cities and communities*: Make cities and human settlements inclusive, safe, resilient and sustainable.
- Goal 12 *Responsible consumption and production*: Ensure sustainable consumption and production patterns.
- Goal 13 *Climate action*: Take urgent action to combat climate and its impacts by regulating emissions and promoting developments in renewable energy.
- Goal 14 *Life below water*: Conserve and sustainably use the world's oceans, seas and marine resources.
- Goal 15 *Life on land*: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
- Goal 16 *Peace just and strong institutions*: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
- Goal 17 *Partnership for the goals*: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Adapted from <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>.

## 1.2 Scale of the Problem: From City to Building Scale

According to the UN (2015), it took hundreds of thousands of years for global population to grow to 1 billion – then in another 200 years, it grew sevenfold. By 2011, the world population reached 7 billion and in 2015, it increased to about 7.3 billion. This 2015 global population of 7.3 billion is predicted in 2030 to reach 8.5 billion, 9.7 billion in 2050, and 11.2 billion in 2100 (UN DESA, 2015). Growth has been driven largely by greater numbers of people surviving to reproductive age, together with significant changes in fertility rates, increasing urbanisation and accelerating migration. These trends will have far-reaching implications for generations to come (UNPF, 2015).

It is the case that the world is undergoing the largest wave of urban growth in history. More than 50% of the world's population now lives in towns and cities, and by 2030 this number will swell to about 5 billion (UNPF, 2015); it is estimated that by 2050, 66% of the total population will be urbanised (RICS, 2015). Although much of this urbanisation will unfold in Africa and Asia, bringing huge social, economic and environmental transformations, all countries and cities will be affected. There will also be migration from densely populated countries, which suffer climate change impacts such as rising sea levels and inundation.

Urbanisation has the potential to usher in a new era of wellbeing, resource efficiency and economic growth, but cities also exhibit high concentrations of poverty and inequality. In some urban areas, wealthy communities coexist alongside, and separate from, slums and informal settlements.

Our cities will grow, in many cases faster than ever before. As such, we need planning and governance that delivers transition from one level, scale and type of development, to others at the city scale, ensuring infrastructure can support growing populations and changing land uses. Alongside this adaptation of existing areas to accommodate greater numbers of people, and as the predominant land uses undergo change, we need to consider optimum levels of sustainable development, which includes, at the building level, different degrees of change of use adaptation. Sustainable change of use adaptation is focussed on environmental, social and economic factors; but is affected also by governance and regulatory frameworks. Within these parts the chapters are presented so that city-scale solutions and research is covered first, followed by building-scale solutions.

### 1.2.1 City-level Challenges

Numerous cities globally are setting up task forces and developing resilience plans. For example, New York published its strategy in 2013. The 100 Resilient Cities (100RC) project has been initiated by the Rockefeller Foundation (100RC, 2016) to assist global cities in their preparations to meet the physical, social and economic challenges we face now and in the future. The 100RC supports the adoption and incorporation of both acute and chronic manifestations of resilience. Acute or shock events include bushfires, earthquakes and floods. On the other hand, chronic

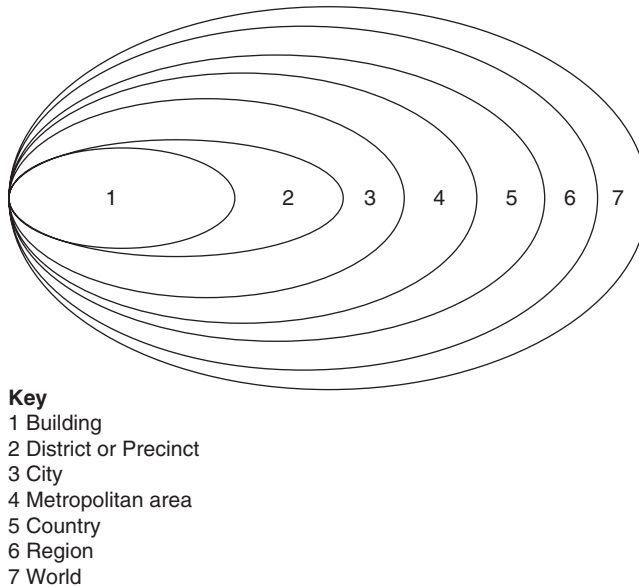
stresses undermine and weaken the fabric of a city on a day-to-day or cyclical basis. High levels of unemployment; inefficient public transport systems; endemic violence; and persistent shortages of water and food are examples of chronic stress factors. By addressing both the shocks and the stresses, a city becomes more able to respond to adverse events, and is overall better able to deliver basic functions in both good times and bad, to all populations. As an example, Melbourne, Australia was selected from 372 applicant cities around the world to be among the first wave of 32 cities to join the 100RC network and published its resilience strategy in May 2016.

