Innovation in the Built Environment

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Sustainable Building Adaptation

Innovations in Decision-making

WILEY Blackwell

Sustainable Building Adaptation: Innovations in Decision-Making

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About the Authors

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.

Dr Craig Langston is Professor of Construction and Facilities Management at Bond University's School of Sustainable Development, Gold Coast, Australia. He has a combination of industry and academic experience spanning more than 35 years. The research described in Part III: Decision-making and

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.

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