Preface

TO BE OR NOT TO BE SUSTAINABLE:
URBAN AND REGIONAL INFRASTRUCTURE

Introduction

The concept of ‘sustainability’ has been pushed to the forefront of policy-making and politics as the world wakes up to the impacts of climate change and the effects of the modern urban lifestyle. Climate change has emerged to be one of the biggest challenges faced by our planet today, threatening both built and natural systems with long term consequences which may be irreversible. While there is a vast literature in the market on sustainable cities and urban development, there is currently none that bring together the vital issues of urban and regional development, and the planning, management and implementation of sustainable infrastructure. Large scale infrastructure plays an important part in modern society by not only promoting economic growth, but also by acting as a key indicator for it. More importantly, it supplies municipal/local amenity and services: water, electricity, social and communication facilities, waste removal, transport of people and goods, as well as numerous other services. For the most part, infrastructure has been built by teams lead by engineers who are more concerned about functionality than the concept of sustainability. However, it has been widely stated that current practices and lifestyle cannot continue if we are to leave a healthy living planet to not only the next generation, but also to the generations beyond. Therefore, in order to be sustainable, there are drastic measures that need to be taken. Current single purpose and design infrastructures that are open looped are not sustainable; they are too resource intensive, consume too much energy and support the consumption of natural resources at a rate that will exhaust their supply. Because of this, it is vital that modern society, policy-makers, developers, engineers and planners become pioneers in introducing and incorporating sustainable features into urban and regional infrastructure.

This book aims to bridge the gap in the current literature by addressing the overall problems present in major infrastructure in society, and the technologies that may be applied to overcome these problems. An overall view is a useful first step for the target audience in order to stimulate and inspire new research or simply to whet their interest. The book advocates the view that the focus needs to rest on ways in which energy intensive but ‘invisible’ (to the general public) facilities can become green or greener. The case studies presented are lessons to be learnt from our neighbours and from our own backyard, and provide an excellent general overview of the main issues facing us all. This book fills a significant gap in the literature by bringing together issues related to urban and regional development, and infrastructure planning, management and provision by focusing on triple-bottom-line sustainability.
Scope

This book focuses on the technologies, planning, provision and management of sustainable urban and regional infrastructures. Chapters of the book cover a variety of issues in this area and contain case studies of a number of city-regions from Australia and overseas. While the focus of the book is on the technologies, planning, provision and management of sustainable infrastructures, it also provides a historical perspective of cities and urban regions, and of how infrastructure is implicitly tied to their development. The book explores the reasons why sustainability, especially in the field of infrastructure, is vital to maintaining not only ecological integrity, but also to maintaining the continuing economic growth and social welfare of populations. Major infrastructures and their single purpose designs are also discussed in detail, with the spotlight trained on energy, water provision, transport, information technology, and social and knowledge infrastructure. It is easy for the general public to overlook the magnitude of the ecological footprints of large infrastructures as they are often hidden or remotely located; therefore, there is a general lack of connection with them. It is then up to policy-makers, planners and academics to configure and implement sustainable features in infrastructure while, at the same time, focussing on both supply and demand aspects of the issue.

The parts of the book that focus on technology include a literature review of current conditions and input, address problems, and provide intelligent and informed input on how circumstances can be improved. The focus is on major infrastructure such as energy, water, transport, information technology, as well as on social and knowledge infrastructure. These are all of vital importance, not only to the economic growth of any city and region, but also for the maintenance of an economically developed lifestyle. Case studies are often useful when it comes to identifying best practice or practices to be avoided. Asian case studies are particularly interesting, not only because they are Australia’s neighbours, but also because they are mostly developing, or are experiencing rapid urban growth. Their experiences are, therefore, comparable to that of many regions in Australia, especially South East Queensland. With new information and technology emerging every day, there are lessons to be learned for Australia – for example, from the ubiquitous communication technology which is currently being implemented in highly connected cities such as Seoul and Daejeon in South Korea. Airports are also given a distinct mention in the book due to their economic and public importance, and their rapid privatisation in recent years which has had significant impacts on their operation, their integrity as private entities (providing a public service), as well as on surrounding land use issues. As with the implementation of any programs or infrastructure, there is a need to monitor and manage them. Using technologies such as geographical information systems and modelling, urban growth, land use structures and the changing environment can be monitored and modelled for current and future urban use, as well as for infrastructure provision.

