Urban Infrastructure
Finance and Management

Edited by

Kath Wellman
Director
Centre for Developing Cities
ANZSOG Institute of Governance
University of Canberra

and

Marcus Spiller
Principal and Partner
SGS Economics & Planning Pty Ltd
Melbourne

WILEY-BLACKWELL
A John Wiley & Sons, Ltd., Publication

This edition first published 2012

Wiley-Blackwell is an imprint of John Wiley & Sons, formed by the merger of Wiley's global Scientific, Technical and Medical business with Blackwell Publishing.

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
2121 State Avenue, Ames, Iowa 50014-8300, USA

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Library of Congress Cataloging-in-Publication Data

Urban infrastructure : finance and management / edited by Kath Wellman and Marcus Spiller.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-470-67218-1 (hbk. : alk. paper)
1. Infrastructure (Economics)–Finance. 2. Infrastructure (Economics)–Australia–Finance–Case studies. 3. Public works. 4. Urban economics. 5. Urban policy. I. Wellman, Kath. II. Spiller, Marcus.
HC79.C3U723 2012
363.6068′1–dc23

2012009755

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 Meaden Creative
Cover image courtesy of iStockphoto.

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

1 2012

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About the Contributors

John Daley is an energy economist with a 40-year background in industry, government, and consulting. He specialized in resources and energy sector policy and strategy, commercial project evaluation and risk mitigation, advising clients in the coal, petroleum, electricity, and natural gas industries. He has worked on climate change policy pertinent to the energy sector since the early 1990s. He is currently a Director of Businesscertainty.com Pty Ltd, a consultancy firm that provides advice to government and private enterprise on energy policy.

Cameron Gordon is an Associate Professor of Economics at the University of Canberra's Faculty of Business and Government and currently a Visiting Professor at the Imperial College of London Centre for Transport Studies. Professor Gordon has previously been a Visiting Professor at the University of Sydney Institute for Transport and Logistics Studies (ITLS) and a Visiting Fellow in Public Policy at the City University of New York (CUNY) Research Foundation. He has had prior academic appointments in Finance with CUNY and in Public Policy and Administration with the University of Southern California.

Andrew McDougall holds qualifications in economics, finance, and planning. He has an extensive record of achievement in consulting, including formal evaluations of government programs; preparation of business cases for government funding; development of strategies and business plans for tourism facilities, cultural institutions, and community organizations; regional economic analysis and strategy development; and public policy research surrounding urban and economic competitiveness and strategies to maximize development potential within this context. He is a Principal and Partner of SGS Economics & Planning Pty Ltd.

Lyndsay Robert Neilson has had a long career in government, academia, and the private sector in Australia and internationally, developing public policy and strategic plans for major cities (Canberra, Melbourne, Riyadh), including significant work on infrastructure planning. He was Chairman of the Group on Urban Affairs in the OECD and in Australia created the national Better Cities Program that helped transform the inner urban areas of Australia's major cities. He established the Centre for Developing Cities at the University of Canberra. He has been Secretary of both the Department of Infrastructure and the Department of Sustainability and Environment in the Government of Victoria, Australia. He is currently Managing Director of Neilson Associates Pty Limited which provides services internationally, notably in the Middle East and Australia, in metropolitan strategic planning, housing programs, urban management, and public policy development.

Frederik Pretorius is an Associate Professor at The University of Hong Kong (HKU) and has been active in urban development for more than 30 years. He has experience in Asia, Australia, New Zealand, and Southern Africa as academic, in the corporate sector, and as a consultant and professional in various activities, including regional economic development and real estate and infrastructure finance. At HKU, he teaches Finance in various Land Economics-related subjects in the Faculty of Architecture and is Adjunct Professor, Urban Finance, Urban and Regional Economics at The University of Canberra. He previously served at the University of Canberra in Australia and the University of the Witwatersrand in Johannesburg.

Marcus Spiller is a Principal and Partner of SGS Economics & Planning Pty Ltd. His consulting experience spans land economics, regional development, housing policy, infrastructure funding, and policy coordination systems. He has taken up secondments as lecturer in urban economics at Melbourne University, adviser to the Minister for Planning and Housing in Victoria, and senior executive in the Queensland Department of Housing, Local Government and Planning. He is an Adjunct Professor in Urban Management at the University of Canberra, a former member of the (Australian) National Housing Supply Council, and a former National President of the Planning Institute of Australia.

Sophie Sturup completed her PhD "Managing Mentalities of Mega Projects" in 2011. She completed a Masters of Science in Geography at the University of Oxford and has a graduate certificate in public sector management from Flinders University. She was director of Antur Projects Pty Ltd, her own consulting company, for 6 years and worked with the Victorian government on the privatization of the electricity industry during the late 1990s. She is currently Principal of Sturup Consulting and undertakes research in the Australasian Centre of Governance and Management of Urban Transport at the University of Melbourne.

Praveen Thakur is one of Australasia's leading experts in spatial economics and has authored several refereed journal articles on the topic. He has extensive experience in combining macroeconomic and urban planning theory to provide new insights into the location choices of firms and households, the economics of infrastructure, productivity, and how cities and regions function. He is an Associate Director of SGS Economics & Planning Pty Ltd.

Kath Wellman has a broad base of qualifications in environmental science, landscape architecture, urban design, and business management. She has been placed in international urban design competitions in Europe, North

America, and Australia and has authored papers and book chapters on environmental science and design. More recently, her focus has been urban management, particularly the finance and management of urban infrastructure in developed and developing nations. She has worked for government, private enterprise, and nongovernmental organizations and has been an Associate Professor at the University of Canberra from 1995 to 2010, first as Head of Landscape Architecture and later as Deputy Director and then Director of the Centre for Developing Cities. She continues her association with the University through the ANZSOG Institute of Governance.

Preface

The magnitude of urban infrastructure investment and the long time frames involved in management and maintenance require a coordinated approach to forward planning, policy development, and implementation. There are major challenges in making long-term decisions on urban infrastructure and getting management structures and processes in place in the present environment where politics, economies, social and technological systems, and our understanding of the physical environment are changing rapidly. Getting it right generates long-term dividends. Getting it wrong involves major costs, often borne by taxpayers.

This book focuses on the finance and management of urban infrastructure. It is posited on a strong belief that the physical structure of cities and the efficiency of infrastructure services delivered are driven by efficiencies within individual infrastructure sectors, lessons learned across these sectors, and the ability to coordinate and integrate sectors to best leverage off economies of scale and scope and minimize negative externalities. This necessitates an interdisciplinary approach, integrating knowledge from finance, governance, planning, and management as well as the characteristics of the individual urban infrastructure sectors involved. Here it is not only about getting the initial decisions and policy settings right, but also ensuring effective implementation. A major theme running through the book is the nature of institutions and the governance structures responsible for delivery and management of urban infrastructure and the decision-making processes involved.

The book takes a deliberately pragmatic approach to the finance and management of urban infrastructure and is written by academics and practitioners presenting both theory and practice. It is written for both students and practitioners in policy, planning, urban management, infrastructure finance, and management. There has been strong use of Australian case studies throughout this book, and these case studies have been placed within an international context where appropriate. Many of the lessons learned in Australia have direct applicability to both developed and developing nations.

Below is a brief description of each of the chapters.

Chapter 1 provides an introduction to the book. It examines the nature of infrastructure investment and productivity and global factors impacting on this, in particular exploring potential impacts from urban growth, climate change, and finance. It touches on innovation in technologies in design and development of not only the physical infrastructure but also the financial and management systems that support this infrastructure. It provides an introduction to microeconomic reform, the productivity benefits of this, and the challenges of coordination of urban infrastructure at a metropolitan scale which remain. Australian case studies are introduced.

Chapter 2 outlines urban management principles and instruments that are used to complement markets or are utilized where markets fail, recognizing that efficiencies driven by markets are not themselves sufficient to ensure effective, integrated urban outcomes, given the abundance of externalities (both positive and negative) that characterize urban growth and change. Policy development, legislation and regulation, fiscal and financial measures, institutional arrangements, advocacy, and knowledge management are discussed and illustrated utilizing case studies.

Chapter 3 examines the productivity of infrastructure and the decision-making processes behind determining whether, when, and how best to invest in infrastructure. Here infrastructure investment decisions are measured against the efficiency with which the project produces service outputs, the effectiveness with which all relevant outcomes are achieved, and the distributional consequences of the investment. Three project evaluation methodologies used to determine whether to invest in infrastructure are critically reviewed: Financial Evaluation, Cost-Benefit Analysis, and Multicriteria Analysis. Once a decision to invest has been made, the form of financing needs to be determined. The chapter concludes with an overview of the forms of project finance and the benefits arising from efficient financing, taking into account the characteristics of the project, fiscal circumstances, and the broader policy context.

Chapter 4 examines in further detail private participation in the provision of infrastructure and in particular public–private partnerships (PPPs) that are characterized by complex, nonstandard, capital-intensive projects with public good characteristics. It is noted in Chapter 3 that in PPPs there is considerable scope to align incentives to manage project risks with the capacity to do so but that poor negotiation and contracting practice by government agencies could result in government retaining unnecessarily high contingent liabilities. This chapter presents a conceptual framework to dissect and integrate systematically the institutional mechanisms put in place to ensure the clear division and allocation of rights and risks and the management of incentive conflicts between the public and private partners in PPPs. This conceptual framework is then utilized to analyze the performance of the process and institutional mechanisms that were used to finance, deliver, and operate the Melbourne CityLink project.

Chapter 5 addresses land management and planning legislation utilized to optimize land use and investment in urban infrastructure and services. The underlying premise is that the form, density, and timing of land development and redevelopment have major impacts on the efficiencies of urban services provision. These efficiencies are shaped by market forces through the land development process and by regulation through land use planning systems and controls. Both market forces and land management and regulatory systems are analyzed to show how each can drive efficiencies and accountability in the funding and provision of urban services and the shaping of cities.

Chapters 6, 7, and 8 are sector specific, analyzing the network structures, finance, and management of urban economic infrastructure in water, energy, and transport. These urban infrastructure sectors provide essential services, and lessons learned on finance and management in these sectors have broad applicability internationally.

Chapter 6 takes an integrated approach to water management, describing spatial characteristics of the urban hydrological cycle and the interconnections between water supply, stormwater, and sanitation. An analysis is made of predicted impacts from climate change on the hydrological cycle and water management. Here a major challenge for urban water management is to balance supply and demand within defined tolerance limits. Water security, demand management, access, water pricing, and water supply are addressed. The final sections of the chapter describe the structure and finance of water utilities. An analysis is made of water infrastructure investment, whether and where competition could be utilized in the water value chain to increase efficiency, and how the investment and economic performance of Australian government-owned water utilities can be improved.

Chapter 7 addresses the finance and management of urban energy systems (excluding transport, which is discussed in Chapter 8). It commences with a description of the dynamic and interactive relationship between energy, technology, and the shaping and retrofitting of cities. Energy systems are introduced, including concepts of energy services and value chains. An analysis is made of the objectives and impacts of energy policy and energy regulation on energy systems, including the impact of a carbon tax or emissions trading. Finance and governance of energy investment are investigated with a focus on economic efficiency and risk management. The central sections of the chapter describe the nature of demand and supply of primary and secondary energy in Australia, including a description of the National Electricity Market. Finally, the potential for future energy systems is examined, including the prospect of more decentralized energy supply systems operating within city precincts and households.

Chapter 8 is set within a framework of transport theory founded on urban economics, planning, and place theory. Australia's unique geography of widely separated capital cities and diffuse but congested urban agglomerations have a profound effect on the nature and cost of providing transport infrastructure to both integrate cities and provide transport within cities. The urban transport network (transport shed) and the characteristics of transport infrastructure including the scale of investment are described. An analysis is then made of modal choice as a function of geography and infrastructure. Transport policy is described, with a focus on intergovernmental considerations in finance and management of the Australian transport network. The final section focuses particularly on Australian intra-urban transport.

Chapter 9 shifts the focus from specific infrastructure sectors to the coordination of infrastructure (both social and economic) across metropolitan regions. Differentiation is made between infrastructure that shapes cities (e.g., major transport corridors) and infrastructure that follows based on the understanding that city-shaping infrastructure should be coordinated and supported by follower infrastructure and the orderly release of land. The chapter explores the challenges arising in metropolitan planning and urban governance to coordinate land release at a local government level with urban infrastructure provision, given the tensions arising from local government autonomy and the intra-sectoral focus of specific State urban infrastructure utilities given their obligation to deliver high-quality, consistent output in an increasingly competitive market. Past involvement of the Australian Government in the development of Australian cities is described. The chapter concludes that strategic infrastructure investments at a metropolitan scale are unlikely to be made without strong political alignment of key decision makers and the financial capacity and political will to implement decisions on infrastructure investment. Achieving urban governance structures and processes which support this remains an important political and professional challenge, particularly in a liberal democracy where power is shared.

