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Sustainable Building Adaptation

Innovations in Decision-making

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Sustainable Building Adaptation

Innovation in the Built Environment

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Sustainable Building Adaptation: Innovations in Decision-Making

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This edition first published 2014

Registered Office
John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom.

Editorial Offices
9600 Garsington Road, Oxford, OX4 2DQ, United Kingdom.
The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom.

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Library of Congress Cataloging-in-Publication Data

Wilkinson, Sara, 1961–
Sustainable building adaptation : innovations in decision-making / Sara J Wilkinson, Hilde Remøy, Craig Langston.
pages cm
Includes bibliographical references and index.
ISBN 978-1-118-47710-6 (cloth)
1. Sustainable buildings–Design and reconstruction. 2. Buildings–Remodeling for other use. 3. Architecture–Conservation and restoration–Case studies. I. Remøy, Hilde Therese, 1972– II. Langston, Craig A. III. Title.
TH880.W53 2014
690.028′6–dc23

2013030498

A catalogue record for this book is available from the British Library.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Cover design by Andy Meaden, Meaden Creative

Set in 10/12pt Sabon by SPi Publisher Services, Pondicherry, India

1 2014

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Dr Sara J. Wilkinson is Associate Professor of Property and Construction at the University of Technology Sydney, Faculty of Design Architecture and Building, Sydney, Australia. She has a combination of professional industry and academic experience spanning more than 30 years. The research described in Part I: Building Adaptation is the result of work undertaken over a 16-year period and has been funded by Jones Lang LaSalle and the Royal Institution of Chartered Surveyors. Sara's research focus is building adaptation within the context of sustainability and represents areas of professional practice prior to becoming an academic. Her PhD examined building adaptation and the relationship to property attributes, whilst her MPhil explored the conceptual understanding of green buildings. Sara is a member of the RICS Oceania Sustainability Working Group. She is the International Federation of Surveyors (FIG) Vice-Chair of Commission 10 'Construction Management & Construction Economics'. Sara is also the author of eight books/book chapters and was awarded the RICS COBRA Conference Best Paper Award in 2012 for her paper 'The increasing importance of environmental attributes in commercial building retrofits', RICS COBRA, Las Vegas, NV, USA. September 2012. http://www.rics.org/au/knowledge/research/conference-papers/cobra-2012-environmental-attributes-in-commercial-building-retrofits/

Dr Hilde Remøy is Assistant Professor of Real Estate Management at the Faculty of Architecture, Delft University of Technology, Delft, the Netherlands. She has experience with adaptive reuse from both practice and academia. The research described in Part II: Adaptive Reuse is the result of studies undertaken in the period 2005–2013. Hilde's research focus is adaptive reuse of existing buildings that have lost their original function, related to obsolescence and vacancy of existing buildings and locations. In research and education, she works on studies concerning the influence of physical property characteristics on obsolescence and adaptive reuse potential and studies to define the future value of reused buildings and cultural heritage. Hilde is the author of several books/book chapters.

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Optimisation is the result of three Australian Research Council (ARC) Linkage Project grants comprising:

- 2009–2012 – Langston, C., Smith, J., Herath, G., Datta, S., Doloi, H. and Crawford, R.H., Making Better Decisions about Built Assets: Learning by Doing, ARC Linkage Project $180,000 LP0990261 (Industry partners: Williams Boag Architects and Assetic Australia).
- 2007–2010 – Langston, C., Liu, C., Beynon, D. and de Jong, U., Strategic Assessment of Building Design Adaptive Reuse Opportunities, ARC Linkage Project $210,000 LP0776579 (Industry partners: Williams Boag Architects and The Uniting Church in Australia).
- 2006–2009 – Crawford, R.H., Datta, S. and Langston, C., Modelling Environmental and Financial Performance of Construction. Sustainability Innovation Feasibility Tool. ARC Linkage Project $179,000 LP0667653 (Industry partner: Williams Boag Architects).

Craig is the author of five international books. In 2010, he won the Bond University Vice-Chancellor's Quality Award for Research Excellence. He was awarded the Emerald Literati Network Award for Excellence in 2013 for his paper 'Validation of the adaptive reuse potential (ARP) model using *iconCUR*', *Facilities*, 30(3–4), 105–123 (2012).