The fiscal side of matters is also important, as more often than not, it is used as a key determinant for decision-making. The value of the infrastructure is connected to the amount of usage and the quality of service it is able to deliver to its users. This is well tied into the management of the infrastructure, which often involve numerous stakeholders who can have complex relationships. To ensure the successful implementation and delivery of projects, it is important that the needs and requirements of the stakeholders are identified and managed, whilst engaging them in comprehensive consultation from the commencement to the completion of the projects. The scope of the book is both broad and deep, with issues at the forefront of politics and policy-making discussed by a panel of specialists in their respective fields. It is thus a valuable addition to the catalogue of literature on sustainable cities.
Content

The foreword and afterword of the book are written by senior, eminent academic researchers. The foreword by Kevin O’Connor of The University of Melbourne, Australia focuses on infrastructure and urban sustainability, and the afterword by Glen Searle of The University of Queensland, Australia focuses on achieving sustainable cities with sustainable infrastructures. The body of the book is organised into three main sections, each clustering a number of chapters dealing with specific aspects of sustainable urban and regional infrastructure: (1) Sustainable infrastructure and technology; (2) Planning for sustainable infrastructure; and (3) Sustainable infrastructure provision, integration and management.

Section 1: Sustainable Infrastructure and Technology

The eight chapters in Section One consider the broad connections between sustainable infrastructure and relevant technologies.

Wendy Miller and Janis Birkeland’s chapter deals with sustainable energy sources. They argue that achieving long term sustainability in the energy sector requires a focus on the energy services required in an urban context, and the planning and implementation of a ‘living organism’ network of independent ‘energy cells’. The significant points made by Miller and Birkeland relate to the **raison d’être** of this section: the need for significant advancement in technologies and processes that can be integrated to ensure long term sustainability of the urban and regional infrastructure.

In the second chapter of this section, Shinyi Lee, Tan Yigitcanlar, Prasanna Egodawatta and Ashantha Goonetilleke focus on sustainable water provision in the era of climate change. The chapter reviews the global challenge of providing freshwater to sustain both lifestyles and economic growth, and evaluate the alternatives to water sources (including desalination, water transfers, recycling, and integrated water management). Using a comparative study on alternative resources, the authors examine major alternative strategies for water provision. They focus mainly on desalination and its strengths, weaknesses, opportunities and constraints as one effort to achieve water security.

The third chapter in Section One focuses on the question of the urban water cycle. The chapter by Les Dawes and Jim Reeves advocates the need for integrated and more sustainable water management systems. In order to achieve sustainable wastewater treatment and promote the conservation of water and nutrient resources, this chapter highlights the need for a closed-loop treatment system, and the transformation of the traditional linear treatment systems into cyclical treatment systems. It questions the traditional understanding of the urban water cycle and promotes the recent understanding of, and shift towards, sustainability in wastewater infrastructure.

In the fourth chapter Fatih Dur, Tan Yigitcanlar and Jonathan Bunker present three perspectives for sustainable urban and transport development: transportation from a technology perspective; transportation from a demand management perspective; and transportation from an integration perspective. They define and focus on prominent transportation planning and urban policy considerations that need to be carefully reconsidered in search of a sustainable urban development path. The chapter draws on the review of the research in these distinctive perspectives in transport infrastructure and services, and on their relationships with sustainable transport infrastructure development.

The fifth chapter by Kristiane Davidson, Ned Lukies and Debbie Lehtonen explores bicycle facilities as a part of the crucial green transport infrastructure of metropolitan cities. The chapter’s authors emphasise that bicycle facilities need to be employed in order for a city to reap the benefits of quality
of life gained by improving and encouraging sustainability. This chapter covers both hard and soft infrastructure, such as segregated bike lanes, green waves, parking facilities, public rental bikes as well as policy, education and management. The authors conclude by underlining the importance of safety, integration of physical facilities with social and cultural mechanisms, and the conversion of human energy into mobility through green transport in order to augment sustainability efforts.

The next chapter in this section focuses on telecommunication infrastructure. Authors, Tan Yigitcanlar and Hoon Han, investigate the contribution of information and communication technologies urban infrastructures to the sustainability of cities. Besides well-known telecommunication technology infrastructures such as telephone, mobile phone and internet, the chapter also explores convergence urban technologies such as global positioning system navigation, smart card, and radio frequency identification. It also provides insights into how these converging technologies and their infrastructure are supportive in improving quality of life, sustainability of urban infrastructure, and urban infrastructure management.

The seventh chapter by Robyn Keast, Douglas Baker and Kerry Brown scrutinises one of the largest urban and regional infrastructure hubs, the international airport. The chapter authors contend that the conversion of an airport into a sustainable airport metropolis requires more than just industry clustering and the existence of hard physical infrastructure. The chapter emphasises the crucial importance of the establishment of an interactive and interdependent infrastructure trilogy of hard, soft and social infrastructures that provides the necessary balance to the airport metropolis to ensure sustainable development. This chapter provides insights for integrating and harnessing the infrastructure trilogy to enable the achievement of sustainable airport cities.