The 100RC has identified and collated the challenges facing a number of global cities. Table 1.1 shows a selection of those cities, in five different

**Table 1.1** Resilience challenges faced in selected cities.

City	Resilience challenges (100 Resilient Cities)
Sydney, Australia	<ol style="list-style-type: none"> <li>1. Ageing infrastructure</li> <li>2. Heat wave</li> <li>3. Infrastructure failure</li> <li>4. Lack of affordable housing</li> <li>5. Overtaxed/under developed/unreliable transportation system</li> <li>6. Rapid growth</li> <li>7. Rising sea level and coastal erosion</li> <li>8. Social inequity</li> <li>9. Terrorism</li> <li>10. Wildfires</li> </ol>
Rotterdam, Netherlands	<ol style="list-style-type: none"> <li>1. Coastal flooding</li> <li>2. Drought</li> <li>3. Hazardous materials accident</li> <li>4. Heat wave</li> <li>5. Rainfall flooding</li> <li>6. Refugees</li> </ol>
Chennai, India	<ol style="list-style-type: none"> <li>1. Aging infrastructure</li> <li>2. Economic inequality</li> <li>3. Economic shifts</li> <li>4. Hurricane, typhoon, cyclone</li> <li>5. Infrastructure failure</li> <li>6. Overpopulation</li> <li>7. Pollution or environmental degradation</li> <li>8. Pronounced poverty</li> <li>9. Tropical storms.</li> </ol>
Dakar, Senegal	<ol style="list-style-type: none"> <li>1. Coastal flooding</li> <li>2. Earthquake</li> <li>3. Endemic crime and violence</li> <li>4. Lack of affordable housing</li> <li>5. Social inequity</li> </ol>
New York, USA	<ol style="list-style-type: none"> <li>1. Heat wave</li> <li>2. Overtaxed/under developed/unreliable transportation system</li> <li>3. Rising sea level and coastal erosion</li> <li>4. Tropical storms</li> </ol>

Source: 100 RC, 2016.



**Figure 1.1** Resilience scales. (Source: Rotterdam Resilience Strategy, 100RC, 2016).

continents, and in developed and developing countries, to illustrate both the number of challenges, as well as the similarities and differences that exist. These issues range from social to environmental and economic. Furthermore, some are chronic whereas other issues are acute. Clearly, change of use adaptation sits within these circumstances. It is apparent that different solutions suit different cities and different locations, and also have different degrees of importance.

Resilience scales are the different levels or scales involved, from worldwide to building level. These are illustrated in Figure 1.1, as taken from the Rotterdam Resilience Strategy (100RC, 2016). They are a useful way of understanding how measures taken at the building level impact up to a global level. Above building scale, there is the suburb, district or precinct scale (depending on which part of the world one lives in). After the district or suburb is the city scale, and it is apparent that the scales are now at the level at which policy is made and executed and governance is applied. After the city scale comes metropolitan areas, or the areas immediately around the city. The next scale is the national scale, and it is at this level that national policy and governance decisions are made and executed. After the national scale comes the regional scale, for example Europe, at which some collective decision-making may take place. The final scale after regional is worldwide or global.

### 1.3 Definitions of Key Terms

As noted above, there are a number of terms that are in current use with respect to ‘change of use’. Literally, to change use is where one land use, say for warehousing, is no longer viable in an area. The buildings may become

obsolete and thus an alternative or changed land use is a better economic, environmental and social option. For example, on a major river, former Victorian warehouse buildings have been changed or converted to residential or retail use as docks have been relocated to areas where deeper-draught ships can berth. Such patterns of change of use are found in many cities in different countries, such as London, Amsterdam, Toronto, New York and Melbourne.

Change of use is also known as ‘adaptive reuse’ or ‘conversion adaptation’ in different parts of the world. In each definition, the key characteristic is that the original land use of the building is no longer economically or socially viable or desirable and a change is required; otherwise the building may be left vacant or, as it is often termed, redundant or obsolete (Baum, 1993). There are many types of obsolescence identified in the literature, from economic, physical, social, environmental and technological, to regulatory or legal. Furthermore, some buildings can be affected simultaneously by more than one type of obsolescence. It follows that the condition of buildings can vary from good to worn out when affected by physical obsolescence (Thomsen and van der Flier, 2011).