Preface: The Rise of Building Adaptation

> A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well-being depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes… To defend and improve the human environment for present and future generations has become an imperative goal for mankind.[1]

It is four decades since these words of forewarning were written, and we should reflect on whether we have heeded the statements. The declaration is a warning and a call to action. The proclamation asserts that humans need to be more prudent in respect of the environment; yet in those 40 years, greenhouse gas emissions have increased, pollution has worsened, and social inequity and injustice around the world has continued to attract global attention. If anything, the environmental legacy for future generations is less than it was in 1972.

The challenge of achieving sustainable development in the twenty-first century will be won or lost in the world's urban centres, and this is due to the contribution that the built environment makes to greenhouse gas emissions and global warming. The challenge is immense and overwhelming, both in terms of its magnitude and potential consequences if humankind does not adapt its behaviours towards the environment. Climate change impacts are occurring, disproportionately affecting developing nations, and are projected to get much worse over time. It is expected that there will be increased variability in climate events, such as harder and more frequent storms, which will lead to changes in climatic averages such as increased water scarcity. Globally as humankind adapts and evolves its behaviours and government strategies and policies, we are transitioning from the 'industrial age' to the 'ecological age'.

The built environment, if upstream emissions from heat and electricity are included, is responsible for around 45% of total global greenhouse gas emissions (GGE). Also there are impacts from water and resources consumption within buildings. As commercial buildings have a life cycle measured in decades or even centuries, the existing stock is of particular interest and consequence. Significantly, our window of opportunity for pre-emptive action to avoid higher levels of climate change and temperature increase is to act decisively up to 2050; time is not on our side. When compared to other sectors, such as transport or waste, the contribution of sustainable building adaptation to climate change mitigation is abundantly clear.

With 1–2% of new buildings added to the total stock annually, humankind needs to adapt its existing buildings, and quickly. While all new construction should adopt sustainability features in design and operation, given typical rates of replacement much of the built environment that will exist in 2050 has already been built. Furthermore, the Inter Governmental Panel on Climate Change (IPCC) concluded that:

> Over the whole building stock the largest portion of carbon savings by 2030 is in retrofitting existing buildings and replacing energy using equipment due to the slow turnover of the stock.[2]

The greatest challenge is the development of successful strategies for adapting existing buildings due to their slow turnover; in other words, effective decision-making for sustainable building adaptation is critical to deliver needed building-related GGE reductions globally. Many cities have acknowledged this need to act and have developed and adopted strategies aimed to deliver carbon neutrality within fixed periods. Local government authorities are encouraging sustainable building adaptation to lower building-related energy consumption and associated emissions.

Sustainable adaptation of existing stock is a universal concern that increasing numbers of local, state and national governments must endeavour to address within the short to medium term. In most developed countries, more is now spent on building adaptation (including maintenance, repair, retrofit and reuse) than new construction, and this represents a gradual but consistent change from decades of investment dominance in new-build projects. There is a need for greater knowledge and awareness of what happens to society's buildings over time and how we might adapt them sustainably. This action includes avoiding premature destruction through finding new uses for buildings that have become unwanted or obsolete. While new development must also be sustainable, there is insufficient time for us to act unless proactive intervention into the performance of existing building stock becomes a priority.

This research-based book contributes significantly to a more informed understanding and management of decisions relating to the sustainable adaptation of existing commercial buildings. This work collectively offers guidance towards a balanced approach that incorporates sustainable and optimal approaches for effective management of sustainable adaptation of existing commercial buildings. It is divided into three discrete parts concerning building adaptation, adaptive reuse, and adaptation decision-making and optimisation.

Part I has been written by Dr Sara J. Wilkinson. She establishes the definition of adaptation in the context of this book. She reviews and synthesises the key literature, while progressively developing the research questions, hypotheses and a conceptual model towards a knowledge-based approach to sustainable office adaptation. She describes and substantiates her latest research demonstrating how to make a preliminary assessment of adaptation potential using the Melbourne CBD as an illustrative case study. A large focus for this part concerns the connection between sustainability and building adaptation.

Part II has been written by Dr Hilde Remøy. She presents her research conducted into Dutch office change of use adaptations. Adaptive reuse, defined as significant functional change applied to obsolete buildings as an alternative to premature destruction, is her focus. Many exemplars demonstrating application of this approach in the Netherlands are provided and augmented with a number of international case studies. In this part, the relationship of adaptation, retrofitting, alteration and inherent flexibility provided by the initial design solution is explored, including discussion of the practical lessons learned from the underpinning work (as case studies for the practitioner audience) and a clear statement of the theoretical contributions involved.