Acknowledgments

This book originated from collaboration between the Centre for Developing Cities, now under ANZSOG Institute of Governance at the University of Canberra, and SGS Economics & Planning Pty Ltd. Thanks go to all authors of chapters whose work made this book possible. Special thanks to Lyndsay Neilson, who founded the Centre, and whose commitment to a cross-disciplinary and cross-sectoral approach to urban management inspired much of its work. I am indebted to Mike Woods, Geoff Campbell, Bruce Dockrill, Peter Rimmer, and Trevor Kanaley for their continued guidance and support and to Chris Harris for his wit and his perceptive responses to the early manuscript. In particular I would like to thank Rick Wellman for his continued patience and for giving up his dining room table for the year it took to edit this book and to the editorial staff at John Wiley & Sons who made the final stages in this process a pleasure. Finally thanks to Mark Evans for his support for the Centre for Developing Cities under the ANZSOG Institute of Governance.

Abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ACTEW	Australian Capital Territory Electricity and Water
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ANAO	Australian National Audit Office
ATRC	Australian Rail Track Corporation
AURDR	Australian Urban and Regional Development Review
BCP	Better Cities Program
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BOO	Build Own Operate
BOOT	Build Own Operate and Transfer
BOT	Build Operate Transfer
BRT	Bus Rapid Transit
CBA	Cost-Benefit Analysis
CBD	Central Business District
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture and Storage
CEDA	Committee for Economic Development
CKI	Cheung Kong Infrastructure
COAG	Council of Australian Governments
CPI	Consumer Price Index
CPRS	Carbon Pollution Reduction Scheme
CSG	Coal Seam Gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSO	Community Service Obligation
DAF	Development Assessment Forum
DCP	Developers Contributions Plan
DFAT	Department of Foreign Affairs and Trade
ENA	Energy Networks Association
ERA	Economic Regulation Authority (Western Australia)
ESAA	Energy Supply Association of Australia
ETS	Emissions Trading Scheme
EU	European Union

EWLNA	East West Link Needs Assessment (Victoria)
G20	Group of Twenty
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GHG	Green House Gas Emissions
GNE	Gross National Expenditure
GST	Goods and Services Tax
GTE	Government Trading Enterprise
HRT	Heavy Rail Transit
IA	Infrastructure Australia
ICT	Information Communications Technology
ICWE	International Conference on Water and the Environment
IEA	International Energy Agency
IPA	Infrastructure Partnerships Australia
IPCC	Intergovernmental Panel on Climate Change
LGA	Local Government Authorities
LPG	Liquefied Petroleum Gas
LRT	Light Rail Transit
MAE	Material Adverse Effect
MCA	Multicriteria Analysis
MIG	Macquarie Infrastructure Group
MWST	Ministerial Water and Sewerage Taskforce (Tasmania)
NBN	National Broadband Network
NCP	National Competition Policy (Australia)
NEM	National Electricity Market
NGER	National Greenhouse and Energy Reporting Systems
NGL	Natural Gas Liquids
NRLV	Net Residual Land Value
NWI	National Water Initiative
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
PCA	Property Council of Australia
PFI	Private Finance Initiative
PPP	Public–Private Partnerships
PV	Photovoltaic
RD&D	Research Development and Demonstration
RET	Renewable Energy Target
R2R	Australian Government's Roads to Recovery Program
SCNPMGTE	Steering Committee on National Performance Monitoring of Government Trading Enterprises
SCRGSP	Steering Committee for the Review of Government Service Provision
SEQ	South East Queensland
TOD	Transit-Oriented Development
TOJV	Transfield Obayashi Joint Venture
TPE	Total Primary Energy
UNFCC	United Nations Framework Convention on Climate Change

UPT	Urban Public Transit
VCAT	Victorian Civil and Administrative Tribunal
VCEC	Victorian Competition and Efficiency Commission
VKT	Vehicle Kilometres Travelled
Voll	Value of lost load
WEC	World Energy Council

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Introduction

Kath Wellman and Marcus Spiller

Introduction

The motivation to write this book comes from a fascination with the complex, dynamic, interactive nature of cities and recognition of the critical role that urban infrastructure plays in this. Why is infrastructure so important in cities? Cities, simply defined, are concentrations of people, resources, information, and activities. Clever and skilled people in close proximity with each other generate many benefits due to the diversity of interactions of people and ideas and the potential for economies of scale and scope from agglomeration. Where interaction is fluid, dense, and diverse, there emerges potential for innovation and creativity. Although we realize that people and ideas are fundamental to successful cities, these people and the processes they put in motion need support from urban infrastructure to ensure that cities remain healthy, safe, and accessible and to support cultural, economic, and social systems. Efficient, effective urban infrastructure does not lead in itself to competitive, innovative cities, but the lack of it would strongly impede their development or sustainability. Through infrastructure's enabling function, complex, dynamic cities come alive.

Understanding the economic nature of urban infrastructure is critically important to any analyses of the contributions infrastructure may make to the efficiency of human interaction in the urban economy. In contrast to the fluid, dynamic nature of human transactions in healthy cities, urban infrastructure is characterized by high capital investment costs in assets which are inflexible, often location and function specific, exhibit network characteristics, and typically require low but steady maintenance and reinvestment. Once committed, the capital is essentially sunk, difficult, or

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

impossible to retrieve. Additionally each city has a legacy of infrastructure from past investment which can either support or inhibit the efficiency of future infrastructure investment. The longevity and essentially path-determining nature of urban infrastructure investment influences urban development patterns and cost structures for decades, as urban infrastructure services are usually inputs to further production or to end consumers. These are important reasons why such inputs have to be efficient—positive or negative efficiency effects are cumulative. Thus a flexible but conservative approach needs to be taken to major investment decisions due to the locational, sunk nature of costs and the long-term impacts of such investment.

The economic benefits generated by urban infrastructure investment follow a well-known pattern over time. Direct returns from infrastructure investment are highest at the early stages of a city's development when the stock of infrastructure is small and basic networks are incomplete, with returns on infrastructure investment falling as a city's legacy of infrastructure grows. Arguably the highest efficiency gains both in terms of resources (such as energy) and finance are thus likely to be made in small to medium sized rapidly developing cities over the next two decades. Having said that, there is the potential to accrue further large productivity gains in established major metropolitan areas from agglomeration (see Chapter 9), intelligent merging of existing grids and networks (see Chapters 6 through 8), development of new facilities management techniques, and efficiency enhancing technologies.

Urban economic infrastructure needs to be robust and flexible enough to deal with changing conditions and demands, which is why a long-term approach to investing in infrastructure is necessary. Flexibility is not inherent in the infrastructure itself, but greatly depends on intelligent planning and incremental enhancement of existing networks. Selective, strategic investment in infrastructure that supports this flexibility may generate high positive developmental impacts and long-run returns. It is likely that urban futures will depend to an even greater extent on wise infrastructure investment policies, given fiscal constraints, climate uncertainty, and an increasing awareness of the necessity to consider sustainability in all human—now mostly urban—activities.

Of course, urban economic infrastructure is hardware and merely represents the most recent physical manifestation of humanity's culture and economy. But cities are about software, about people. Thus, additional to economic infrastructure (sewerage, water supply, transport, electricity, gas, communications, etc.) is social infrastructure. Social infrastructure comprises the institutions and built structures that support such services as health, education, law, and justice. For efficiency at a city level, both economic infrastructure and social infrastructure need to be coordinated. How investment decisions are coordinated and made on urban infrastructure and how this infrastructure is managed is therefore critical to cities, and increasingly to nations dependent on these cities.

Global Challenges of Urban Growth, Climate Change, and Finance

The growing international interest in cities, and the urban infrastructure that supports them, arises from a realization that globally there is rapid urban growth (UNFPA, 2007, 2011) and that cities contribute significantly to human well-being and to national economies (World Bank, 2009; Glaeser, 2011). Currently the world population is estimated to be over 7 billion of which approximately half, about 3.5 billion, now live in urban areas. If we look at how this urban population is distributed, about 0.93 billion (27%) now live in cities in the more developed regions of the world, 1.9 billion (54.5%) live in less developed regions excluding China, and about 0.64 billion (18.5%) live in cities in China. The growth rates for cities (2005–2010) varies from an overall growth rate of 1.92% for world urban populations, to a growth rate of 0.68% for more developed regions and 2.33% for less developed regions excluding China. China has an urban growth rate of 2.62% (UN, 2010). We can see from this that over half of the world's urban population is living in developing regions and these populations are growing at a much faster pace than populations in developed regions. These developing regions have the lowest stocks of existing infrastructure and have potentially high efficiency and productivity benefits from effective and efficient investment in infrastructure and management.

Fertility rates impact on infrastructure investment and management. Countries with high fertility rates will generally sustain higher population growth rates requiring more services and facilities. A relatively large proportion of the population being young will put demands on education and employment. Low fertility rates also have impacts. The proportion of young people will decline relative to the proportion of old people due both to low fertility and the greater life expectancy of old people. This will impact on urban services, increasing the demand for health, aged care, and income support, perhaps on a smaller tax base. It will particularly impact on urban infrastructure where finance is dependent on government budget appropriations (such as in the transport sector in Australia, see Chapter 8). Fertility rates vary across developed and developing regions, with many countries within developing regions, particularly in Africa, having high fertility rates. All countries in Europe (with the exception of Ireland and Iceland) and countries such as Thailand, Iran, Australia, and China have low fertility rates. Intermediate fertility rates are found in countries such as India, United States, Indonesia, Mexico, and Bangladesh. Low fertility rates and an aging population are already of substantial concern in Europe and Australia (Productivity Commission, 2005) where a very high proportion of the nation's population live in the cities. Strong rural urban migration flows in nations, such as China, add further complexity.

How the urban population is distributed is also of concern. Much has been written about mega cities with populations of over ten million people, such as Tokyo, Delhi, New York, Mumbai, Sao Paulo, Mexico City, and Shanghai and on national and regional cities of 5 million and above. These cities already have a large legacy of infrastructure and are important drivers of their countries or regions' economies. Cities of 5 million inhabitants and above account for about 15.5% of the total world urban population (aprox. 37% of the population of cities greater than 750 000 inhabitants). Much of the impact of urban growth is going to be felt in smaller and intermediate cities of below five million inhabitants which now support 84.5% of the world urban population. Currently cities of 750 000 up to 5 million inhabitants support 26% of the world urban population (aprox. 63% of the population of cities 750 000 or greater). The remaining 58.5% of the world urban population live in cities of less than 750 000 people.

The large number of small- to intermediate-sized cities involved becomes evident if we plot the number of cities that have greater than one million population within each of three size categories based on population; those between one and five million inhabitants, those between five and ten million inhabitants and metropolitan areas with over ten million inhabitants (see Figure 1.1). With globalization and the scale of urbanization, there is intense competition for resources between these cities. Thus getting efficient, effective infrastructure where investment occurs is important, particularly where the existing infrastructure stock is small and networks are incomplete, for here investment is likely to have substantial returns. Getting it wrong will leave a legacy that may well impede not only the present efficiency of urban infrastructure but also future investment in infrastructure. The scale of the challenge is daunting and much will be gained from developing cities benefiting from the lessons learned in developed cities rather than playing catch up on outmoded systems.

This urban growth and the increasingly competitive environment for cities are occurring at a time when the limits of the biosphere to produce resources and absorb waste are evident. The supply of water and climate change are of particular concern and both are interlinked (for a description of climate change see Box 1.1). To mitigate climate change, governments internationally are negotiating amelioration strategies, with two frequently advocated strategies being a 'carbon tax' or a 'cap and trade' system for emissions (see Chapter 7 on Energy Systems). Both strategies would have a marked impact on the energy and transport sectors (Chapters 7 and 8) and a flow through effect on other urban infrastructure and services that have a heavy reliance on energy, such as manufactured potable water (particularly desalinization).

Limitations of natural systems have increased pressure on governments to develop urban infrastructure that is not only efficient in an economic sense and equitable, in that the outcomes are distributed transparently and fairly, but also environmentally sustainable, protecting long-term environmental assets and mitigating climate change.

The complexity of financing and managing urban infrastructure is further heightened by the financial environment in which investment decisions are made. Historically, the financial environment has been intermittently volatile and will seemingly continue to be so into the foreseeable future. An increasingly globalized and interconnected financial world has triggered a series of recent financial crises (the Asian Financial Crisis of 1997, Dot-Com

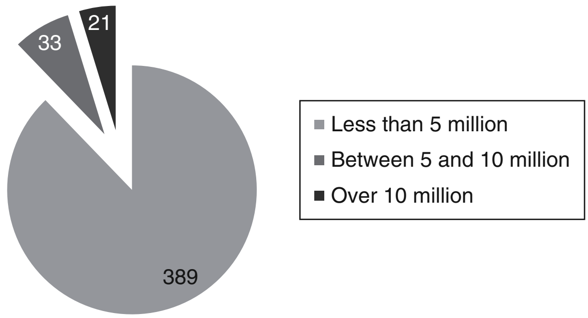

Figure 1.1 Number of urban agglomerations with more than one million inhabitants in 2009.