Furthermore, when discussing change of use, terms such as retrofit, refurbishment, renovation, remodelling, reinstatement, rehabilitation and recycling of buildings are often used (Wilkinson *et al.*, 2014; Mansfield, 2002; Douglas, 2006; Bullen, 2007). Adaptation occurs ‘within use’ and ‘across use’. For instance, if an office is adapted and remains an office, it is within-use adaptation. If the use is changed to say, residential, this is an example of across-use or change of use adaptation. Adaptation is defined as: ‘any work to a building over and above maintenance to change its capacity, function or performance’ or, ‘any intervention to adjust, reuse, or upgrade a building to suit new conditions or requirements’ (Douglas, 2006: 14). The various options for adaptation are illustrated diagrammatically in Figure 1.2 with the change of use or across-use options highlighted.

A second set of key terms requiring discussion is ‘decision-making for sustainable change of use adaptation’, in other words, *how we identify, model, evaluate and prioritise potential retrofit/reuse, including risk assessment, sustainability and latent conditions*. Throughout this book various models or approaches to decision-making are outlined in the context of environmental, economic and social sustainability criteria. These criteria vary according to circumstances, such as the client and their needs and goals and/or the environmental priorities and regulatory frameworks operating within a city or town. In addition, the budget and/or economic climate will also impact on what is provided. What is required however, is a framework or decision-making tool that enables clients to identify optimum solutions that meet the competing demands and requirements of all stakeholders. Overarching these variables are the resilience issues, which increasingly need to be included to ensure the utmost is done to mitigate the social, environmental and economic impacts of climate-change-related disasters and events.

What is meant by sustainable change of use adaptation? In this case the term sustainability is defined in the framework of the triple bottom line: the economic, environmental and social aspects (Elkington, 1998), which

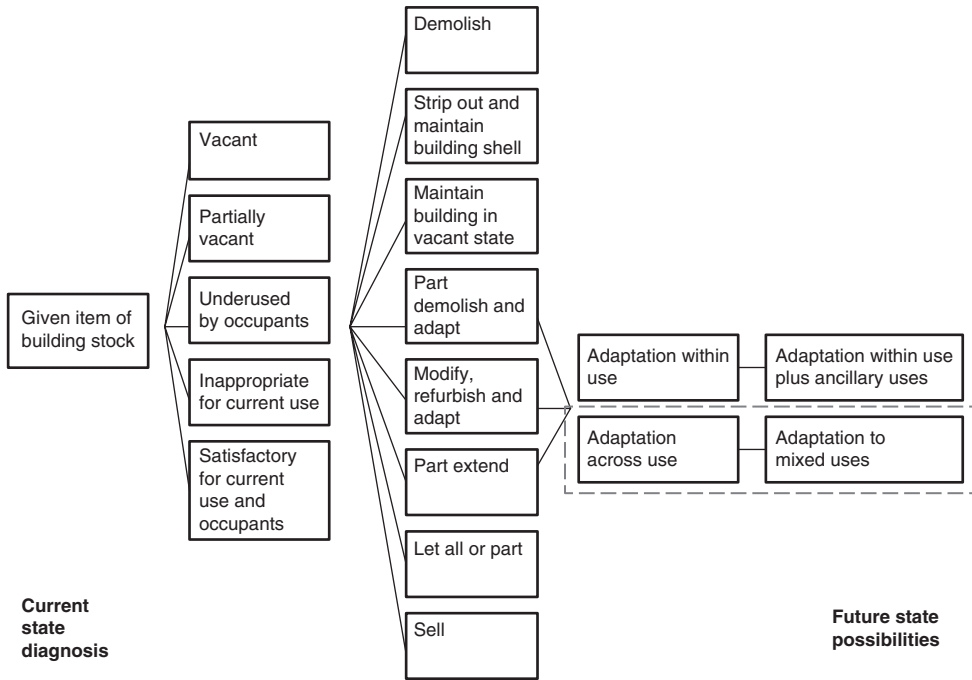


Figure 1.2 Options for adaptation. (Source: Wilkinson, 2011).

are then set within the context and activities of building refurbishment and renovation. Wilkinson (2012), in defining sustainability in the context of political, economic, social, technological, legal, environmental and philosophical thinking and beliefs, has shown there is a wide spectrum of sustainability from very strong to very weak. Furthermore, other studies (Wilkinson 2012, 2015) have revealed, to date, property and construction firms and practitioners generally adhere to and adopt weak sustainability in practice.

### 1.4 Background and Scope

This book examines the definitions, the best practices and existing guidelines and frameworks for sustainable change of use in building urban resilience in the period to 2050. All commercial land uses, including office, retail and industrial are covered. Case studies and exemplars from Europe, Australia and the UK and several other regions are used to illustrate practical implications of the theory and issues outlined in the chapters.