Part III has been written by Dr Craig Langston. He covers adaptation decision-making and optimisation using multiple criteria. He describes and substantiates his research into how to make a strategic assessment of whether and when to adapt. Cost planning is a key feature of the decision-making process and its integration into a broader financial–social–environmental frame is explored. He also introduces a model to assess new design to ensure that it will deliver adaptation benefits much later in life. Each presented decision/optimisation model is demonstrated via one or more actual case studies.

To sum up, the key issue and motivation for this book is that we need to adapt our existing building stock to reduce its environmental footprint, to aim for higher sustainability, better energy performance and more efficient use of natural resources. We are currently some way from this being standard practice in many urban settlements. Whilst there are an abundance of environmental rating tools to choose from across a range of countries, there is patchy take-up within the real estate markets, especially with lower quality or lower profile stock. Nevertheless, there is an increasing amount of legislation relating to sustainability and evidence that industry practices are improving – but whether the rate of uptake is sufficient to make a meaningful change only time will tell.

As is often quoted, 'the greenest buildings are the ones we already have'.[3]

Notes

1 Extract from the Declaration of the UN Conference on the Human Environment (1972), available online at http://www.unep.org/Documents.Multilingual/Default.Print.asp?documentid=97&articleid=1503&l=fr. Accessed 19 August 2013.
2 Extract from the Intergovernment Panel on Climate Change (IPCC) Fourth Assessment Report (2007), available online at http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch6-ens6-es.html. Accessed 19 August 2013.
3 Originally attributed to Jacobs, J. (1961) *The death and life of great American cities*, New York: Random House.

Part I Building Adaptation

The author for this part is Dr Sara J. Wilkinson. Sara is Associate Professor of Property and Construction at the University of Technology Sydney, Faculty of Design Architecture and Building, Sydney, Australia. She has a combination of professional industry and academic experience spanning more than 30 years.

The research described in this part is the result of work undertaken over a 16-year period and has been funded by Jones Lang LaSalle and the Royal Institution of Chartered Surveyors. Sara's research focus is building adaptation within the context of sustainability, and represents areas of professional practice prior to becoming an academic. Her PhD examined building adaptation and the relationship to property attributes, whilst her MPhil explored the conceptual understanding of green buildings. Sara is a member of the RICS Oceania Sustainability Working Group. She is the International Federation of Surveyors (FIG) Vice-Chair of Commission 10 'Construction Management & Construction Economics'. Sara is also the author of eight books/book chapters and was awarded the RICS COBRA Conference Best Paper Award in 2012 for her paper 'The increasing importance of environmental attributes in commercial building retrofits', RICS COBRA, Las Vegas, NV, USA. September 2012. http://www.rics.org/au/knowledge/research/conference-papers/cobra-2012-environmental-attributes-in-commercial-building-retrofits/

This part of the book establishes the definition of adaptation within the context of this book. It reviews and synthesises the relevant literature, while progressively developing the research questions, hypotheses and the conceptual model towards a knowledge-based approach to sustainable office adaptation.

Sustainable Building Adaptation: Innovations in Decision-Making, First Edition.
Sara J. Wilkinson, Hilde Remøy and Craig Langston.

It describes and substantiates latest research demonstrating how to make a preliminary assessment of adaptation potential using Melbourne as an illustrative case study. Further, this part covers the issue of decision-making in commercial building adaptation. It uses empirical data to identify and explore the factors that are most important in adaptation and how they relate to sustainability. Whereas many previous studies relied on relatively small data sets of adaptation on which to base models and findings, this research is built on a significant number of cases over an extended time period.

Chapter 1 commences with a definition of building adaptation and alternate terms. Sustainability is explored within the context of social, economic and environmental paradigms. The relationship between building life cycles and adaptation is also explained and how it can affect the timing and degree of adaptation. The various decision options and different levels of adaptation are illustrated to demonstrate the numerous options available.

Chapter 2 describes the drivers and barriers for adaptation. Building life cycle theory is introduced and the ways in which adaptation occurs at different stages after completion. These adaptations may occur as a result of legal, economic, physical, social and environmental drivers. The relevance of building performance theory to adaptation is explained in this chapter as well as how performance inevitably declines over time. In the context of the social, environmental and economic factors, the links between building adaptation and sustainability are then highlighted. Finally, other attributes associated with adaptation, such as physical, locational, land use and legal attributes, are discussed.