Source: United Nations, 2010. *World Urbanization Prospects: The 2009 Revision*. Department of Economic and Social Affairs, Population Division, File 12 population of urban agglomerations with 750,000 inhabitants or more in 2009 by country, 1950–2025.

Box 1.1 Climate change, adaptation, and mitigation.

The Intergovernmental Panel on Climate Change (IPCC) has issued four major reports (IPCC, 1990, 1996, 2001, 2007a) which review findings on atmospheric change and its likely causes. The latest report states that warming of the climate system is unequivocal, evident in the observations of increases in global average air temperatures, widespread melting of snow and ice, and rises in global average sea level. There is growing evidence to support the thesis that climate change is induced by recent changes in the atmosphere caused through carbon emissions from human-centered activity. This has a direct impact on the financing and management of urban infrastructure, both in terms of its effects on infrastructure, the need to adapt infrastructure to withstand the impacts of change, and the need to mitigate infrastructure contribution to carbon emissions.

Climate change is predicted to have impacts on rainfall and runoff in urban water catchments as well as an increased frequency of storm events, with associated cyclones and flooding (see Chapter 6). There is a predicted rise in sea level of between 18 and 59 cm by 2100, with a possible additional contribution from ice sheets of 10–20 cm (IPCC, 2007b). This rise, coupled with an expected increase in storm surges, will have a direct effect on low-lying infrastructure in coastal areas and estuaries, including major infrastructure facilities, such as airports. Particularly at risk are low-lying natural resources such as land and coastal ecosystems as well as freshwater aquifers. The coastal nature of many Asian and Oceania cities makes them vulnerable. Managing urban infrastructure for climate change requires strategic planning and governance at a metropolitan level (see Chapter 9) to ensure the effective coordination of infrastructure (both social and economic), adapting cities to changing environments such as rising sea levels, and retrofitting cities to improve energy outcomes and reduce carbon emissions.

Crash of 2000 and Global Financial Crisis (GFC) of 2008, European Debt Crisis of 2011). Although there is strong interest globally for heavier regulation of the financial institutions that have played a role in these crises, it is probable that the interconnectivity of global financial systems will facilitate further financial 'epidemics' in the future, impacting upon investment decisions and the structured provision of infrastructure.

Technological Change

These are indeed large global challenges, but along with these challenges we are making improvements not only in the technologies of infrastructure (more diversified, better client fit, smaller scale, higher energy efficiency, better communication technologies, more efficient use of materials, etc.) but also in the institutions and financial products to invest in this infrastructure and support its effective maintenance and management. Microeconomic reform has been particularly important in supporting this innovation, by opening markets for contestability and supporting third-party access in distributive networks which have monopoly characteristics. This third-party access to existing distributive networks has the potential to support continuous modification and growth of these systems increasing their efficiency through renewal and innovation. There is still some way to go. This book tracks some of these improvements, both in the infrastructure itself and the institutions, policies, and financial packages that support these (see Chapters 2, 3, 6, and 7).

Microeconomic Reform and Productivity

Microeconomic reform has been a key formative factor in the finance and management of urban infrastructure throughout the developed world. The aim of microeconomic reform is to increase the efficiency of the economy by directing resources to highest value use. Thus, major objectives of the microeconomic reforms in urban infrastructure have been to create flexibility and contestability in infrastructure service provision to support differentiation and innovation in both technology and service delivery. In many countries, this has been subject to social safeguards on public facilities (whether managed by the public or private sector) to meet social obligations. This reform process has at its core the need to structure transparent and accountable processes so that costs, benefits, and risks are identified, allocated, and managed by those who take them on. Here it is important to differentiate the objectives of the reform agenda from the mechanisms (such as unbundling to increase contestability and privatization) utilized for reform, as the mechanisms can change depending on the circumstances and should not be considered ends in themselves.

The push for microeconomic reform started in the 1970s and 1980s when inflation and slow economic growth led to unemployment among a number of developed nations. It was hard for governments to expand expenditure to stimulate the economy without growing the tax base and there was considerable political opposition to doing this. It was also thought at this time that monopoly power was being used in the public and the private sector to obtain unfair profits, particularly where tariffs restricted trade and markets were small (King *et al.*, 1996). Pressure on the private sector to reform and the high service fees and monopoly powers of many public services, including economic infrastructure utilities, placed substantial pressure on the public sector to undergo similar reforms.

At this time, institutional arrangements for delivering and managing urban infrastructure were characterized by a traditional bureaucratic model. This often had a technocratic bias in investment planning and operations, with engineers and social planners tending to dominate the managerial ranks of these institutions. These institutions, generally public monopolies, were ordinarily afforded a degree of statutory independence to facilitate a focus on their explicit social mission—*clear slums and build decent housing, build more roads to stimulate regional economic development, deliver clean water, etc.*

Some nations moved faster along this reform process than others. From 1984 to 1994, the New Zealand Government led the rest of the world in transforming the role played by government and its agencies in the broader economy. Starting with significant deregulation of financial markets and the removal of input subsidies, the Government progressively reformed state-owned enterprises, many of which had been delivering infrastructure services. The central departments were next reformed, followed by the budgeting process and the separation of accountabilities for inputs, outputs, and outcomes. Since 1994, there has been some critique of these reforms; however the comprehensive nature of these reforms has served New Zealand's productivity well (Box 1.2).

Over the past three decades, most developed nations have followed New Zealand's lead and liberalized their economies, unleashing productivity growth through flexible labor markets, financial innovation, and greater competition in utilities, transport, and other production inputs (for Australia see Hilmer, 1993; National Competition Council, 2007). Although much has been achieved by microeconomic reforms at a national level, microeconomic reform of urban infrastructure sectors is a continuing process with still much that can be achieved within urban economic infrastructure sectors such as water, energy, and transport (see Chapters 6 through 8). Here there is also the potential for lessons in efficiency learned in one sector to be applied in another, though care needs to be taken on the context in which the reform mechanisms have been used. Thus networked grids used in energy distribution are now used for water and principles from the electricity pool market might also be used for water supply. Due to the productivity benefits of these reforms it is likely that these reforms will be continued and followed in developing economies.

Because economic and social infrastructure supports the delivery of essential services, there is a need to identify distributional consequences of these reforms to ensure that vulnerable segments of the urban population have equitable access to these services. The benefits of this fairness accrue not

Box 1.2 New Zealand reforms: 1984–1994.

1984 Market principles to replace administrative control

- Deregulation of financial markets
- Float of exchange rate
- Removal of input subsidies
- Phasing out of export tax concessions

1986 State-Owned Enterprise Act

- Separation of policy, regulation, and production/trading
- Managerial focus on business performance, inputs, pricing, marketing
- Adoption of principles of competitive neutrality
- Private sector–based boards, government shareholding

1988 State Sector Act

- Senior management accountability
- Contract employment, competitive rewards
- Harmonization of industrial rewards

1989 Public Finance Act

- Defining of Ministerial and Chief Executive accountabilities for inputs, outputs, and outcomes
- Reduction of input controls
- Adoption of accrual accounting
- Consistency of reporting across corporate plans, performance agreements, budgets, and financial statements

1992 Public Finance Amendment Act

- Expansion of whole-of-government reporting

1994 Fiscal Responsibility Act

- Use of commercial accounting principles, including for the management of assets and liabilities
- Annual statement of 10 year fiscal objectives covering expenditures, revenues, the fiscal balance, and public debt
- Six monthly economic and fiscal updates, with 3 year forecasts
- Economic and fiscal updates prior to elections

only to the poor and marginalized, but also, through public health, labor participation, less crime, and the like, to the rest of society as well.

Turning to the specifically urban application of these issues on sectoral efficiency reforms, we should note that simply endeavoring to increase economic efficiency within individual sectors will not sufficiently facilitate the creation of efficiencies across all sectors at a city level. Due to the connectivity and interactivity of cities, urban development is characterized by a range of externalities (both positive and negative). The challenge for urban managers is not only to drive efficiencies within individual sectors but also to capture these wider efficiencies through the coordination of the provision of urban infrastructure (both economic and social), with land development and redevelopment, leveraging where possible off positive externalities and minimizing negative impacts.

There is also an added complexity. Microeconomic reforms are conceptualized and implemented within largely aspatial models of the economy. However spatial distribution and connection are important in how cities work. Recent research and policy development has revived interest in how connectivity, agglomeration, and place-based synergies can generate powerful competitive advantages for firms and indeed cities, particularly through the stimulus given to innovation (World Bank, 2009; Glaeser, 2011). Land development and infrastructure decisions do shape the metropolis, and can determine a city's liveability and affordability. This in turn affects who wants to live in the city and whether they can afford to do so. Thus through people and the physical connection between people and their activities these urban management decisions impact on the city's capacity for innovation. For mature economies and for the more astute developing economies, the challenge is to understand how urban structure and management can drive or impede productivity growth, not just in a logistical sense, but also in terms of creativity and new enterprise formation and what role governments should play in this.

The major challenge for the future is to retain the efficiency and innovation benefits generated from microeconomic reform within urban infrastructure sectors, while extending this reform process across sectors and across urban metropolitan regions. This has the potential to drive further spatial and economic efficiencies and foster innovation through spatial agglomeration.

Australia as Case Study

The book draws particularly on the experience of Australia in both finance and management of urban infrastructure, recognizing that the concepts explored in the Australian context have international applicability. Australia has much to offer. Australia is a developed nation which has been undergoing substantial reform in infrastructure finance and management over the past 30 years. The need to do this has been driven largely by its geography. Two thirds of its urban population is found in its widely separated capital cities. Low to medium density housing characterizes these capitals. Large distances between cities and the diffuse nature of housing in these cities have placed a heavy financial burden on government for infrastructure provision and management. Since 1970, the total level of investment in economic infrastructure in Australia as a proportion of GDP has averaged

4.8% and has stayed in the upper quartile of a group of developed countries (New Zealand, France, Germany, Canada, United States, and the United Kingdom) whose proportion of infrastructure investment to GDP averaged 3.5% (Chan *et al.*, 2009). This relatively large financial share of the national economy (GDP) and government budgets that is represented in economic infrastructure has placed substantial pressure on Australian governments and government business enterprises to achieve reform and has encouraged an interest in private sector participation in infrastructure provision (see Chapter 4 on Public–Private Partnerships).

Australia is also a federated State, with individual States taking primary responsibility for infrastructure services delivery. This has led to a variety of approaches to infrastructure finance and management at a State level and an effort at federal level to coordinate reforms, which has been carried out through a Council of Australian Governments (COAG). The focus of these reforms has been centered on economic efficiency: the utilization of resources effectively to support highest value use. Competition has been used as a key mechanism to improve economic efficiency and provide the potential for innovation. The overall microeconomic reform process in Australia has generated substantial increases in productivity (PC, 2005). From 1995 to 2008, there were 13 years of uninterrupted output growth—one of the longest phases on record; the rate of growth in real per capita incomes in the second half of the 1990s was as high as at any time during the twentieth century and unemployment remained low until the Global Financial Crisis of 2008. The reform process and the issue of intergovernmental coordination in this reform process are of interest to other countries, particularly democratic, federated States.

Australian cities currently have populations below five million. Sydney, the largest, has a population of 4.58 million, with Melbourne, Brisbane, Adelaide, and Perth having populations of 4.08, 2.04, 1.20, and 1.70 million, respectively. Hobart, Canberra, and Darwin have populations of less than 750 000 (ABS, 2011). As noted earlier, these intermediate to small-scale cities, particularly in developing nations will create the greatest challenges for, and have the potential to generate high productivity returns from, efficient and effective infrastructure finance and management.

As a liberal democracy and a federated State, Australia has a complexity in governance at a metropolitan scale involving three tiers of government, the private sector, and the community. The moderating characteristics of these checks and balances have benefits; they stop the heavy application of power and inhibit corruption, but they can also cause frustration and reduce efficiencies where supply lags demand. Here inefficiencies are caused not only by congestion but by lost opportunities in shaping the development of the city. As a liberal democracy, Australia has much in common with countries, such as the United Kingdom and the United States (DiGaetano and Klemanski, 1999) in the need to develop strategic alliances across government and between government, the private sector and the community to proactively manage the metropolis toward required outcomes, particularly where forward investment in infrastructure is required to shape the city (see Chapters 2 and 9).