Adapting the built environment for climate change is now acknowledged as vital, and the implications of inaction are outlined in the IPCC Report of 2013 (Stocker *et al.*, 2013). Globally, organisations, governments, and city governments are setting out plans and strategies for adaptation to mitigate the impacts of climate change. These plans and approaches vary



in breadth and depth as well as the climatic conditions that they are addressing. As an example, the Australian Sustainable Built Environment Council (ASBEC) has stated that cost-effective energy efficiency and fuel switching can reduce projected 2050 building-related GHG emissions by half (ASBEC, 2013), with financial benefits estimated at \$20 billion by 2030 and a total contribution of 25% of the national emissions reduction target. The challenge is to extend the practices adopted by market leaders to the wider market, and ASBEC recommended strong policy measures, with supporting frameworks and governance, and with minimum mandatory standards, energy market reform, targeted incentives and programmes and a range of education measures, supporting data, information and training (ASBEC, 2013).

## 1.5 The Notion of Urban Resilience

The notion of urban resilience has grown in recent years and is used in policy and academic discourse (Meerow *et al.*, 2016; UGC, 2013; NSW GPE, 2014). Here, the theory of resilience is used to explain complex socio-ecological systems – urban settlements, cities and buildings – and their sustainable management. Theorists claim that systems are changing continuously in non-linear ways, and that resilience offers a framework for dealing with uncertainties in the future. Another characteristic of ‘resilience’ is that it is perceived as positive: it involves taking action to make us less vulnerable to climate change, natural disasters and/or manmade disasters, such as economic downturns or collapses. Resilience is an attractive perspective with regards to cities, which are complex adaptive systems (Batty, 2008), and have changed from housing 10% of the population in 1990 to 50% in 2010 (UN DESA, 2010). Urban areas of over 50,000 people account for 71% of global energy-related carbon emissions although they cover only 3% of the area. In accommodating growth and expansion, cities and the buildings within them need to possess resilience. The word ‘resilience’ is derived from the Latin word *resilio*, which literally means to bounce back. Then, according to Alexander (2013), in the 19th century, the term evolved to embrace the notion of resisting adversity.

Meerow *et al.* (2016) noted that the term has been adopted and used by many disciplines, which each understand and interpret the notion differently. In their extensive literature review of definitions of urban resilience, they found that five themes or attributes emerged as shared qualities of resilience (Meerow *et al.*, 2016). These attributes are listed below and are considered in detail below:

- equilibrium versus non-equilibrium
- positive versus negative conceptualisations of resilience
- mechanisms of system change (from persistence, transitional or transformative change)
- adaptation versus general adaptability
- timescales of action.

A sixth tension exists around the definition of the term ‘urban’. The authors posited a definition embodying all the attributes of urban resilience (Meerow *et al.*, 2016):

The ability of an urban system – and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales – to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity (Meerow *et al.*, 2016).

In contrast, the 100 Resilient Cities project (100RC, 2016) defines urban resilience as ‘the capacity of individuals, institutions, businesses and systems within a city to adapt, survive and thrive no matter what kind of chronic stresses and acute shocks they experience’. Both definitions view urban resilience as dynamic and ever-changing. It is necessary to define the word ‘urban’ and the characteristics of urban settlement. Many definitions examined state that cities and urban systems are complex networked systems (Desouza and Flanery 2013: 91) and conglomerations of ecological, social and technical components. Ernstson *et al.* (2010) claim cities are complex socio-ecological systems composed of networks that are both socio-ecological and socio-technical. Cities and their hinterlands are highly interdependent, with delineation of boundaries problematic. This is because some systems extend beyond the physical city limits, for example water or food supply systems.

Now considering each of the Meerow’s five themes in turn:

### **Equilibrium**

An important aspect of urban resilience is equilibrium. Scholars debate issues of single-state equilibrium, multiple-state equilibrium and dynamic non-equilibrium (Davoudi *et al.*, 2012). Single-state equilibrium refers to the ability to return to a previous state of equilibrium after a disturbance. This notion prevails in the disaster management literature, an example being where an area and buildings are reinstated after flooding. Multiple-state equilibrium, however, acknowledges that there can be numerous states of equilibrium in any system. Recently it has been recognised that systems exist in a state of dynamic non-equilibrium: no constant state can exist and there is a continuous state of flux and change. This acceptance has led to the rejection of the notion of resilience as ‘bouncing back’ in the literal sense of the Latin translation. In this newer understanding of the term, systems are ‘safe to fail’ as opposed to failsafe, and it is acknowledged that, after a disturbance, cities and the buildings therein may not return to a previous state. Sanchez *et al.* (2016) note that a return to ‘normal’ may not be desirable and appropriate if the original state was vulnerable; it is undesirable to perpetuate vulnerability. They advocate for a coordinated proactive approach to risk mitigation and adaptation within the urban planning and built environment context.