Chapter 3 focuses on how to assess adaptation using a robust method developed to identify the most important attributes associated with adaptation. Using a large database of adaptation events, principal component analysis is undertaken to establish which attributes are most important. From this analysis a Preliminary Adaptation Assessment Model (PAAM) is developed. Critically this model is designed for non-experts to use in making an initial assessment of a building's potential for minor adaptation. The chapter concludes with an illustrative case study to demonstrate the application of the model in practice.

Chapter 4 uses case studies to explore sustainable building adaptation in Melbourne, Australia. The City of Melbourne is committed to encouraging sustainable adaptation through its innovative 1200 Buildings Program. This chapter identifies the measures typically adopted in sustainable building adaptation before describing ten sustainable building adaptations. The case studies highlight the rationale and objectives for each adaptation, their sustainable features, key challenges and the outcomes of adaptation. The remainder of the chapter compares the adaptations with regards to a number of attributes previously shown to be important.

1

Defining Adaptation

1.1 Introduction

This chapter defines adaptation and alternate terms commonly adopted around the world. The distinctions between in-use and across-use adaptations are identified before describing the significance of adaptation within the context of sustainability. Sustainability is discussed to illustrate why the need to adapt our existing stock becomes more of an imperative as time passes. Adopting the standard convention, sustainability is explored with the context of environmental, social and economic paradigms. The chapter then moves on to show the relationship between adaptation and building life cycles and how this can vary the timing and extent of adaptation projects.

Contextual placing of adaptation within our systems of governance is then discussed with reference to the drive for climate change adaptation such as carbon neutrality that is prompting city authorities around the world to implement legislation and policy to encourage sustainable building adaptation. The scope and extent of these initiatives will increase as the manifestations of anthropogenic climate change become more apparent with the passage of time. The framework currently adopted in Melbourne, Australia, is used to illustrate what is being done in this respect.

The final section examines the stakeholders and decision-making issues in sustainable building adaptation and how they affect the degree of adaptation and sustainability that may be achieved. The numerous levels of adaptation as well as the different stakeholders can make the possible outcomes vary extensively.

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1.2 Terminology

Adaptation, in the context of buildings, is a term that has been broadly interpreted and defined by many researchers (Ball 2002; Mansfield 2002; Douglas 2006; Bullen 2007). Adaptation is derived from the Latin 'ad' (to) 'aptare' (fit). Typically the definitions refer to 'change of use', maximum 'retention' of the original structure and fabric of a building as well as extending the 'useful life' of a property (Ball 2002; Mansfield 2002; Douglas 2006; Bullen 2007). Frequently there are terms such as renovation, adaptive reuse, refurbishment, remodelling, reinstatement, retrofitting, conversion, transformation, rehabilitation, modernisation, re-lifing, restoration and recycling of buildings used to define adaptation activities. The terms all have different meanings, for example, 'refurbishment' comes from the word refurbish which means, 're', to do again and, 'furbish', to polish or rub up. On the other hand, 'conversion' literally means to convert or change from one use to another, for example, a barn converted to a residential property, and this aspect of adaptation is dealt with specifically in Part II. Three decades ago Markus (1979) noted these terms existed in an 'unhappy confusion'; it is an unhappy confusion which still exists and one we must be cognisant of.

Building adaptation occurs 'within use' and 'across use'; that is, an office can undergo adaptation and still be used as an office (i.e. within-use adaptation), or it may change use to residential ('across-use' adaptation) (Ellison and Sayce 2007). Adaptation of existing buildings can encompass some or all of the terms renovation, adaptive reuse, refurbishment, remodelling, reinstatement, retrofitting, conversion, transformation, rehabilitation, modernisation, re-lifing, restoration and recycling of buildings. For this part of the book, a broad definition is adopted, which includes all forms of adaptation, except for minor day-to-day repair and maintenance works. A useful definition of building adaptation, adopted for this book, is

> any work to a building over and above maintenance to change its capacity, function or performance, in other words, 'any intervention to adjust, reuse, or upgrade a building to suit new conditions or requirements'. (Douglas 2006:4)

1.3 The Significance of Building Adaptation

With the rise in consensus within the scientific community regarding anthropogenic activity and climate change, increased sustainability in the built environment is an imperative (Stern 2006; Garnaut 2008). One method of reducing mankind's environmental impact is to adapt buildings rather than default to demolish and new build. This book examines the case for adaptation, adaptive reuse and decision-making with regard to the building adaptation.