In the final chapter, Sujeeva Setunge and Arun Kumar contend that knowledge and creativity are keys to soft infrastructure and socio-economic development. The chapter underlines the relevance of soft infrastructure forms such as research, training, innovation and technology, to sustainable urban development. This is evidenced by the efforts of many city administrations around the world that are adjusting their endogenous development strategies by increasingly investing in soft infrastructure and aiming for a knowledge-based development. The chapter scrutinises the relations between knowledge assets and urban infrastructures, and examines management models to improve soft infrastructure provision.

Section 2: Planning for Sustainable Infrastructure

The eight chapters in Section Two provide insight into planning and policy strategies applicable to the successful implementation of sustainable urban and regional infrastructure development.

The chapter by Phil Heywood ‘Planning infrastructure: considerations for regional development’ focuses on three related issues. Firstly, the chapter draws attention to social infrastructure provisions; secondly, it raises the need for new technologies, organisation and funding; and, thirdly, it focuses on regional scale responses to the expanding scale of modern settlements and the reach of technology. Continuing the theme of the first section of the book, Heywood’s chapter distinguishes three levels of metropolitan, provincial and rural regions; illustrates metropolitan and provincial infrastructure problems and provision; and draws on rural infrastructure examples and lessons from global case studies.

The subsequent chapter in this section focuses on promoting sustainable cities in Nigeria. In this chapter, Motoo Kusakabe advocates the role of information and communication technology infrastructure that has a real impact on economic growth, and explores suitable policy indicators that are the most crucial determinants in creating a knowledge-based economic development at city level. Focusing on the role of Open City Portal in establishing sustainable cities, the chapter considers the Nigeria Delta Region as
a pilot initiative. Kusakabe also investigates prospects and constraints of the Open City Portal approach, using cross-country and city-level survey studies that were conducted in 2005, 2007 and 2008.

The third chapter in Section Two focuses on sustainable infrastructure development in the South Eastern Asian capital cities of Hong Kong, Kuala Lumpur and Singapore. In discussing sustainable urban and infrastructure development, the authors – Suharto Teriman, Tan Yigitcanlar and Severine Mayere – describe the opportunities and constraints that Hong Kong, Kuala Lumpur and Singapore have faced as the cities of the South East Asia region that are attempting to re-invent themselves as sustainable cities of the 21st Century. The authors’ conclusion is that these three city cases (Singapore, Hong Kong and Kuala Lumpur) provide important experiences in managing urban form and infrastructure whilst at the same time promoting sustainable patterns of urban development – experiences from which other cities could learn.

Sang Ho Lee, Tan Yigitcanlar and Johnny Wong’s chapter on ubiquitous and smart system approaches to infrastructure planning, presents an argument for understanding the need for planning to give greater attention to the notion of ubiquitous cities’ infrastructure needs. A ubiquitous city is an urban environment where any citizen can access any service from anywhere, and at any time, by using any communication device. Using case studies focused on the Republic of Korea, Japan and Hong Kong, the authors scrutinise the development of ubiquitous and smart infrastructure. The chapter and the case studies provide an invaluable learning for policy-makers and urban and infrastructure planners in considering adopting these system approaches in their cities.

The fifth chapter of the section, by Justine Lacey and Phil Heywood, investigates ‘the ethics of regional water planning’ that has recently become a very important issue for many regions that are dealing with tough drought conditions. The chapter focuses on the ethical side of planning and management of water resources in high growth regions. Lacey and Heywood examine how loss of agricultural land and natural habitats; coastal impacts of desalination plants; concerns over re-use of waste water; and demand management issues of water rationing, pricing mechanisms and behaviour change have impacts on infrastructure planning in South East Queensland, Australia. The chapter demonstrates that these four key ethical principles and their associated indicators have merit (both in terms of substance and process) in evaluating water infrastructure planning.

In the next chapter, Eddo Coiacetto points out some key aspects of the infrastructure challenges for planners and urban policy-makers in facilitating transit oriented developments. The chapter looks at transit oriented development as one of the key infrastructures to improve the sustainability of cities. A closer examination of the development industry helps to explain some of the challenges of implementing transit oriented developments, and why their implementation may be considerably slower than what their advocates may desire. Coiacetto particularly scrutinises transit oriented developments in the case study of Brisbane, Australia by focusing on the role and views of the developers involved in implementing transit oriented developments.