### **Positive versus Negative notions**

The notion of resilience was perceived as positive in all 25 definitions analysed by Meerow *et al.* (2016): systems possessing resilience were held to be able to maintain basic functions and then to prosper and to improve. However, other studies have questioned whether existing states may be undesirable, for example areas characterised by poor-quality or inadequate housing (Cote and Nightingale, 2011). Hence the debate extends to pose the questions of, for whom and, to what resilience is desired. Furthermore, it should be noted that power inequalities could determine whose resilience agenda prevails (Cote and Nightingale, 2011).

### **Mechanism of Change**

There are three mechanisms of change or ways to resilience. The first is persistent change, where efforts are made to return or maintain the built environment and its systems in an existing state. For example, after a storm, buildings are reinstated (Chelleri, 2012). In this sense, retrofitting or refurbishment could be said to be examples of persistence. The second mechanism is transitional change, which implies some degree of adaptation to a new state or an incremental change, such as the change from warehousing to residential use as an area deindustrialises. The third and most extensive mechanism is transformative change, whereby wide-scale change occurs. An example is where significant change of use adaptation occurs and areas become completely transformed. This change of use adaptation can be an example of transitional systems change and resilience and, collectively, transformational systems change.

### **Adaptation**

The fourth aspect of resilience is adaptation and refers to the differences between specific adaptations, such as high adaptability as against more generic adaptability (Haase *et al.*, 2014). Wu and Wu (2013) argued that too much emphasis on specified resilience undermines system flexibility and the ability to adapt to unexpected threats. Other academics have perceived adaptability as being synonymous with adaptive capacity, and noted the importance of maintaining general resilience to unforeseen threats in addition to specified resilience to known risks. An example might be where there is a known risk of pluvial flooding affecting a city or region. Measures can be taken in the design, construction and adaptation of buildings to reduce the risk of water damage arising and also ensuring faster recovery should pluvial flooding occur. Equally, adopting flexible design and construction in buildings might accommodate a greater variety of alternative uses over time, thereby having adaptive capacity. The Tower of London in the UK is a good example of a building with high levels of adaptive capacity; in its 900-year history, the building has been used as a royal home, a prison, barracks,

armoury and now a museum and tourist attraction. Warehouse buildings are another example of building designs with good adaptive capacity, and globally they are now used as residential buildings, hotels, art galleries and retail centres.

### **Timescale**

Finally, there is the notion of timescale within urban resilience definitions. Some studies perceive immediacy and rapidity of recovery as essential characteristics. However, timescale is dependent on whether the focus is on rapid onset events such as storms and floods or more long-term gradual states such as changing climate (Wardekker *et al.*, 2010). Moreover, the measurement of timeframes is unclear and can be measured in hours, months or years. Reinstatement of energy supply following a storm would preferably be delivered within hours, whereas reinstatement of flood-damaged buildings might take many months. Furthermore, there is the question of reinstatement being a return to the 'prior state', or an improved and different state that would be more resilient to the same type of event. Sanchez *et al.* (2016) note that urban transformation requires active engagement in setting long-term goals at city or state level. However, flexibility is a prerequisite, otherwise unintended adverse consequences may result. Although these issues are dealt with at city or state level, it is at building level where many interventions and adaptations will occur.

Although resilience is a complex concept with multiple attributes and levels of interpretation, a definition is proposed above. However, Meerow *et al.* (2016) also suggest it is vital to consider other questions: the so-called '5 Ws'. These are who, what, when, where and why? When considering resilience, it is important to be cognisant of who is determining what is desirable for an urban system, whose resilience is prioritised and who is included or excluded from the urban systems. In respect of 'what', we must ask what should the system be resilient to, what networks/sectors are included in it, and whether the focus is on generic or specific resilience? The question of 'when' relates to whether the focus is on rapid or slow onset disturbances, on short- or long-term resilience, and finally, is it on the resilience of current or future generations? The fourth W covers 'where' and relates to the boundaries of the urban system; whether resilience of some areas is prioritised over others, and whether building resilience in some areas affects the resilience of others. Finally, there are issues of 'why': what is the goal, what are underlying motivations and is the focus on process or outcome (Meerow *et al.*, 2016)? A summary is provided in Table 1.2.