But care needs to be taken to understand the context in which decisions are made. How responsibilities and powers are allocated across government can affect the distribution and quality of infrastructure across the metropolis. This can be illustrated by a comparison of Australian and US local government responsibilities. Both Australia and the United States have three tiers of government: federal, State, and local. In both nations, local government is not mentioned in national constitutions and is a construct of State governments, resulting in variations in the detailed arrangements of local government between States and even within States between city and rural areas. Despite these variations, there are defined differences between the two nations that have an effect on infrastructure and the delivery of services.

In Australia, city governments have responsibilities for managing the land development and assessment process, through local development plans approved by the States. Responsibilities include local roads, parking, waste management, and small local facilities such as swimming pools. Taxes are collected through a property tax. Where this differs markedly from the United States is that Australian local governments are not responsible for funding schools and the police force. These responsibilities rest with the States. In the United States, responsibilities for funding schools and the police force from property taxes impact on peoples' locational choice. Parents of school age children seek good schools in safe environments. Poor local governments cannot provide these to the same standard as their rich counterparts and those parents that can afford it shift to richer neighborhoods, further depleting the tax base of poorer local governments and their ability to fund infrastructure and services.

Understanding where similarities exist (here the need to build strategic alliances for metropolitan governance) and the affect of differences (here local government responsibilities) are fundamental to the effective application of principles drawn from case studies.

It is evident here also that cities abound with interconnections and there is seldom any interception in city urban infrastructure finance or management which does not generate externalities (either positive or negative) on parts of the city. Urban management is an emerging discipline which endeavors to structure an integrated approach to these issues. Policies and principles for urban management are described in Chapter 2 and the utilization of infrastructure to shape the city and coordination for urban governance are described in Chapter 9.

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2

Urban Management Principles and Instruments

Lyndsay Robert Neilson

Introduction

This chapter addresses principles of urban management and instruments available to governing bodies (public or private) to manage urban growth and change effectively. The term *urban management* is used to describe the integration of inputs from separate fields of professional practice, management, and politics, to achieve urban development that meets stated societal objectives.

Urban development is a process that can generate major public costs as well as major private benefits, and markets are often poor tools for managing urban growth and change as externalities abound in urban transactions. Hence managing to achieve acceptable outcomes—social, environmental, economic, and physical—is a common task for governments and private community managers throughout the world. Outcomes-driven management lies at the heart of urban management.

The traditional 'urban' disciplines of town planning, urban design, architecture, engineering, urban economics, sociology, and environmental science provide necessary inputs to the urban management task, but none is adequate on its own—integration and cross-disciplinary action are almost always essential. Furthermore, traditional tools of town planning—plan making and development regulation—while necessary, are insufficient to bring together all the elements that modern city-building and management require.

Essential to effective and accountable urban management are clear statements of policy, outlining the governing body's intentions. While they may take the form of an urban strategic plan, such statements increasingly include policies relating to housing affordability, infrastructure financing,

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

environmental management, access to public health facilities, public transport policies, and many more.

Definitions of public policy are widely variable (Althaus *et al.*, 2007). There are layers to policy that range from the very general to the tightly specific, as Althaus *et al.* (2007) explain:

> This multitude of meanings is inevitable, since policy is a shorthand description of everything from an analysis of past decisions to the imposition of current political thinking. (2007, p. 6)

Seeking to implement policy effectively is what governments at all levels set out to do (Colebatch, 2006).

This chapter sets out ways in which policy is implemented in an urban context and seeks to illustrate by way of case examples how particular instruments of policy influence urban outcomes either directly or in combination with others.

Althaus *et al.* (2007) identify five common types of policy instruments used in Australia:

1. policy through *advocacy*—educating or persuading, using information available to government
2. policy through *network*—cultivating and leveraging relationships within and across government and with external partnership bodies to develop and implement desired goals and behaviors
3. policy through *money*—using spending and taxing powers to shape activity beyond government
4. policy through direct *government action*—delivering services through public agencies
5. policy through *law*—legislation, regulation, and official authority (2007, p. 89)

In an urban context these five categories require amplification, for three reasons: First, lower-order policies (operational policy) are used frequently as a device to amplify and implement strategic policy, especially in the context of hierarchical statutory planning systems—so policy is an instrument as well as a framework. Second, in an urban context taxing and spending need to be treated separately as their impacts are vastly different, so money as a category is too broad. Third, government action and networks are better combined within the institutional arrangements that governments establish or are enabled to establish between government and the private sector, or with the community or within and between governments themselves. For example, many urban public services are delivered through the private sector or through communities, not necessarily through public agencies. In addition, knowledge management or sharing of understanding and experience is often a more formal process than is implied by the concept of networks while at the same time, in today's e-information age, it has a more informal element to it as well.

For these reasons, this chapter adopts the somewhat extended set of instruments presented by Neilson as relevant to the urban setting and the task of urban management (Neilson, 2002, p. 4).

- *Policy*—Statements of policy are themselves a key instrument of urban management. Policies operate at many levels, from very high order strategies to policies that guide detailed operational decisions. Their intention is, as indicated above, to give clear statements about the intentions of the government or other relevant organizations.
- *Legislation and regulations*—Legislation is the law, and regulations the rules that govern urban growth and change. Some may argue that markets should be regulated as little as possible, but in urban settings the call for regulation is often a political and social driver of government action, particularly given communities usually seek regulations to protect their own interests.
- *Fiscal measures*—the structure of taxation (where it exists) and pricing for goods and services impacts on outcomes of urban development and ongoing capacity to manage growth and change. Full cost recovery for urban services will produce a different city from one where services are heavily subsidized.
- *Financial measures*—the spending priorities of the governing body will influence the form and functioning of each city. This is especially the case with transport infrastructure, housing for lower income groups, public amenities and the public realm, and other aspects of the built environment.
- *Institutional arrangements*—the roles and responsibilities of government, the private sector, and communities can vary greatly depending on ideology, private sector capacity, and community expectations, and this variation will result in different management and developmental outcomes. Within governing bodies the way functions, powers, and responsibilities are allocated across different organizations will also have substantial effects on management style and capacity, and therefore on the functioning of a city.
- *Advocacy*—Leadership and advocacy influence community and business behavior and hence the way cities perform. Road safety campaigns, antilittering campaigns, and water and energy conservation campaigns have all been shown to change behavior and improve urban performance against declared objectives.
- *Knowledge management*—Sharing knowledge and experience impacts on the speed with which changes occur in cities. Learning how others have been successful and replicating their efforts are important elements in modern urban management.

This chapter addresses how these urban management instruments are used, providing Australian case studies to illustrate their application. The intent is to provide a considered framework for organizing and thinking about the way in which policy is developed and the mix of tools used to implement an outcomes-driven strategy for the future of a city.

Inputs, Outputs, and Outcomes

The key problem with managing urban growth and change is the constant and iterative interaction between the elements with which we construct the city and the way the city responds to the presence, or absence, of those elements.

A good example of interaction might start with a transport investment, which changes the accessibility people experience to services and opportunities they need, which feeds back into city form and structure. A new freeway that reduces travel time from distant locations to centers of employment almost always induces land market responses—homes are built along the freeway corridor, further away (in distance, not time) from the employment location, and the city 'sprawls'. New long-distance rail connections have a similar effect. Such sprawl creates expensive demands for new water supply and sewerage services in new housing estates, for new schools, health-care facilities, garbage collection services, and numerous other services to meet the needs of new residents. If these are publicly funded services, as they often are, new pressures on government budgets arise and may need to be funded through increased borrowing or taxes.

To control such costs, governments may regulate against excessive sprawl, but they may also need to upgrade public transport and other transport facilities in established areas to meet demand for higher density development. Opponents of higher density development in established suburbs may create political pressure to establish policies that lead to regulation against new developments in their municipality. Governments may then change the authority of municipalities to deal with such matters to reduce the effective opposition to higher density development.

Managing development to achieved desired *outcomes* requires an understanding of such interactions and the way they develop over time. Central to urban management in this context is a reasonably clear notion of the outcomes that are sought by governments, or other executive actors, on behalf of the communities they represent.

Outcomes are not unfamiliar concepts, but are often summarized by high-level indicators. For example, at a high level, Gross Domestic Product (GDP) measures an outcome—the economic performance of a nation, State, or city. Increasing GDP per capita is widely seen as desirable and the trends in GDP as a measure of the outcome of economic activity in a nation are closely watched and used frequently to assess the economic performance of governments.

A similarly high-level measure, the Ecological Footprint (Wackernagel and Rees, 1996) is used to measure the outcome of a nation, State or city's (or household's) environmental sustainability, at least in terms of per capita use of the earth's scarce resources and the production of wastes. It is now widely used to assess environmental performance and to plan remedial strategies to improve performance and reduce the Footprint measure.

Management by outcomes is a familiar concept in business, and in recent years has become more commonly adopted within government as a means of guiding policy (though it has yet to penetrate far into the budgetary world

Box 2.1 Inputs, outputs, and outcomes.

Inputs are the resources used in a program and include staff, funding, physical assets, materials, and equipment. Measuring and managing inputs control program costs.

Outputs are the goods or services that a program produces by applying inputs. Measuring outputs is a means of assessing progress in implementing a program.

Outcomes are the results that a program achieves. They reflect the impact of program outputs on those elements in the economy or the community at which the program is directed. Measuring outcomes provides indications of the changes that a program has brought about, and hence its effectiveness.

In the Building Better Cities program

Inputs comprised Commonwealth funding and State and Territory contributions (in funds and resources).

Outputs were principally the capital items constructed under the program. They included elements for transport, housing, and new or improved urban infrastructure. Other BCP outputs were new planning and coordination arrangements between State and local Governments.

Outcomes were the improvements in urban factors at which the program was aimed. These included reduced transport times, more intensive use of urban infrastructure, an improved urban environment, and more affordable housing.

Source: Reproduced with permission from Australian National Audit Office (October 1996) 'Building Better Cities' ANAO Audit Report No 9 of 1996/1997, 1.13.

of government to guide the allocation of resources to interrelated outputs that each contribute to a common outcome).

Some definitions are appropriate here. A most useful set was provided by the Australian National Audit Office in its 1996 audit of the Australian Government's Better Cities Program (BCP), (Australian National Audit Office, 1996 Section 1.13), reproduced in Box 2.1.

Outcomes are defined as the result that a program or activity achieves. Results are the focus of urban management. An important concept in these definitions is the concept of effectiveness. To be *effective*, measures taken in managing a business, city, or nation, must achieve intended results. If the means applied (the outputs) do not lead to the results needed (outcomes) then different means (inputs and outputs) might be needed. Alternatively if the means being used are under-resourced (the inputs are too small or are not affordable) increased resources or different inputs might be needed.

Monitoring and feedback mechanisms are essential to assess progress in achieving outcomes, and appropriate measures of baseline conditions are also fundamental to ensure that movement away from a starting point can be measured.

Outcome measures may be trends (e.g., increasing public transport usage by 1% per annum) or targets (e.g., 20% of work journeys by public transport by the year 2020). Trends are often more useful as they can provide shorter-term feedback than targets.

Essentially, measuring effectiveness means knowing what conditions apply at the start of the process, setting one or more indicators that represent the outcome desired, and then managing inputs and outputs of various kinds to get the most rapid, value-for-money transition toward the outcome.

It is not important at this point to know how inputs are provided and by whom outputs are delivered—that is an institutional question (potentially involving private as well as public players). Rather the intention is to ensure that inputs and outputs are meaningful, are related to a strategic purpose, and actually assist in achieving that purpose.

A focus solely on outputs, found in many government budgets where *efficiency* (least cost) is a key objective, can lead to inadequately considered expenditure—for example, building an additional 10 km of freeway in a city where a more effective means of addressing the task of accessibility may be to change land use policies so that people have jobs closer to home.

Focusing on outcomes leads decision-makers to question why a particular program or investment or regulation is being made, to establish links with other measures that assist in achieving the desired outcome, and to understand the need for monitoring and comparing the effectiveness of each output and input in leading to the desired result.

There is an important point here—rarely, especially in urban settings, can a desirable urban outcome be achieved by having only one output. For example, the desired outcome for a city may be to improve access for all residents and businesses to services and opportunities they need—a gain in accessibility across the city. This could be measured, for example, by a reduction of 2% over 5 years in average travel times for all trips.

One response may be to simply build more road capacity. But there are many people who do not have access to cars or do not drive—they rely on public transport. However, if there is good road-based public transport (buses, mini-buses, taxis), then building more road capacity might increase accessibility (if buses and taxis can travel more quickly to collect and deliver passengers). Additional gains in accessibility might also be available if more buses are purchased and operated. Upgrading railway signals to increase track capacity may also make a contribution.