Buildings are inextricably linked to sustainability issues, and the construction industry has a major role in reducing the adverse effects on the environment as buildings contribute around half of all greenhouse gas emissions (UNEP 2006). Sustainability has a broad and differing definition depending upon the context in which it is used. It is most commonly defined as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987:2) or 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (Commonwealth of Australia 1992). Brundtland (WCED 1987) described the concept of sustainable development as a strategy to optimise the relationship between the global society and its natural environment with consideration of the social, economic and environmental goals of society.

International concern for the environment was reflected via the UN conference in Stockholm in 1972 and the idea of eco-development emerged as 'an approach to development aimed at harmonizing social and economic objectives with ecologically sound management' (Gardner 1989). Although eco-development was the precursor of the concept of sustainability, the early concept of sustainable development was firmly entrenched within the environmental movement, and sustainability was often interpreted as sustainable use of natural resources (Hill and Bowen 1997). Debate continued on the appropriate definition of the concept of sustainability. It was argued that development inevitably leads to some drawdown of stocks of non-renewable resources and that sustainability should mean more than the preservation of natural resources (Solow 1993), while it was believed that sustainability had three dimensions, those of environmental, social and economic sustainability (Goodland 1995; Elkington 1997). The divergence of opinions demonstrated that sustainability is so broad an idea that a single definition cannot capture the concept; however, there is agreement that uncontrolled exploitation of natural resources is not beneficial to humankind in the long term (Hill and Bowen 1997). It was proposed that sustainable construction meant 'creating a healthy built environment using resource-efficient, ecologically-based principles' (Kibert 2005). Four principles, adopted by Hill and Bowen (1997) in the concept of sustainable construction, were social sustainability, economic sustainability, technical sustainability and biophysical sustainability. This notion of sustainable construction provides the building and construction industry with a practical framework to guide the implementation of sustainable buildings (Hill and Bowen 1997).

Adaptation is inherently environmentally sustainable because it involves less material use (i.e. resource consumption), less transport energy, less energy consumption and less pollution during construction (Johnstone 1995; Bullen 2007). The embodied energy within existing stock is considerable, and the Australian Greenhouse Office (AGO) estimated the reuse of building materials saves approximately 95% of embodied energy (Binder 2003). Even when economic costs for adaptation are high, the environmental argument along with social factors may sway the decision in favour of adaptation (Ball 2002). The process of demolition is a wasteful process in terms of materials unless they are reused or recycled (Department of the Environment and Heritage 2004). Since the late 1990s the concept of sustainability has been one of the major drivers of adaptation due to the notion of recycling of buildings (Ball 2002). Upgrading performance of existing stock, through adaptation, is the most critical aspect of improving sustainability of the built environment (Cooper 2001).

Humans have adapted buildings since they started constructing. Over time, the usefulness of any building for its original function diminishes; this process is known as obsolescence and represents a lack of utility. Obsolescence takes several forms such as physical obsolescence, where buildings or their component parts literally wear out. Functional obsolescence occurs where the original function of the building becomes redundant, for example, the workhouses built in the Victorian period throughout England for the poor and destitute are no longer perceived as appropriate methods of housing people experiencing economic hardship and unemployment. Economic obsolescence occurs when the economic rationale for a building is removed; an example is the 2007 closure in Geelong, Victoria, of the Ford Motor Company factory as a result of cheaper production elsewhere and a downturn in vehicle sales generally. Locational obsolescence occurs when the location of the building is no longer suitable, such as warehouses sited on canals in England that became obsolete when motorways overtook canals as rail and road primary means of transporting goods and materials in the nineteenth century.

Obsolescence can affect any building at any time during its life cycle and can trigger an opportunity for adaptation. Building obsolescence is the subject of much research (Cowan et al. 1970a, b, c; Nutt et al. 1976; Baum 1991; Building Research Board 1993; Khalid 1994; EKOS Limited and Ryden Property Consultants 2001). Previous studies examined the causes and impact of building obsolescence and ways to defer the time when a building has no utility whatsoever and demolition remains the only viable option. One way of deferring obsolescence in buildings is to adapt them either through a change of use or within the existing use (Kincaid 2002). Selected examples from Hong Kong (China) are provided in Figure 1.1, Figure 1.2 and Figure 1.3. Further discussion of obsolescence is contained in Part II.