Bosher (2008) identified a built-in resilience environment and noted it was the 'quality of a built environment's capability (in physical, institutional, economic and social terms) to keep adapting to existing and emergent threats'. Thus its focus is on coping with dynamic changes. Sanchez *et al.* (2016) observed that, in interpreting disasters as natural, Bosher (2008) absolved policy-makers and stakeholders from blame. This approach is now changing because many stakeholders, particularly in government, are making

**Table 1.2** The 5 Ws applied to resilience in buildings.

The 'Ws'	
Who	<ol style="list-style-type: none"> <li>1. Who is determining what is desirable for an urban system?</li> <li>2. Whose resilience is prioritised?</li> <li>3. Who is included or excluded from the urban systems?</li> </ol>
What	<ol style="list-style-type: none"> <li>1. What should the system be resilient to?</li> <li>2. What networks/sectors are included in the urban system, and this the focus on generic or specific resilience?</li> </ol>
When	<ol style="list-style-type: none"> <li>1. Is the focus on rapid- or slow-onset disturbances?</li> <li>2. Is the focus on short- or long-term resilience?</li> <li>3. Is the focus on the resilience of current or future generations?</li> </ol>
Where	<ol style="list-style-type: none"> <li>1. Where are of the boundaries of the urban system?</li> <li>2. Is the resilience of some areas prioritised over others?</li> <li>3. Does building resilience in some areas affect the resilience of other areas?</li> </ol>
Why	<ol style="list-style-type: none"> <li>1. What is the goal?</li> <li>2. What are underlying motivations?</li> <li>3. What is the focus, on process or outcome?</li> </ol>

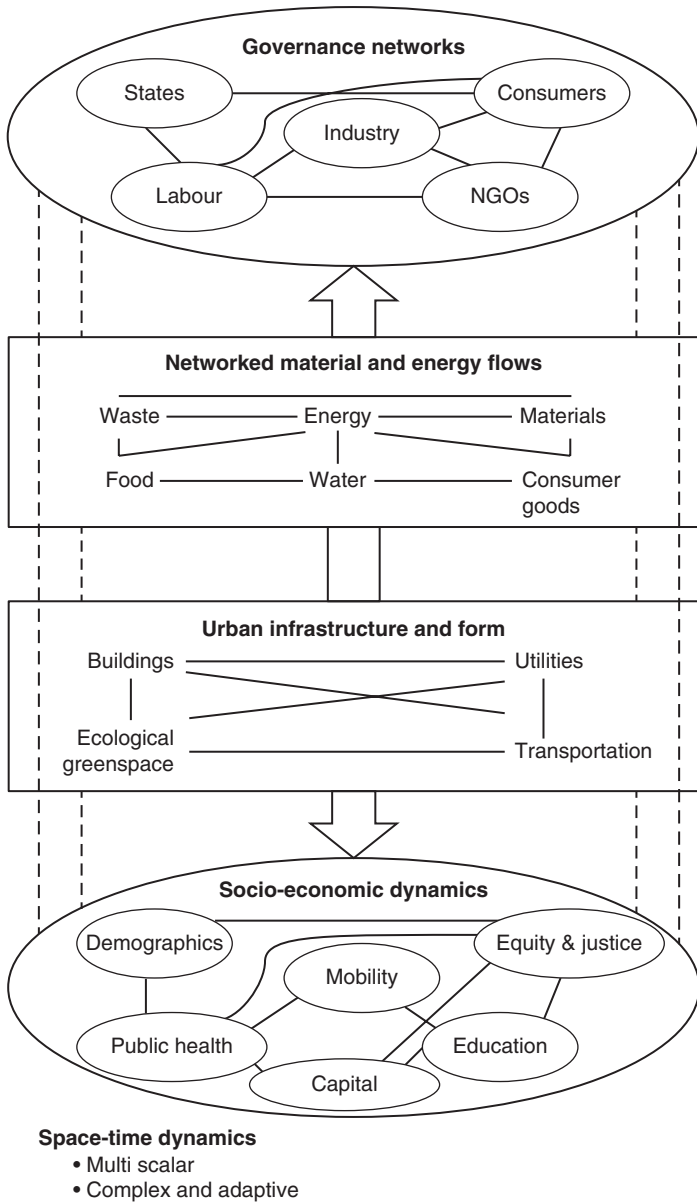
Source: Adapted from Meerow *et al.*, 2016.

and publishing resilience plans. There are no right or easy answers to these questions, but it is imperative that we are cognisant of them and continue to debate them, as we endeavour to build resilient cities and resilient buildings. Figure 1.3 shows a simplified conceptual schematic of the urban system, showing the socio-ecological and social-technical networks described above. Figure 1.3 also shows where buildings fit into the framework.

Other concepts distinguish between built environment resilience, which refers to the physical built environment that accommodate human activities, and community resilience, which refers to the resilience of individuals or a group of inhabitants and their social constructs. Here the literature is focused on notions of wellbeing, governance and economy. Sanchez *et al.* (2016) give the example of built environment resilience, with different stakeholders having a different focus. With regards to built environment resilience, engineers are focused on engineering infrastructure and restoring systems to operation as soon as possible after a disaster, whereas community engineering resilience has a focus on social and economic outcomes.