So three outputs—building more roads, buying and operating more buses, upgrading signals—can serve the same outcome. This is the 'not only but also' principle: not only building more roads but also buying and operating more buses and upgrading signals. And the principle can be extended: not only these three outputs but also upgrading nonroad-based public transport vehicles, building cycle paths, improving pedestrian pathways (including lighting at night), and so on.

All these outputs can contribute to the outcome of improved accessibility across the city. To go further, nontransport outputs might also help—changing land use policies to allow more mixed-use development that provides local jobs, and reduces the need to travel long distance to work. Changing regulations to allow higher density, mixed-use development alongside existing transit systems—transit-oriented development—again potentially reduces the need for travel and improves access to public transport.

By combining outputs that all contribute to the same outcome, we have an integrated and outcomes-driven program of activity that can be located in time and funded with an appropriate budget—even if its components are delivered by different agencies or organizations, or by the private sector.

Creating such integrated programs is a key role of urban management. Further, these outputs may combine with others to produce different desirable outcomes. For example, better footpaths and better lighting will facilitate people walking for exercise, improving health outcomes, and facilitating community interaction.

Management for outcomes requires strategic thinking, collaboration, and commitment. In government, it may need a 'whole of government' commitment, and this raises institutional challenges. Typically, institutions prefer simple regimes where accountability is held at the level of delivering outputs. This is acceptable in an outcomes-driven framework provided each institution can account for how its outputs contribute to the outcomes they and others share. This is unsurprising in a business context—for example, where business subsidiaries or divisions within a company or group are all contributing (albeit competitively) to the overall group or company profits. Their contributions are easily measured and may be rewarded through bonus and other incentive schemes.

In government, outcomes-driven management is necessarily more complex because government objectives are far more diverse than those of business. However, the critical need for outcomes-driven management to deliver government policies effectively in cities means that overcoming such difficulties is a necessity.

Urban Policy

Urban management involves policy-making and implementation through regulation or other policy instruments. Policy in urban management can take a number of forms, from high-level strategic policy down to policies regulating the palette of colors available for painting buildings in a heritage precinct.

Policy derives from many roots and operates at many levels. At the higher end of the spectrum is strategic policy. Strategic-level policy can be broadly equated with outcomes—the focus is on results. For example, it is an appropriate strategic-level policy for a government to state that there will be no absolute limits on the population growth of a city, but that the city will manage its growth, whatever the level or pace, in the most sustainable manner possible. One outcome is ongoing population growth, a second would be the lowest possible consumption of resources to meet the needs of that growth.

A related strategic policy would be to establish which areas around the city will be for urban use and which areas will be protected from urban development, perhaps because they are the location of strategic resources for the future (water supply catchments, minerals, valuable agricultural land, or areas for conservation of valued flora and fauna).

At the level of outputs, a more tactical policy may be that urban development is to be concentrated along existing transport spines, especially around public transport nodes, to reduce over time the dependence on car travel. The outputs may be new public transport stations, or a program of publicly facilitated higher density urban development around those stations.

At the level of inputs, policy becomes more operational. In the example above, there may be a policy of shifting expenditures (inputs) from roads to public transport for 5 years to 'kick-start' the transit-oriented development. The shift in expenditure will be necessary to facilitate new higher density development around new transit stations. These developments, when occupied, should contribute to reducing dependence on car travel, and hence accommodate future growth in a more sustainable manner.

It is apparent that at each level policy is always a statement of intent about what is to be achieved, and therefore needs to be supported by the appropriate means of implementing that intent. Thus, as policy moves from strategic to operational, it takes on more of the characteristics of a means of implementing higher-order policies rather than simply existing as a stand-alone policy in its own right.

To take an example from the bottom up, we can refer to the heritage policy suggested above. Why have a policy on a color palette for a heritage area? This policy (about inputs) helps maintain or restore a heritage precinct—an important urban design output. This may be expressed in a policy statement: 'It is the government's policy to maintain designated heritage precincts in a manner as close to their original character as is practicable.'

The policy and output may contribute to the overall design qualities of a city, its role as a tourism destination, to the protection of property values or to satisfying the interests of citizens who want to maintain and enhance the character of their neighborhood and its assets—all useful outcomes.

It is not really helpful to try to stretch these links too far. Policy, as stated above, takes many forms. But it is a sound discipline to address the purpose of policy and the effect it is intended to have, and to do so with reference to inputs, outputs, and outcomes. This provides at least a more careful and considered process of both formulating policy and testing its linkages, intentions, and relationship to results.

Urban Policy Case Study: Melbourne 2030—The Strategic Policy Framework for Managing Melbourne's Growth

Melbourne 2030 is the high-level strategic policy framework guiding the development of metropolitan Melbourne. Adopted by the Victorian State Government (as the preeminent planning authority) in 2002, it has served, sometimes controversially, to guide both broad planning decisions and, as a policy framework with statutory effect, to guide decisions on particular development proposals being debated before adjudicatory tribunals and panels (Government of Victoria, Melbourne 2030, 2002).

The basic purpose of Melbourne 2030 was to provide a planning framework to accommodate an anticipated increase of about 1 million people in the population of metropolitan Melbourne from 3.5 million people in 2001 to around 4.5 million by 2030. This increase also involved an increase of around 620 000 in the number of households, and therefore dwellings.

A range of possible scenarios was explored through both in-house analysis and community consultation. These included:

- continuing the laissez-faire development policies of past State Governments that allowed planning and development to be dominated by private sector and property-holder interests, resulting in accelerated urban sprawl;
- strong anti-growth scenarios that aimed at reducing the rates of population growth;
- decentralized scenarios aimed at spreading growth across regional Victoria as an alternative to Melbourne's continuing expansion; and
- compact city scenarios of various kinds aimed at containing growth within declared urban growth boundaries.

At the conclusion of a significant State-wide consultation process (country Victorians were also asked what they thought about Melbourne's future), the Government adopted a strategic plan with emphasis on:

- compact development within a declared Urban Growth Boundary;
- 'Green Wedges' to protect natural and man-made areas of conservation value and tourism interest from urban encroachment;
- new development and urban renewal focused on the established transport networks;
- Activity Centers at major and minor public transport nodes to increase development opportunities in established suburbs; and
- increasing the share of new dwellings accommodated within the existing built-up area as an alternative to continuing 'greenfields' urban sprawl.

Provision was made, however, for at least 25 years of new land supply for urban use (residential and other) within the urban growth boundary in each of five Growth Areas of the city.

Box 2.2 sets out the directions that formed the Melbourne 2030 Framework, and Figure 2.1 illustrates its basic spatial elements: the Urban Growth Boundary; several categories of Activity Centers; Growth Areas; Green Wedges that separated the Growth Areas and protected key environmental assets from urban intrusion; major transport networks and nodes; and transport links to Victoria's main regional centers, forming part of a networked system of cites all within the wider metropolitan labor market due to fast rail, road, and telecommunications linkages.

Importantly, Melbourne 2030 was closely linked with the Government's ongoing planning for transport facilities and services for Melbourne. The future growth areas were located along major transport corridors where both freeways and rail transport were in place. Activity Centers were mostly

Box 2.2 Directions of Melbourne 2030.

The core of *Melbourne 2030* is nine 'directions'—or outcomes—whose achievement over time depends on putting into effect specific, carefully framed policies and supporting implementation measures.

Direction 1—A more compact city
Direction 2—Better management of metropolitan growth
Direction 3—Networks with the regional cities
Direction 4—A more prosperous city
Direction 5—A great place to be
Direction 6—A fairer city
Direction 7—A greener city
Direction 8—Better transport links
Direction 9—Better planning decisions, careful management

Source: Reproduced with permission from State Government of Victoria (2008) 'Melbourne 2030' Available at: http: //www.dse.vic.gov.au/melbourne2030online/

located at, or near, rail stations or other public transport interchanges or important nodes in the tram, train, or bus networks. The plan proposed the extension of strategic rail links into new growth corridors to provide fixed-track public transport into all planned Growth Areas.

Melbourne 2030 had Implementation Plans for each of the major Directions of the Plan. These were, however, heavily reliant on the Victorian planning laws and regulations as the basis of implementation and placed little reliance on other instruments of governance other than collaboration within and between government agencies and with local government.

The implementation plans involved a series of Ministerial Directions and other measures under the Victorian *Planning and Environment Act 1987* to give legal effect to Melbourne 2030. The overarching Ministerial direction for implementation of the Melbourne 2030 framework required that, in preparing and amending Planning Schemes, local governments needed to take serious account of the policies and provisions of Melbourne 2030. So the municipal planning schemes, the framework for approving development proposals, were to be the main means of implementing the overall strategy.

This approach proved less than adequate, as implementation of Melbourne 2030 required concerted action on the part of municipalities to enable more intensive urban residential infill in established suburbs. It also required action by municipalities and the public transport agencies to facilitate new development on and around railway stations; and it required shifts in transport spending priorities away from road expansion toward upgraded public transport.

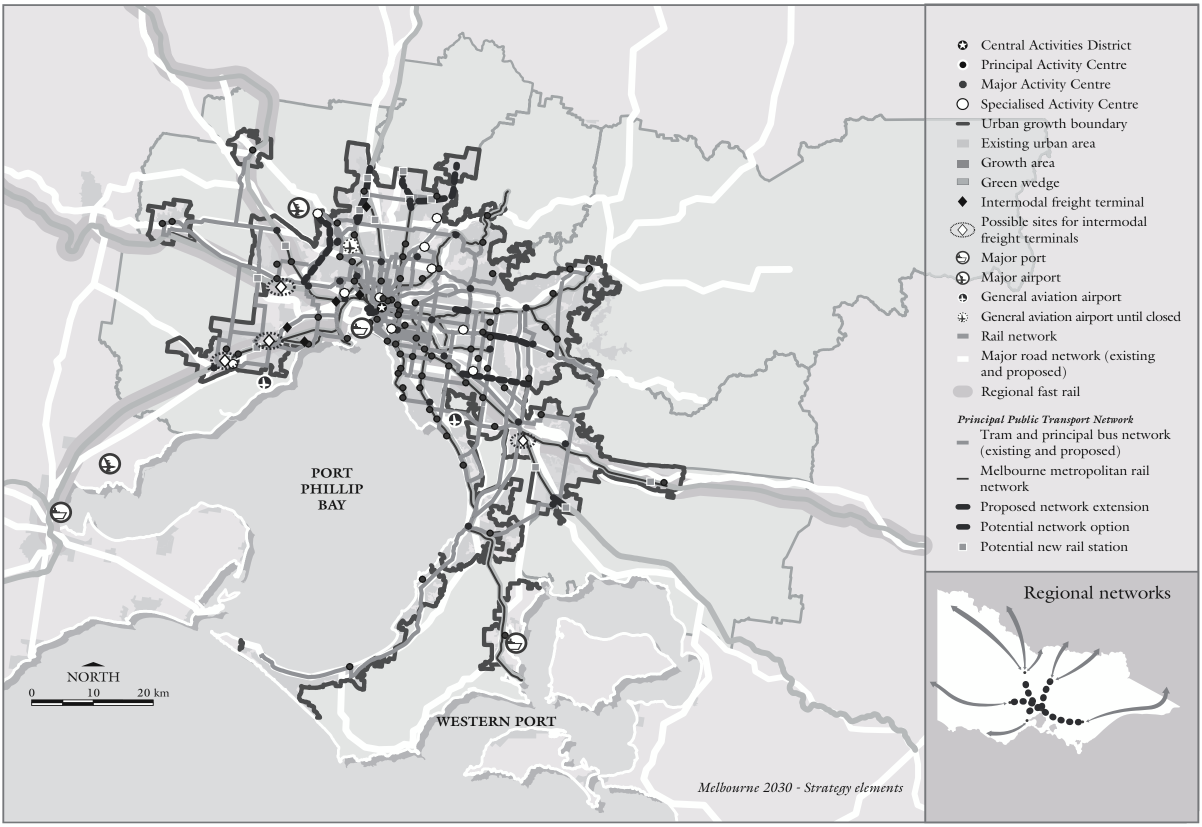

Figure 2.1 Melbourne 2030 framework elements.
Source: Reproduced with permission from State Government of Victoria (October 2002) Melbourne 2030: Planning for sustainable growth 'Melbourne 2030 in Summary', pp. 6, 7.

These changes would occur, but over much longer time periods than many people felt were desirable. Melbourne 2030 was being criticized within 2 years of its adoption for implementation failures, despite the fact that the Plan itself clearly pointed to the need of at least a decade for major transformations to become evident.

The Melbourne 2030 Audit

In the sound formation of any strategic policy, it must be recognized that circumstances, conditions, and events affecting planning can change. Mindful of the fact that strategic plans require sufficiently long periods of time to take full effect, it is essential to recognize that one of the major challenges of long-term strategic planning is keeping policies and action programs updated regularly.