Substantial expenditure is directed to building adaptation across developed nations, and in the UK more work is undertaken on adaptation than new build (Egbu 1997; Ball 2002). Half of the total expenditure on construction in the UK was on existing buildings (Cooper 2001), and in 2004 £45 billion was spent on UK building adaptation (Goodier and Gibb 2004). Looking at the Australian built environment, construction normally contributes between 5% and 6% of national Gross Domestic Product (i.e. 6.7% in 2002/2003) (Australian Bureau of Statistics 2013). A median percentage of 17.8% of all construction work undertaken in Australia for the decade between 1991 and 2001 was on existing buildings. With an estimated $267 billion of new commercial property to be built in Australia before 2018, the performance gap between new and old stock looks set to increase (Romain 2008). The proportion and amount of annual expenditure on building adaptation in Australia and other national economies of developed countries demonstrates the importance of adaptation to business and commerce, both in the past and increasingly into the future. Similar circumstances for stock

Figure 1.1 Western Market (1906–2003), Sheung Wan, Hong Kong.

Figure 1.2 60–66 Johnston Road (1888–2008), Wan Chai, Hong Kong.

Figure 1.3 Former Marine Police Headquarters (1881–2009), Tsim Sha Tsui, Hong Kong.

condition and proportions of expenditure on adaptation exist in other developed nations globally.

'Highest and best use' is defined as 'the use which results in the most efficient and/or profitable use' of the building (API 2007). Highest and best use is a key appraisal and zoning principle employed in valuing land or buildings and is an important influencing factor in determining obsolescence. Clearly the value of a building and its use are linked closely: highest and best use leading directly to highest present value providing the greatest return for investors and owners. Furthermore, a building's value is influenced by the surrounding environment, so land use has to be consistent or complimentary to neighbouring land uses. Other influencing factors affecting value are local competition and political forces; therefore, the timing of a development or redevelopment is vital to achieve the highest and best use. In city centres, multiple uses are not uncommon, and this makes an appraisal of highest and best use more complex given a combination of land uses may be optimal. Highest and best use appraisals consider four factors: legal permissibility, physical possibility, financial feasibility and the maximum productive use (API 2007). Even so the most comprehensive appraisal is only relevant to a specific point in time and is an expert opinion only (Tosh and Rayburn 2002). Some argue for consideration of social criteria and not only economic factors in the appraisal (Jarchow 1991; Nahkies 2002). Over time the methods of accounting for the costs and benefits of social and community aspects in development have been acquired and may be integrated into the assessment. In this book the underlying assumption is that adaptation is predicated on the goal of achieving and maintaining highest and best use for a building at a given point in time.

Globally, the market is noting an increasing amount of adaptation in buildings over the last 20 years. For example, increased levels of adaptation were noted in Alabama and Chicago (Olson 2005; Colchimario 2006). There was a 'frantic pace' of adaptation activity in the UK that outstripped new building activity (Kincaid 2000). A study into the adaptation of offices to residential uses found a large upturn in activity in Boston, Sydney, Melbourne and Vancouver during the 1990s (Heath 2001), while a UK study reported an increased level of adaptation in the retail sector (Douglas 1994). This increase in the rate and amount of adaptation across developed countries is, in part, a response to the case that adaptations are typically faster to complete and occupy than new build and that adaptation often costs less (Chandler 1991; Highfield 2000). Subsequent to the 2008 global financial crisis, there has been a slowdown in all areas of construction. Since the early 2000s there has been a discernible response to the emerging importance of sustainability within the built environment and embodied energy within existing buildings, and thus adaptation can represent a more sustainable solution to new build (Bullen 2007). This move towards incorporating sustainability has occurred alongside significant UK and Australian Government-led global economic reports (Stern 2006; Garnaut 2008) highlighting the potential outcomes of ignoring global warming and climate change. The momentum for sustainability in buildings has been further increased through the adoption of corporate social responsibility (CSR) reporting by leading business organisations around the world and the subsequent adaptations that enhance the sustainability of their building stock (Newell and Sieraki 2009).