## 1.6 Synopsis

This book collates the findings of research conducted in Australia, the UK and the Netherlands, although many of the issues and principles are applicable and relevant elsewhere. The authors review aspects of sustainability, and to some extent resilience at various levels from the level of new economic systems and paradigms, to governance and policy, to conversion at masterplan scales, to building-level conversion criteria, to opportunities for top up additions to buildings, to heritage conversion and sustainability in civic buildings, to assessing the potential for office-to-residential conversion,



**Figure 1.3** A simplified conceptual schematic of the urban system (in Meerow *et al.*, 2016 and adapted from Dickens, 2011).

to the rating tools used in adaptive reuse. Finally, we present a manifesto for the future in respect of adaptive reuse based on the work discussed in the book.

In Chapter 2, Laura Wynne and Professor Chris Reidy of the Institute of Sustainable Futures, University of Technology Sydney examine the concept of the sharing economy and described an operational model

applied to adaptive reuse. They assert that adapting cities through urban infill development is a key alternative to urban sprawl, where infill developments and adaptive reuse projects offer spaces for social innovation that can lead to the discovery of new ways of being in the city that are better adapted to sustainability challenges. Such innovations include a reimagining of the way we use spaces and assets and the way we connect with one another. The sharing paradigm captures a broad range of activities and services that are reflective of this reimagining of consumption and ownership. Sharing resources, goods and services can enhance urban resilience by reducing demand for new materials and infrastructure, supporting local economies, and enhancing social networks. This chapter identifies some of the sharing paradigm initiatives that might be enabled through adaptive reuse and infill development in cities around the world.

Chapter 3 explores planning policy instruments for resilient urban redevelopment, and specifically the case of office conversions in Rotterdam. It is written by Assistant Professor Erwin Heurkens and Associate Professors Hilde Remøy and Fred Hobma of Delft University of Technology. Cities all over the world are searching for ways to become more resilient to climate change and related economic challenges. The general consensus seems to be that resilience refers to the ability of a system to respond to exogenous and endogenous pressures. Resilient urban redevelopment through sustainable building adaptation could possibly be a strategy to accommodate endogenous pressures such as socio-demographic change. It changes the economic base of cities and enhances urban environmental quality. Urban resilience can be built in part by reshaping real estate markets, in which institutions and organisations prefer adaptation of real estate over demolition and new building. However, this requires the utilisation of public planning policy instruments, which correspond to changing real estate market demands and private actor needs. This chapter illustrates that making urban areas more resilient by adopting existing real estate to new uses requires an effective mix of planning policy instruments and activities, aligned with market needs at both city and local-development levels. This is achieved by introducing some planning policy instrument classifications, providing case study examples of the utilisation of a variety of planning policies for the adaptation of obsolete office buildings in Rotterdam, and concluding with some general implications for resilient urban redevelopment practice and research.

In Chapter 4, Hannah Baker and Dr Alice Moncaster, from the University of Cambridge, examine how the decision to demolish or adapt existing buildings changes in the context of a masterplan design. UK legislation emphasises the release of brownfield land for new development. The chapter explores adaptation and demolition on larger regeneration sites: for residential developments which will have 200+ dwellings, or over four hectares. These can lead to transformative changes within cities. Decision-making on these larger sites sits within the context of national and local policy, involving higher degrees of complexity than when only the individual building scale is involved. Existing decision-making frameworks focus mostly on individual buildings, and are not generally appropriate for larger scales, the authors argue, for masterplan regeneration sites. The different buildings

within the curtilage of the site will often be considered for different adaptation options:

- demolition
- part-demolition and adaptation
- modification
- refurbishment
- adaptation
- part extension.

The inherent complexity of considering multiple buildings at the same time is increased by the additional relationship between the master plan and urban infrastructure, as the consideration of factors such as utilities, ecological green space and transportation affect the decisions being made about individual buildings. Illustrative case studies show how these differences operate and impact in practice.

There is a shift to the building scale in Chapter 5, where Professor Craig Langston of Bond University in Australia examines issues affecting sustainable design and building conversion. Good architecture is something we all seek, but is hard to define. Langston uses Gordon's 1972 definition of buildings that exhibit 'long life, loose fit and low energy'. These characteristics, named by Gordon as the 3L Principle, are measurable and embody the principle of adaptability discussed in this chapter. Life-cycle cost (LCC) provides a method for accessing the economic contribution or burden created by buildings to the society they aim to serve. No research investigates the connection between 3L and LCC, and Langston hypothesises that buildings with a high 3L index may have a low-LCC profile. If this is the case, then LCC may be used to assess 'good architecture'. This chapter uses a case study methodology to assess the durability, adaptability and sustainability of 22 projects that have won architectural design awards. The 3L criteria are measured and compared with the average LCC per square metre using a long time-horizon (greater than 50 years). Langston claims the research is significant, as it tests a process to assess objectively what is commonly intangible and to determine if LCC is a suitable predictor of 'good architecture'. LCC is suggested as an economic paradigm as part of the consideration of feasibility. It can be used in a cost-benefit analysis to help compute profit. This chapter expands current thinking on economics by proposing a 4P decision-making model based on profit, people, politics and planet as a way forward to greater resilience and sustainability.