While certain fundamentals need to be held in place over lengths of time in the interests of stability, plans as a whole cannot remain entirely static over their duration. In the example of Melbourne 2030, the Victorian Government committed itself to reviewing the plan every 5 years, and a review was commenced in 2006, with a specialist Audit Group of experienced professionals appointed to review the strategy (see Box 2.3). They concluded that the principles of Melbourne 2030 were sound and provided a good framework for the future, but that implementation in collaboration with local government was lagging (Government of Victoria, March 2008, Executive Summary).

The audit recommended three critical steps to ensure momentum was given to the implementation of the Strategy:

1. Create new governance arrangements to ensure responsibility, authority, and visible leadership to oversee and coordinate the implementation of *Melbourne 2030*.
2. Allocate funds to *Melbourne 2030* initiatives, through government agencies being required to revise their budget processes to align resources to agreed *Melbourne 2030* implementation actions.
3. Develop a strong and mutually supportive partnership with local government, and their communities and the development industry (Government of Victoria, March 2008).

In response the Government made 'in principle' commitments to follow these recommendations.

Melbourne@5 Million

Following the Audit, new population projections for Melbourne were prepared, based on the 2006 National Population Census. To the surprise of many, the *Victoria in Future 2008* projections indicated that Melbourne could achieve a population of five million people before 2030—more rapid

Box 2.3 Melbourne 2030 audit conclusions.

'We are convinced that the fundamental principles of *Melbourne 2030* are more relevant than ever. This is because of the challenges posed by climate change, traffic congestion, the faster than expected growth of Melbourne's population, and the fact that Melbourne is still an extremely spread-out city.

Compared to five years ago, there is now an even greater urgency to implement the many initiatives of *Melbourne 2030* if Melbourne's development is to be sustainable and the city is to remain liveable.

While we discovered strong support from many stakeholders for the fundamental principles of *Melbourne 2030*, we also heard considerable criticism of the Plan and its implementation. We found this a little surprising since, in our view, there is nothing revolutionary about *Melbourne 2030*: it is basically a restatement of planning approaches that have enjoyed general acceptance, in Victoria and internationally, for the past 40 years.

The concerns expressed relate to several issues. *Melbourne 2030* is seen by many as a plan imposed from above, with a resultant lack of community ownership. Others view it as a symbol of changes that have the potential to destroy the character of their neighborhoods.

Some tensions are evident between State Government, the proponent of the policy, and local government, which has a crucial role in its implementation. Other criticisms relate to the lack of dedicated funding mechanisms and apparent failure of "whole of Victorian Government" commitment to the Plan.

We have concluded that some of the negative views have a degree of validity, and we have suggested ways in which these matters can be addressed. Other criticisms we consider to be overstated or misguided (what we describe in the report as "myths").'

Source: Reproduced with permission from State Government of Victoria (March 2008) Melbourne 2030 Audit Expert Group Report, p. 4.

growth than had been forecast at the time Melbourne 2030 was prepared. A critical external circumstance had changed.

For the Government, this raised the issue that, at a time of poor housing affordability, Melbourne 2030's ambition to maintain 25 years of urban land supply within the Urban Growth Boundary could not be met—demand would outstrip supply, prices would rise, and affordability of housing would worsen. At the same time, population growth in almost all established suburbs (but especially the inner city) had also accelerated. To address these challenges, a further analysis of Melbourne 2030 was prepared in the light of the revised forecasts, and was published in 2008 as *Melbourne@5 million* (Government of Victoria, December 2008).

Melbourne@5 million proposed amendments to Melbourne 2030 policies, principally reducing the number of Activity Centers and increasing the expenditure by government on the largest of them, and investigating the extension of the Urban Growth Boundary to accommodate more rapid

Box 2.4 Melbourne@5 million.

The Victorian Government will be focusing on:

- The creation of a multi-center city through six new Central Activities Districts in Box Hill. Broadmeadows, Dandenong, Footscray, Frankston, and Ringwood. Moving from one center (the Central Business District) to a number of centers will reduce congestion and enable people to spend less time commuting to and from work and more time with their family.
- Employment corridors that support the Central Activities Districts by linking activity centers, universities, research and technology precincts, medical precincts, and areas with high employment. Three employment corridors will be given priority attention by the government: Avalon Airport to Werribee, Melton, Melbourne Airport, and Donnybrook (Hume-Mitchell); Caulfield to Dandenong; and Monash University/Chadstone to Box Hill, Austin Hospital, and Bell Street.
- The expansion of the outer Melbourne Urban Growth Boundary to accommodate some of the 284 000 new dwellings expected to be built in the growth areas and to maintain housing affordability. Areas to be considered for inclusion within the growth areas are designated as 'investigation areas'. Detailed planning in these areas will identify the final location of the Urban Growth Boundary within the investigation areas. Councils, residents, and developers will have an opportunity to make submissions on proposed changes to the Urban Growth Boundary in early 2009.
- The amendment of the State infrastructure contribution announced in A Plan for Melbourne's Growth Areas. The Growth Areas Infrastructure Contribution will be used to provide vital infrastructure and oversee development in the growth areas of Melbourne.

Source: Reproduced with permission from State Government of Victoria (December 2008) Melbourne 2030: A planning update—Melbourne@ 5 million. Available at: http://www.dse.vic.gov.au/DSE/nrenpl.nsf/LinkView/1352EB2F109044AFCA2575120016BE8B718331E8AB7D9987CA256D1900299B45

growth (see Box 2.4). New zoning and regulatory provisions were introduced, to accelerate the supply of land to the market within the Urban Growth Boundary, giving Melbourne's newly created Growth Areas Authority more power to prepare and to approve Precinct Structure Plans for new Growth Areas (setting local policy for land use, infrastructure, and urban form well ahead of development and reducing delays in development approvals by at least 12 months).

Investigation to implement the Government's proposed outward extension of the Urban Growth Boundary to provide more 'greenfields' land for development was finalized in 2009.

The Melbourne 2030 story is a case study of strategic policy-making at the metropolitan level, designed to shape government decisions across a wide range of responsibilities and functions—notably land use policy and regulations, building development regulation, transport investment, utilities investment, investment in open space and environmental conservation, and investment in other major government facilities. The scale and time frame of the policies make them complex to implement and require commitment over time.

The case study shows that changes, such as those in population forecasts, external to the policy, necessarily lead to review and adaptation—while in this case still adhering to the policy principles of the initial strategy.

Economic circumstance created by the Global Financial Crisis may have further impacts. Initial reactions by the Victorian Government have been too fast track urban renewal and related activity center projects that are consistent with Melbourne 2030 policies and to provide more outer urban land for new development.

Policy Implementation

Legislation and Regulations

The system of planning and development management is a *statutory* system in Australia. This legal regulation of development requires government approval of many (but not all) development projects, and includes the capacity to impose penalties where individuals act in ways not permitted by the law. The principle behind this system is that public interests are respected and valued over the interests of private individuals, and that the external impacts of those individuals' proposed projects on the interests of others must be considered in approving development. Planning legislation and regulations are the means of managing what individuals are permitted to do with their land and buildings, in the interest of the community as a whole.

State Government legislation governs the use of land (except in the Northern Territory, and the Australian Capital Territory where the land is ultimately controlled by the Australian Government). Only in rare circumstances do property titles grant land owners the unconstrained right to use their land as they see fit. Use rights are granted by the Crown through legislation and regulations, and the issue of titles and leases (usually with lease purpose clauses).

Local Government legislation usually empowers local governments to act on behalf of the State Government in managing the development and use of land, to a greater or lesser extent. There is also likely to be legislation establishing special purpose government or semi-government agencies that play a role in planning and managing the use and development of land in particular places, or through particular stages of decision-making. For an introduction to the Victorian Planning System see Box 2.5.

Not all these matters fall within a single piece of legislation in any particular State. To fully comprehend the system of land use and development, planning and management will usually require familiarity with a number of pieces of relevant legislation (Department of Planning and Community Development, 2008). This may include legislation governing

Box 2.5 Victorian planning system.

At the local neighborhood level, urban and rural planning is concerned with the use of land, and the buildings and other developments that go on the land. There are not many actions that owners can undertake on their land which do not affect others in some way. Some regulation of land uses is essential to avoid the inevitable conflicts that would occur if everyone did as they pleased, especially in heavily populated areas.

Today, all municipalities in Victoria are covered by land use planning controls which are prepared and administered by State and local government authorities. The legislation governing such controls is the Planning and Environment Act 1987.

The bodies controlling land use planning are planning authorities and responsible authorities. A planning authority, which may be a local council or the State Government, conceives land use planning schemes and devises appropriate controls. A responsible authority, which is usually the local council, administers the scheme. This involves:

Considering proposals to use or develop land, and giving notices and issuing permits in accordance with the planning scheme.
Making sure that the land is not used or developed in conflict with the scheme's requirements. Those who do not obey the laws about the land and development can be prosecuted.
Issuing Planning Certificates about the scheme.

Planning and the Department of Planning and Community Development

In an economic and social environment characterized by rapid change, it is essential that our planning system is flexible to respond to and manage this change. But it needs to be prescriptive enough to provide certainty and consistency.

The Government's strategic land use planning is based on a sound analysis of issues and trends that can be monitored and reviewed regularly, with an integration of the transport, environmental, and social aspects of development.

Such strategies are reflective of the broader community and are therefore based on extensive community consultation and debate. The Government's approach relies on creative and effective partnerships with local government, local communities, business, industry, and other organizations and interest groups.

Source: Reproduced with permission from State Government of Victoria (2009) An introduction to planning. Available at: http://www.dse.vic.gov.au/DSE/nrenpl.nsf/LinkView/F14D628BDCAC84F-5CA256D4E001ADAEEE2544497E47593D1CA2572FF000BB0D9

the surveying of titles and the subdivision of land (including the specifications for the road set out and construction) or legislation providing for the reservation of land for infrastructure and for public purposes (footpaths, cycle-ways, parks, schools), each of which impacts on development layouts and density. For more detail on land use planning and its relationship to infrastructure provision see Chapter 5.

Legislation relating to the powers, functions, and duties of government or other bodies responsible for operating urban services may also have an impact. For example, under the Australian Constitution, telecommunications companies operate under *Commonwealth* legislation and regulations, meaning State or local government laws cannot control the activities of those companies. Hence the installation of optic fiber or other telecommunications cabling cannot be prevented by local planning regulations. The location of telecommunications towers is similarly exempt from local control.

A further example applies to privatized airports. Since major airports are *leased* to private operators (for up to 99 years), the land remains the property of the Australian Government. These airports are therefore constitutionally exempt from State and local planning laws and regulations. Consequently, Master Plans for each airport, approved by the Australian Minister for Transport, have allowed intensive commercial development on most airport sites, competing with other established centers and generating large traffic volumes that need to be managed by State and local agencies, at their cost.

The complexity of legislative and regulatory management of development and related matters means that all States have established substantial courts or tribunals with varying degrees of judicial formality to deal with ongoing disputes and legal challenges arising from development proposals.

In Victoria the Victorian Civil and Administrative Tribunal has a large urban planning division, while in New South Wales and Queensland relevant courts (Land and Environment Court, Local Government Court) deal with disputes. Specialist legal practitioners operate in these jurisdictions.

Overall, the legislative and regulatory frameworks governing development serve as the most obvious and common interface between property owners, developers, the community, and government in managing urban development. Other instruments of government (fiscal and financial in particular) may, in fact, have greater influence on how and where development occurs, but regulation and legislation has the highest profile as the means by which government manages development on behalf of those it represents.

Fiscal Measures

In this chapter, fiscal measures refer to the *revenue-raising* activities of governments, and include measures such as:

- Income taxes;
- Taxes on company profits;
- Wage and salary taxes;
- Property and land taxes;
- Taxes on property and other transactions (sales taxes);
- Excise or levies on products such as liquor, tobacco, and fuels;
- Royalties on the extraction of natural resources;

- Licensing and registration fees for vehicles, pets, businesses, and many other matters;
- Fines and other monetary penalty payments;
- Prices for the provision of goods and services by government organizations;
- Special ‘hypothecated’ levies and charges (e.g., Melbourne’s environmental levy of 5% on the profits of water retailers, to pay for environmental improvements to Victoria’s rivers and lakes); and
- Many others.

In addition, fiscal measures include revenues that could be collected but are not—revenues foregone; they include subsidies paid to allow people to pay less than they otherwise would and they include tax breaks that favor certain kinds of investment over other kinds. An example of revenue foregone is the lack of capital gains tax on owner-occupied housing in Australia, as distinct from housing held by investors to rent to tenants.