The age and quality of the stock in an area affect the amount and scope of adaptation undertaken. Within Australia, previous studies estimate between 85 and 90% of the commercial building stock is aged over 10 years (Davis Langdon 2008). In older more established cities, the average age of the building stock is higher still. Furthermore, in established urban centres, only small percentages of new buildings are added to the existing stock total each year. For example, in London 1–2% is added to the total stock of commercial buildings annually (Knott 2007), whereas Melbourne typically has 2–3% added to total stock (Jones Lang LaSalle 2008). It is estimated that 87% of the residential stock the UK will have in 2050 is already built and 89% of the stock Sydney will have in 2030 is already built (Kelly 2008). As a result there is an ongoing need to adapt the existing stock to meet the changing current and future needs of investors and building users. Pressure is placed on existing building stock in Australia from increased immigration, resulting in further opportunity to adapt buildings (Foran and Poldy 2002). Melbourne is seeking to grow to a population of five million by the year 2025, and recent growth exceeded this prediction (Department of Premier and Cabinet 2008). The UK also experienced population growth in the first decade of the twenty-first century through immigration within an expanding European Union. Population increases put pressure on the existing stock to meet societal needs that can make adaptation attractive. Moreover, the situation is compounded with a construction labour skill shortage in Australia which has driven new build construction costs upwards, and adaptation can be an attractive economic alternative in some cases.

Globally in some urban areas, vacancy rates for office buildings are high and rates are increasing with the ongoing global economic turmoil (RICS 2009). Vacancy rates are higher for lower-grade stock, and some sections of stock that have been vacant for three or more years are considered to be a structural and long-term issue (Remøy and Van der Voordt 2006). For instance, in the Netherlands there was seven million square metres of office space vacant in 2012, which presented challenges to owners by way of lost income (DTZ 2012). Moreover, empty buildings are more vulnerable to vandalism, arson and squatting that drive up ownership costs and, in the long term, the effects of vacancy including social blight and economic decline. It was concluded that one million square metres of Dutch office space (or 2% of total stock) should be removed from the market because it is outdated and suffering to various degrees from technical, functional, locational and physical obsolescence (Remøy and Van der Voordt 2006). In Australian cities the positive economic conditions of the early 2000s have led to comparatively low vacancy rates. Melbourne had an all-time low vacancy rate for office space in 2007 when rates were 4.7% (Savills 2009). However, as a result of the global financial crisis in 2008, national office vacancy rates increased across Australian cities to 9% in July 2011 (PCA 2013). Adaptation offers a new economic life for a building at a fraction of the cost of new construction, and with a greater amount of lower-grade space available, there is an opportunity for businesses to occupy better-quality space as developed countries move out of recession in due course.

1.4 Decision-Making Issues in Building Adaptation

Building adaptation decision-making is complex (Blakstad 2001; Douglas 2006). There are many stakeholders involved, each representing a different perspective. Decision-makers are investors, producers, developers, regulators, occupants/users and marketers (Kincaid 2002). An additional layer of complexity is that these stakeholders make decisions at different stages in the process and each has different degrees of influence (see Table 1.1).

Generally decisions made at the early stages of the process have an ongoing impact throughout the project. For example, the decision to change the use affects all the decisions that follow. Furthermore, the capacity of stakeholders to influence decisions can be classed as either direct or indirect. Another layer is added where a stakeholder intends to be an occupier or user, in which case the decisions will have a daily impact on their ongoing business operations. The motivations of stakeholders influencing decision-making vary, for example, a developer who intends on selling the property post-adaptation experiences different drivers than if the intention is to retain the property within the developer's property portfolio. In summary, stakeholders are multiple and exert their influence to different degrees at different stages.

Table 1.1 Decision-makers in building adaptation.

Decision-makers	Professional and other affiliations	Stage in adaptation where decisions are made
Investors	Pension/superannuation funds, insurance companies, banks, independent investors, professionals who find capital to invest	Beginning/early
Producers	Professional team – facilities manager, quantity surveyor, architects, engineers, contractors, surveyors, suppliers, fire engineers, structural and mechanical and electrical engineers	Quantity surveyor/architect at feasibility stage Design stage Construction stage
Marketeers	Surveyors, stakeholders, professionals who find users for buildings	During design (if selling off plan) and/or construction stage
Regulators	Local authorities, planners, heritage, building surveyors, fire engineers	During design stage (and possibly during construction if amendments are made)
Policymakers	Federal, state and local government departments	Indirect effect on decision-making in adaptation at all stages
Developers	Organisations that combine investment, production and marketing in whole or in part. Professionals from aforementioned bodies and others	Beginning/early
Users: corporate, residential	Large institutional owners and users, individuals, business organisations and occupiers	—

1.5 Decision Options and Levels of Adaptation

A further aspect is the range of options available to stakeholders (Kincaid 2002). Kincaid rationalised the options as follows: Option one is to change the use with minimum intervention because of the inherent ‘flexibility’ of the building. Option two is for adaptation with minor change, while option three requires a higher degree of intervention and is typically referred to as ‘refurbishment’ or ‘retrofitting’. Option four involves selected demolition, whereas option five is the extension of the facility. Finally, option six is demolition and redevelopment and is selected when the social, economic, environmental, regulatory and physical conditions are such that the building is at the end of the life cycle, lacking utility (Bottom 1999). This part of the book is focused on decision-making that occurs through options two to five inclusive. Effective decision-making demands the consideration of issues such as framing the issue properly, identifying and evaluating the alternatives and selecting the best option (Turban et al. 2005; Luecke 2006).