Professor Gordon Holden discusses the ecological performance of new additions constructed on top of existing buildings, focusing on apartments. The emerging architectural typology of 'building-top apartments' is discussed as a more 'sustainable' solution to providing urban apartments than conventional 'demolished-site' developments. Apartments built on top of existing buildings avoid demolition of the host building, thereby avoiding waste and improving life-cycle performance. The addition can be built more economically and quickly, as it does not require excavation and footings. Furthermore, it contributes to urban densification, supporting city social and cultural



vitality and economic development. Urban densification means that many more people will walk to work, thereby reducing transport congestion and pollution as well as contributing to public health through better fitness. It supports higher numbers of people in the city as casual observers and thereby potentially contributes to reductions in crime. By accommodating a significant proportion of the city's population growth in building-top apartments, land subdivision on the city's boundaries, which consumes energy and resources at a higher rate, is potentially reduced. This emerging urban architectural typology contributes to city sustainability and resilience in terms of having less impact on the environment than conventional development while contributing to better economic performance and to social and cultural endeavours.

In Chapter 7, Rob Geraedts, Theo van der Voordt and Associate Professor Hilde Remøy of Technical University, Delft, examine whether building owners and other stakeholders can adopt different strategies to cope with issues and choices around vacancy, renovation, change of use adaptation, or whether to demolish and build a new building. This chapter discusses how to cope with vacancy through change of use adaptation and gives overviews of the many factors and aspects that enable or hinder change of use adaptation of (office) buildings into housing. They explain how to assess the characteristics of the market, location, building and the stakeholders. They present the 'Conversion Meter', a tool to assess the potential for converting vacant office buildings into housing. The tool is built up from an initial fast appraisal using so called 'veto' criteria, followed by a more detailed assessment of the conversion potential. No single criterion is sufficient to decide if conversion is viable or not; it is the combination of all the criteria that provides a valuable indicator of conversion potential. The next step calculates a conversion potential score as a weighted sum of all the criteria. This is followed by an assessment of financial feasibility and a final check on possible risks, and the opportunities to eliminate them. The chapter concludes with lessons learned from case studies in which the Conversion Meter was applied.

In Chapter 8, Associate Professor Sara Wilkinson of the University of Technology Sydney, analyses the rating tools used to measure adaptive reuse in the context of resilience and sustainability. The literature review evaluates the issues related to sustainability-rating tools and conversion adaptation in different countries and then compares and contrasts approaches. Issues raised in earlier chapters regarding regulations are discussed, as is the question of whether a mandatory or voluntary approach is best for conversion adaptation. Finally, this chapter relates how regenerative infrastructure impacts on resilience and conversion adaptation.

In the final chapter Sara Wilkinson sets out the main conclusions that can be drawn from the preceding chapters and describes a manifesto for the future.

## 1.7 Summary

The notion of resilience is being explored actively by many stakeholders, including the UN, city and municipal authorities, developers, urban planners and academics. They hope to gain a deeper understanding of what resilience

means and how we can promote a built environment that enhances it. With the largest wave of population and urban growth ever experienced, the built environment has a pivotal role to play in delivering resilience. We must capitalise on the opportunities with our existing buildings, to retain heritage and a sense of place where appropriate, and to increase resilience of existing generations and those to come. The Rotterdam resilience scale shows clearly how buildings ultimately impact up to the global scale. This chapter has also shown there is great potential to learn from different approaches taken in cities globally and also to share experience across the developed and developing world.

Resilience has attributes of equilibrium and non-equilibrium, which means we are in a constant state of flux to some degree and that we need to adopt a 'safe to fail' paradigm, and acknowledge that after a disturbance we will adapt to a new state. We need to be cognisant of whose resilience agenda is prevailing and to answer questions of resilience: 'for whom' and, 'to what'. We should embrace the positive aspects of resilience and be aware that we make changes for the better. It has been shown that adaptation is an example of persistence, whereas adaptive reuse, or change of use adaptation, is a transitional change to a new state. At the city or masterplan scale, where more than one building is involved, the change is transformative. We must also be aware that some retention of system flexibility is useful to cope with the unexpected and there are many examples of buildings that have stood the test of time over centuries. Finally, we note the different timescales in which resilience can be delivered at the different scales. The chapters that follow address all of the issues raised, either explicitly or implicitly, and demonstrate how our collective thinking is transforming and maturing in respect of resilience, sustainability and change of use adaptation.

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