The most significant urban tax break over recent decades, having a significant impact on Australian cities, has been the capacity to deduct expenses incurred in investing in property for commercial returns from a person’s or company’s taxable income from all sources (including income from the rental property)—the so-called ‘negative gearing’ provisions. These provisions led to a massive surge in bank lending for property investment in the early 2000s and to upward pressure on property prices, which continues to impact upon housing affordability across the nation.

The choices a government makes about the imposition of fiscal measures create unequal costs across different parts of the community (property owners versus tenants, users of toll roads versus public transport users) and between different localities. They are significant drivers of spatial inequality. For example, the cost of travel for residents in that part of a city served by a toll road may be far more than the costs faced by others with facilities offered free of charge—although there also may be offsetting benefits such as less congestion.

Land and property taxes that vary according to property values can appear progressive—households owning more expensive property pay higher charges than those in areas where property is less expensive—but in fact may be regressive; these charges may represent a smaller share of total income for wealthier residents compared to those living in less expensive locations.

An example of fiscal differentiation and the impact it might have on urban form lies in the way in which high-rise buildings are differently taxed in terms of the assessment of property taxes in different States across Australia. This creates different incentives in the market place for owning, renting, and occupying multistorey developments. Box 2.6 analyzes different systems of setting rate bases in the States and explores how this may result in the cost of occupying high-rise real estate varying from locality to locality and from State to State (Morton, 2009).

Similar interstate and locality differentials exist in the application of land taxes applicable to commercial properties, and to transaction taxes applicable when properties are bought and sold. Transaction taxes (stamp

Box 2.6 Implications of different valuation methods used for levying local government rates.

Australian States use different valuations to levy local government rates. For example, Queensland is the only State where councils use unimproved capital valuation of the land. In Victoria and Tasmania, councils can chose to use land site value, capital improved value, or annual (rental) value. In some cases (e.g., Victoria), there is no difference in the distribution of rating burden for residential properties from the use of capital improved value (CIV) or net annual value (NAV) as legislation dictates that NAV must be 5% of CIV. To illustrate how this difference in rating effects the distribution of the rate burden, consider the example of a high-rise block of units having a mix of one, two, and three bedroom units.

In Queensland, the unimproved valuation for each unit is the unimproved value of the building site distributed to each unit relative to its lot entitlement under the community management scheme for the property. In many cases, each unit may have the same lot entitlement so unimproved valuation of each unit in the block is the same regardless of the size of the unit or the level (and value) in the complex. In practice in Queensland most high-rise units have an unimproved valuation for rating purposes that attracts the minimum rate.

In Victoria, with either CIV or NAV, the valuation for rating purposes will relate directly to its market value. So a one-bedroom unit on the ground floor would have a substantially different valuation than the penthouse on the top floor. So the rates levied on each property in the complex could vary quite substantially (e.g., a small $250 000 unit would attract only around one quarter of the rate levy of a $1 million apartment).

Where rental value is used without a direct relationship between capital value and rental value (e.g., Tasmania only specifies that assessed annual value cannot be less than 4% of capital value), the variation in rate levies in the situation discussed above might not be as great given that rental value of the $1 million unit may not be four times more than the $250 000 unit. However, in general terms, the capital value and rental value approaches produce similar outcomes in terms of the incidence of rating on units whereas the unimproved valuation method produces a substantially different outcome.

Some councils in Queensland have tried to find differential rating categories to overcome what they see as an inequitable outcome as a result of the use of unimproved valuation for strata title units. They point to the fact that a unit with, say, a $1.5 million capital value might be paying the minimum general rate (say $600) whereas a house on a canal with a similar value might be paying 5–6 (or more) times this level of rates. Gold Coast City has devised 51 categories for units in the City (based on level, floor area, and whether owner occupied or rented short or long term) to overcome the inequity they observe.

Another example of significant differences relates to vacant residential land. In Queensland, with unimproved valuation, vacant land will typically pay the same general rates as a neighboring house that could be occupied by four to six people. Where capital valuation is used, the vacant property would pay significantly lower rates than the occupied property. While Queensland councils could put such vacant land in a differential category and charge a lower rate in the dollar, they tend not to do so as they consider they have many costs that can be attributed to the number of properties (e.g., local road and park maintenance). It would, however, appear that other costs associated with people services do not occur until houses are constructed.

Source: Alan Morton, Morton Consulting, Personal Communication, May 2009.

duties) are an ongoing political issue, with frequent interstate competition to lower them. They remain in place because they are a significant source of revenues for State Governments.

Equally differentiated are costs imposed on developers for infrastructure and services contributions for new development. In New South Wales, costs for new services in new developments in outer Sydney, imposed by State and local governments, can be as high as A$90 000 per new housing allotment. In Melbourne by contrast, a levy of only A$95 000 per hectare, or less than A$10 000 per allotment is imposed, creating significant differentials in housing affordability between the two cities.

Within Melbourne, municipalities charge developers widely varying levels of contributions to local services, infrastructure and amenities, from almost zero in urban renewal areas to tens of thousands of dollars per allotment in some outer suburbs. These cost differentials are important in affecting the relative price of new land and house packages across the outer suburbs, and the profitability of development between suburbs.

The revenues raised by fiscal measures vary widely from place to place, especially among local governments for whom property taxes are a key source of income. Capacity to use revenue to provide needed services to the community will also vary with a spatial impact on the quality and character of public facilities, places, and spaces.

People who can afford more expensive real estate can generally also pay more for utilities and services like water for gardens, attention to streetscapes, or for other private facilities such as private swimming pools, tennis courts, and other amenities. In expensive high-rise apartment complexes similar circumstances apply. People who can afford more obtain more. Consequently, all our cities have areas occupied by the wealthy, as well as a spectrum of areas of other income categories extending down to the poorest localities where those with the least resources (and therefore fewest options) live. Government fiscal policies can ease or exaggerate these differences.

The capacity to pay taxes to obtain common services, or to avoid taxes and pay private fees for private services, is a powerful driver of the quality of city life. Those who can pay the cost are, of course, those least dependent on services provided by government for shared use across the community—parks, gardens, swimming pools, recreation centers, and so on. Conversely, those least able to afford private facilities are also those least able to contribute to taxes and other levies to fund the provision of services for community use. These issues of spatial inequality have long been a preoccupation of politics in Australia, at all levels of government. One response has been the system of horizontal fiscal equalization.

Horizontal Fiscal Equalization

To face the challenge of World War II, the Australia Government took responsibility for levying all income taxes, the main form of taxation other than company tax. To ensure agreement among the States to this measure as well as to recognize the particular expenditure needs of the more remote States relative to their capacity to raise taxes from small, scattered populations, the Australian Government introduced a system of Horizontal Fiscal Equalisation (Commonwealth Grants Commission, 1995).

In principle, the system was to distribute taxes collected by the Australian Government in the form of revenue grants to the States according to formulae that calculated the needs of each State relative to their capacity to pay taxes, and allocated grants on the basis of the calculated shares. The complexities of the calculations are significant and have varied widely over the years, but, in essence, they amount to measuring a series of cost factors (such as length of roads, share of the population not speaking English as a first language, and many others) and comparing these to standardized measures of capacity to pay taxes and each State's actual level of taxation (its revenue effort). Adjustments are then made to ensure that each State has roughly the same level of revenue according to the need as any other, and that its citizens would not have to make an extraordinary effort in terms of cost to them to obtain a basic bundle of needed services and infrastructure in their community. The system is overseen by an independent organization known as the Commonwealth Grants Commission.

Over time, the system has been extended significantly, to include the allocation of money to municipal governments from the Australian Government—in other words, revenue payments are made to each local government across Australia, from funds provided to the States for the purpose of local government, by the Australian Government. In each State, a Grants Commission oversees this horizontal fiscal equalization process across each States' municipalities.

A number of national principles are applied to the fiscal equalization process as set out in Box 2.7.

These principles are designed to ensure State Grants Commissions are generally following similar guidelines in their analysis of need and effort across municipalities within each State (Department of Infrastructure, Transport, Regional Development and Local Government 2010).

The significance of the grants to municipalities varies. For wealthy inner urban municipalities (e.g., the City of Melbourne), the grants are not a major part of revenue, as such municipalities have strong, established tax bases and therefore are judged to have lesser need. For regional cities with large service areas and for rural municipalities with small populations,

Box 2.7 Grants Commission Principles.

A. General purpose grants

The national principles relating to allocation of general purpose grants payable under section 9 of the *Local Government (Financial Assistance) Act 1995* (the Act) among local governing bodies are as follows:

Horizontal equalization: General purpose grants will be allocated to local governing bodies, as far as practicable, on a full horizontal equalization basis as defined by the Act. This is a basis that ensures that each local governing body in the State/Territory is able to function, by reasonable effort, at a standard not lower than the average standard of other local governing bodies in the State/Territory. It takes account of differences in the expenditure required by those local governing bodies in the performance of their functions and in the capacity of those local governing bodies to raise revenue.

Effort neutrality: An effort or policy neutral approach will be used in assessing the expenditure requirements and revenue-raising capacity of each local governing body. This means, as far as practicable, that policies of individual local governing bodies in terms of expenditure and revenue effort will not affect grant determination.

Minimum grant: The minimum general purpose grant allocation for a local governing body in a year will be not less than the amount to which the local governing body would be entitled if 30% of the total amount of general purpose grants to which the State/Territory is entitled under section 9 of the Act in respect of the year were allocated among local governing bodies in the State/Territory on a per capita basis.

Other grant support: Other relevant grant support provided to local governing bodies to meet any of the expenditure needs assessed should be taken into account using an inclusion approach.

Aboriginal and Torres Strait Islander people: Financial assistance shall be allocated to councils in a way that recognizes the needs of Aboriginal and Torres Strait Islander people within their boundaries.

B. Identified local roads grants

The national principle relating to the allocation of the amounts payable under section 12 of the Act (the identified road component of the financial assistance grants) among local governing bodies is as follows.

Identified road component: The identified road component of the financial assistance grants should be allocated to local governing bodies as far as practicable on the basis of the relative needs of each local governing body for roads expenditure and to preserve its road assets. In assessing road needs, relevant considerations include length, type, and usage of roads in each local governing area.

Source: Reproduced with permission from Commonwealth Department of Infrastructure, Transport, Regional Development and Local Government (2010) 2007–08 Local Government National Report, Figure A.1 National principles for allocating general purpose and local road grants, p. 74.

the grants can be over 60% or 70% of their revenues (Victorian Grants Commission, 2008).

Table 2.1 sets out examples of grants to municipalities in Victoria for 2008–2009. Based on assessments of need and capacity to pay, large grants go to remote rural shires (East Gippsland), rural cities with rapid growth (Mildura Rural City), large regional cities also with rapid growth (Greater Geelong), and rapidly expanding outer metropolitan municipalities (Casey City Council).

The application of fiscal measures is, of course, a matter of great political significance—taxes and prices are high on the agenda of public awareness and debate. Rational use of such measures to achieve desired urban outcomes can therefore be very difficult—political concerns will almost always dominate.

A key outcome of the application of fiscal measures in urban management should be to reduce spatial inequality—as measured by the share of household income required to access a comparable bundle of urban services and facilities. The Grants Commission process in Australia is a major means of addressing this, in terms of assessing the taxing capacity of States and local governments, taking into account a wide variety of factors including the income of residents. It is also a *financial* process, addressing the revenue side of municipal finances.

Financial Measures

Financial measures refer to how governments choose to spend the revenues they raise. The spending priorities of the governing bodies will greatly influence the form and functioning of each city. This is especially the case with transport and other infrastructure, housing for lower income groups, public amenities, and many other aspects of the built environment. Large point-located facilities like hospitals and university campuses, for example, are major drivers of land use patterns, travel demand, social character, property values, and many other aspects of city and suburban life.

Politics influences spending, and spending, in turn, influences the nature and character of the places in which we choose to live or can afford to live. Spending programs of government can be *capital expenditure*—normally associated with the construction of real facilities and property—roads, railways, buses, and rolling stock, other infrastructure, buildings, parks and open spaces, and so forth. Alternatively, they can be *recurrent expenditure*—payments needed

Table 2.1 Examples of Grants Commission allocations, Victoria, 2009.