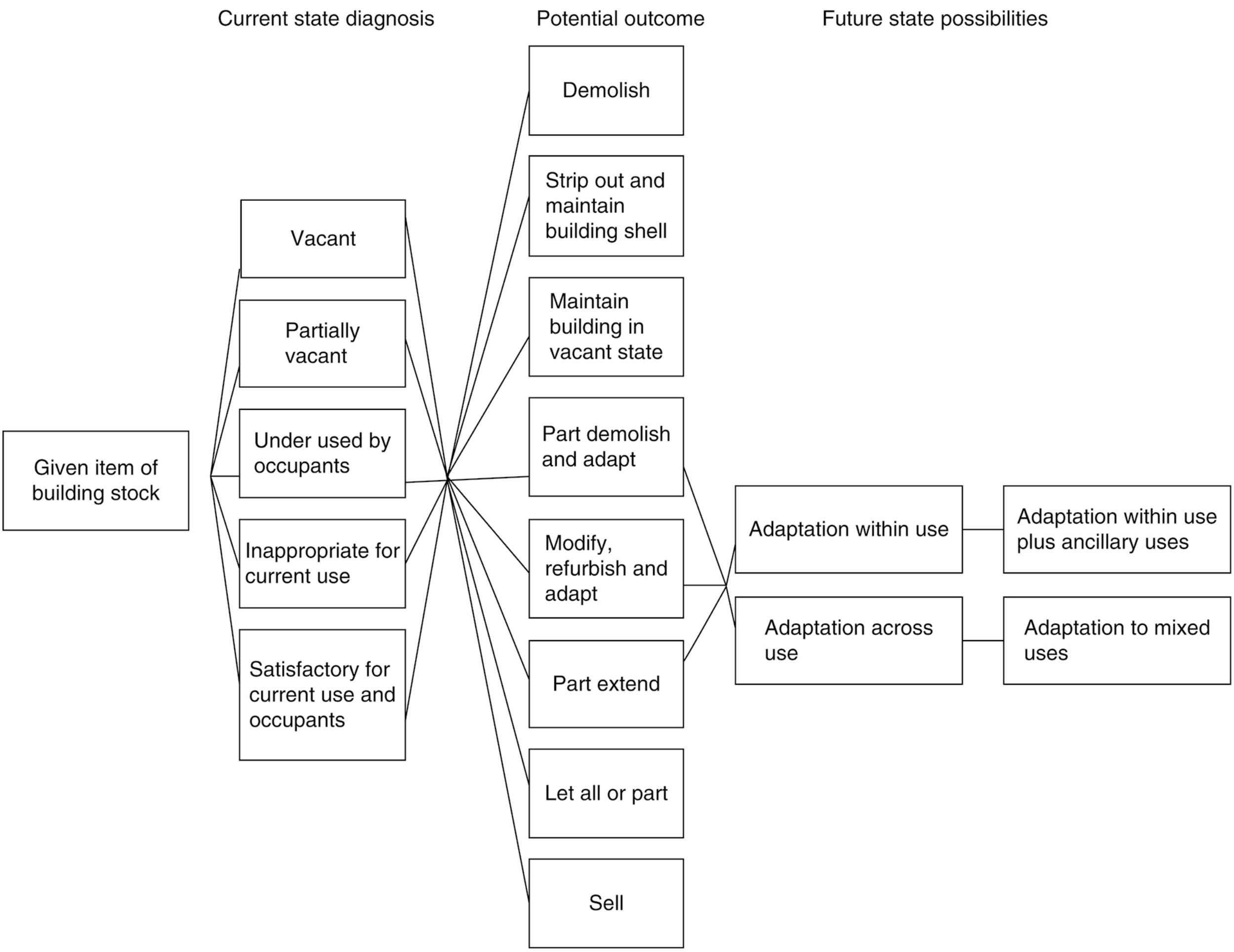

Figure 1.4 Options for adaptation.