The seventh chapter of Section Two targets the contestation of sustainability in infrastructure. Authors Kuniko Shibata and Paul Sanders present an interesting case of the Brisbane (Australia) Eastern Busway development where local community groups have argued that the sustainable development principles in the Busway Plan do not uphold the sustainability agenda set in the broad South East Queensland Regional Plan. Shibata and Sanders demonstrate that principles of sustainable infrastructure should be measurable, and local communities better informed in order to fulfil the public interest in regional planning.

In the final chapter of this section Azime Tezer, Care Olgun Caliskan, Mehmet Murat Calik and Serkan Sinmaz discuss one of the most important urban infrastructures and its sustainability: ‘sustainable
transportation’. The authors assess urban transportation development and its sustainability in the case of Istanbul, Turkey. The case study particularly looks into the development of the third bridge crossing on Bosphorus and its connected highways. The chapter concludes that the new bridge proposal is not a solution to travel demand, and even creates additional problems for urban life such as further congestion, environmental degradation, social exclusion, and injustice in the provision of urban transportation management.

Section 3: Sustainable Infrastructure Provision, Integration and Management

In five chapters, the final section of the book focuses its attention on issues related to sustainable infrastructure provision, integration and management.

The first chapter of Section Three introduces technologies used in monitoring urban growth and change in order to provide infrastructure sustainability. Geospatial technologies offer reliable tools and systems to support analysis, problem solving, planning, decision-making, and support and management of the process required to pursue infrastructure planning and provision. Virendra Pathak and Robert Webb discuss several key geospatial technologies in an attempt to provide a basic understanding of how these technologies support urban and infrastructure development mechanisms and their sustainability. Major technologies, systems and tools introduced in this chapter include: satellite remote sensing, geographical information systems, global positioning systems, and light detection and ranging.

The second chapter in this section focuses on planning integration in order to provide sustainable development. In Michael Regan and Bhishna Bajracharya’s chapter the focus is on the South East Queensland regional economy and the policy decisions taken in recent years to embed and integrate both regional planning and regional infrastructure investment strategies through statutory the South East Queensland Regional Plan and Infrastructure Plans and Programs. In an Australian case study, Regan and Bajracharya examine the benefits of the integrated approach that brings together regional economy considerations, environmental and social issues, urban and infrastructure development, and the challenges facing the region.

The chapter by Benson AuYeung, Tan Yigitcanlar and Severine Mayere examines and identifies limitations of the contemporary planning approach to facilitating sustainable urban development and effective urban management. It discusses the importance of infrastructure management for sustainable urban development, and introduces a new integrated infrastructure management framework. The Brisbane Urban Growth Model developed for Brisbane, Australia aims for timely and coordinated delivery of sustainable urban infrastructure. The authors see the model as an important step for local government in moving towards integrated and effective infrastructure management.

In the fourth chapter, Adrian Bridge, Robert Lee Kong Tiong and Shou Qing Wang explore infrastructure procurement in Australia. In particular, the chapter focuses on developing an understanding of the determinants of value at key procurement decision points, which range from the make-or-buy decisions to buying in the context of market structures (including the exchange relationship and contractual arrangement decisions). This chapter presents a state-of-the-art integrative framework for internalisation and externalisation, which provides a structured approach to identifying and measuring attributes of the transaction pertaining to an infrastructure project, along with attributes concerning the capability and competence differential between government and private sector.

The final chapter of this section is authored by Bambang Trigunarsyah and Martin Skitmore and explores the project management of sustainable infrastructure provision. It discusses the critical success factors and management strategies necessary for the successful delivery of sustainable infrastructure projects.
factors of infrastructure project delivery, and the management of stakeholders in delivering sustainable infrastructure projects, from project conception to completion. Specifically, the authors highlight issues relevant to managing stakeholders for project selection, and engaging them to improve project constructability, operability and maintainability. In short, the authors argue that delivering sustainable infrastructure projects involves many stakeholders; therefore, the impact of stakeholders in infrastructure project delivery needs to be carefully considered.

Contributors

All chapter authors of this book are affiliated or associated with the Sustainable Built Environment Research Cluster of Queensland University of Technology (QUT), Brisbane, Australia. The Cluster is a research organisation of QUT’s Faculty of Built Environment and Engineering, and its activities are coordinated by the book’s editor. It aims to make significant contributions to the theory and practice of sustainable urban and transport development through research and best practice pertaining to a variety of issues ranging from triple-bottom-line sustainability to climate change; from green energy to water transport governance; from urban, regional, environmental and transport planning to developmental infrastructure planning; and from sustainable urban growth management to knowledge-based urban development. With over a dozen interdisciplinary core senior academic members and a large and expanding number of affiliate professionals, academics and higher degree research students from Australia and overseas, it conducts research and provides consultancy on the important issues affecting the quality of our lives and environment.

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