Municipality rural shires	General purpose grants 2008/2009 Equalization grant	Natural disaster allocation ($)	Total ($)	Local roads funding 2008/2009 ($)	Total general revenue assistance 2008/2009 ($)
Alpine Shire Council	2 094 254	0	2 094 254	934 895	3 029 149
Baw Baw Shire Council	4 510 212	0	4 510 212	2 196 324	6 706 536
East Gippsland Shire Council	7 913 999	0	7 913 999	3 905 086	11 819 085
West Wimmera Shire Council	2 224 555	0	2 224 555	1 988 203	4 212 758
Rural cities					
Benalla Rural City Council	1 979 449	0	1 979 449	1 130 181	3 109 630
Horsham Rural City Council	2 824 268	0	2 824 268	1 670 954	4 495 222
Mildura Rural City Council	7 395 332	0	7 395 332	2 947 396	10 342 728
Swan Hill Rural City Council	3 485 831	0	3 485 831	1 606 222	5 092 053
Large regional cities					
Ballarat City Council	7 805 404	0	7 805 404	1 615 120	9 420 524
Greater Bendigo City Council	10 113 036	0	10 113 036	2 533 588	12 646 624
Greater Geelong City Council	14 748 941	0	14 748 941	2 581 326	17 330 267
Outer metro growth suburbs					
Casey City Council	12 724 865	0	12 724 865	1 651 195	14 376 060
Whittlesea City Council	7 378 117	0	7 378 117	1 154 588	8 532 705
Melton Shire Council	7 373 496	0	7 373 496	1 002 644	8 376 140
Brimbank City Council	10 417 565	0	10 417 565	1 282 266	11 699 831
Inner metro established AR areas					
Melbourne City Council	1 588 813	0	1 588 813	578 722	2 167 535
Moonee Valley City Council	1 994 826	0	1 994 826	541 812	2 536 638
Port Phillip City Council	1 701 472	0	1 701 472	327 718	2 029 190
Yarra City Council	1 384 835	0	1 384 835	338 829	1 723 664

Source: Reproduced with permission from Victoria Grants Commission (2009) Allocations of general revenue assistance, 2008–09. Available at: http://www.dvc.vic.gov.au/Web20/rwpgslib.nsf/GraphicFiles/Allocations+of+General+Revenue+Assistance+2008-09/$file/GRA_Summary_2008_2009.xls

year on year to provide government services—the salaries of teachers, nurses, police, and firemen, the maintenance of assets and buildings, the subsidies to those on welfare, and the servicing of government debt.

Both capital and recurrent expenditures impact on urban form and quality. Although capital expenditure choices have the more obvious impacts, recurrent expenditure is also vital—the frequency with which buses or trams or trains run, the extent of their services, and the reliability of the vehicles all depend on the levels of recurrent expenditure supporting such services. The choices governments make about these matters lie at the heart of political debate at State and local government level (where most such expenditure is made in Australia).

The analysis of spatial patterns of government expenditure is frequently hampered by the fact that Australian and State Governments rarely report that spatial structure, despite many attempts at both national and State level to introduce area budgets. Partly this is a reaction to the political sensitivity of spatial expenditure patterns, and partly it is a result of reluctance by Treasuries to move far from the functional allocation of and accounting for funds.

Typically, funds are appropriated with the authority of Parliament, for a specified purpose—roads, schools, hospitals, public housing,—or for a recurrent program—nursing costs, teaching costs, maintenance of environmental assets, and so on. Expenditures can be scrutinized for their efficiency in such a framework, enabling parliaments to assess if the money appropriated actually delivered the intended output (a road, a school, a hospital) at an acceptable cost over an acceptable time period.

Sometimes the expenditures can also be scrutinized for their effectiveness—for example, did the new hospital contribute to improved health-care outcomes?

A number of other questions about urban impact might be raised. Did the new hospital induce rises or falls in land values in its vicinity? Did it lead to land use changes in the area? Did those changes make the city more sustainable?

These types of questions are important because urban investments are interlinked and have flow-on effects—'externalities'—that are too rarely considered in assessing investment decisions. But understanding and capturing the benefits of positive externalities arising from individual functional investments in a city is a key task of urban management.

Building on those externalities with other actions linked to them can drive urban growth and change in new directions with little more effort than coordinated decision-making and some facilitating funds to overcome barriers to change. Just such an approach was adopted across Australia in the 1990s through the Australian Government's Building Better Cities program, which is the focus of the second case study.

Financial Measures Case Study: Building Better Cities Program (BCP)

The Building Better Cities Program of the Hawke-Keating Australian Government in the mid-1990s was a national initiative, led by Deputy Prime Minister Brian Howe, to align the spending of the National, State, and local governments to bring about needed improvements in the way urban development was managed across Australia. The program targeted inner urban renewal, mindful that the inner city areas of Australia were facing continuing population and employment declines at the time. The program also aimed to emphasize the early introduction of public transport and transit-oriented suburban design in new urban growth areas, and to revitalize key regional cities across Australia, providing new jobs, new housing forms, and demonstrating how regional centers could transform themselves.

It was an ambitious initiative on many fronts, not least because it was the first major outcomes-driven government program that involved all three spheres of government—National, State, and local—as well as the private sector. The

Australian National Audit Office (ANAO), in reviewing the program in 1996, remarked as follows:

> The BCP agreements incorporated a major innovation in accountability and measurement of performance by the States and Territories. Their accountability to the Commonwealth would be through reporting program outcomes and outputs.
>
> (Australian National Audit Office, 1996, Para 1.13)

The program was managed through an Umbrella Agreement with each State Government whereby they agreed to work with the Australian Government on the program. Under that umbrella were Area Agreements for each State, setting out the areas where the program would focus (one inner city, one outer suburban, and one regional was the aim for each State or Territory) and the planned outcomes and outputs for each area.

The 26 Areas agreed upon, and a summary of the broad nature of the strategy for each in terms of the main areas of expenditure, are set out in Box 2.8. Each Area Agreement summarized the estimated cost of the overall package of needed investment by government and Australian Government funds were allocated as a (variable) share of that total cost. States would receive the money in tranches, and would report progress against output milestones for each tranche before the subsequent tranche was approved for allocation.

The States had, therefore, to manage the delivery of outputs, and to arrange how to combine their spending, local government spending, and private sector spending where this was significant (and in most cases it was) to deliver results on the ground. This meant drawing on the budgets and outputs of agencies across government, coordinating the timing of their expenditure and its location, sometimes combining budget allocations (not usual in government), and generally learning how to cross the boundaries of traditional 'functional silos' in delivering effective urban outcomes. In this sense the program was complex as well as innovative.

As the ANAO (1996, Para 1.11) stated in its 1996 Audit:

> The Commonwealth, States and Territories agreed to contribute cash, land and facilities, and infrastructure investments to BCP. The total value of these contributions was estimated at the commencement of the program at $2512 million, of which the Commonwealth was to provide $816.4 million, or around one-third. Implementation arrangements emphasised a partnership approach between levels of government in planning and program delivery.

This arrangement created genuine challenges for State and Territory governments. They needed to devise new models for cooperative management of spending across agencies, in a selected area, in order to satisfy their agreements with the Australian Government and to receive funds. The Australian Government did not prescribe what form these arrangements should take—this was itself part of the experiment. Instead, it asked States

Box 2.8 Better cities program.

State	Area strategies
New South Wales	**Ultimo/Pyrmont** High density affordable housing, planned light rail, sewerage and water systems, and a new neighborhood park
	Transit West (West Sydney) Development of Parramatta and Blacktown as key regional centers; construction of Blacktown bus and rail interchange and the Merrylands–Harris Park 'Y' rail link
	Honeysuckle and Environs (Newcastle) Rejuvenating inner Newcastle; improving employment opportunities, public transport, and housing choices
	Eveleigh Medium density housing and open spaces; development of an Advanced Technology Park to encourage employment in knowledge-based industries and scientific research
Victoria	**Plenty Road** Transport improvements—tram line extension to Mill Park; improved public housing; development of former institutional land; R&D commercialization facility at La Trobe University
	Inner Melbourne and Rivers Higher density public and private housing; city circle tram service; flood mitigation works
	South West Development of Bio-Technology precinct at Werribee including the Australian Food Research Institute; upgrade Geelong–Werribee–Melbourne rail line; redevelopment of the Norlane Public Housing Estate (Geelong)
	South East Rail infrastructure improvement, including redevelopment of Dandenong Railway Station; joint venture development of residential housing; promoting Dandenong as a regional employment and service center
Queensland	**Brisbane–Gold Coast Corridor** Extension of railway from Beenleigh to Robina; higher density housing, including public housing, with access to improved transport interchanges
	Brisbane—Inner North Eastern Suburbs Conversion of former industrial sites for residential housing; higher density housing, including low-cost housing and public housing; improvements to public transport; cycle path network and public footpaths
	Inala—Ipswich Institutional reform, including closure of Wacol Rehabilitation Centre and the Challinor Centre for persons with intellectual disabilities and rehousing residents; infrastructure improvements including flood mitigation works; construction and upgrade of public housing
	Mackay Urban Consolidation Project Provision of low-cost housing and student accommodation; increased urban densities

	South Townsville Inner City Village High density housing adjacent to Townsville CBD; better traffic management; improvements to community services
Western Australia	**East Perth** Infrastructure upgrades including water, sewerage, drainage, power, and road works; affordable housing and promotion of an urban village concept
	Stirling Infrastructure upgrades—sewerage system, road, and rail links, Stirling bus–rail interchange
	Bunbury New public housing, tourist and recreational facilities; environmental and infrastructure works, including removal of oil storage facilities, wastewater treatment system, and waterfront public open space areas
	Fremantle Infrastructure upgrades—sewerage, stormwater drainage, and water recycling systems; higher density housing including affordable housing and housing for the elderly
	Perth Urban Innovative housing close to employment and transport
South Australia	**Elizabeth—Munno Para** Infrastructure improvements—stormwater drainage, water storage, and landscaping; affordable housing initiatives
	North West Sector Development of Multi-Function Polis site and adjoining Northwest Crescent of Adelaide; road links and environmental improvements
	Southern Areas Improved infrastructure—sewerage disposal, roads and cycle paths; employment opportunities at Noarlunga
	Western Area Higher housing densities; improved community facilities; better traffic management
Tasmania	**Launceston Inner City** Increased housing densities; development of cultural, community, and conservation sites
	Hobart Western Shore Improved urban environment and land use including decontamination of sites; institutional reform and conservation of historical sites
Northern Territory	**Darwin** New deep water port for Darwin at East Arm Peninsula; environmental improvements
ACT	**North Canberra** Wastewater recycling plant scheme; an energy-efficient rating system for new residences; higher density housing and institutional reform

Source: Reproduced with permission from Australian National Audit Office (October 1996) Building Better Cities ANAO Audit Report No 9 of 1996/1997, Table 1—Better Cities Area Strategies at December 1995.

and Territories to propose suitable arrangements that would guarantee delivery of the outcomes and management of the outputs under the Agreement. Diverse arrangements were made, from fully legislated statutory authorities to inter-agency committees of varying make-up and capacity. Some are described later in this chapter.

In reviewing the program, the ANAO (1996, Para 1.27) concluded the following:

> The ANAO is of the opinion that the management of the program was effective in controlling financial risks to the Commonwealth. In most cases, agreed outputs and completed BCP projects were delivered on time. Accountability for Commonwealth inputs and program outputs was also effective. In relation to the measurement and reporting of BCP outcomes, the agreements entered into by the Commonwealth and States did not adequately define the outcomes sought or appropriate means of measuring them. As a result, the high level of accountability by outcomes intended through the adoption of the BCP model was not achieved.

The ANAO comment on outcomes was based on the fact that measures of many of the matters being addressed through the program were simply not available (no statistics were available) at the time the program was initiated, so base-levels against which changes could be accurately measured either did not exist or had proxies only. Examples included local use of public transport for journeys other than work, where only sample-based surveys existed at a regional scale, not suited to local analysis.

In ANAO's stated view, the financial arrangements were sound but the measurement of outcomes lacked adequate baseline data or sufficient effective indicators to ensure outcomes were measured, a matter to be remedied through improved program planning and design.

ANAO's (1996, Para 3.12) suggestions on possible future outcome indicators stated:

> The ANAO considered that the nature of many BCP development activities suggested a number of possible outcomes that could be measured to indicate what BCP had achieved. In relation to BCP projects that were reviewed during the audit, some of the outcomes sought could be measured by changes in:
>
> - waste water treatment and associated river and harbor water quality;
> - occupation and population demographics in areas or precincts in which 'an appropriate social mix' was the intended outcome;
> - air quality in areas where lower rates of usage of private vehicles were intended;
> - public attitudes to, and public acceptance of, different housing types, densities and modes;
> - the number of different housing types available;
> - time taken to obtain planning approvals for housing development;

- employment levels and job creation in BCP target areas;
- rail and public transport journey times;
- levels of public transport usage;
- the cost of home construction in BCP areas and other new comparable housing areas; and
- the level of impact of new BCP housing on public infrastructure and the cost of its provision.

In a separate evaluation of the Program (Department of Housing and Regional Development, 1996), it was assessed that the $2 billion of government funding, after 5 years, had induced a further $5 billion of private sector investment, with more to follow in subsequent years as development in each area proceeded. One main outcome is now being achieved—across all Australian State capital cities, inner urban population decline has been reversed and the inner city areas are among the fastest growing parts of Australian cities. The financial contribution of the BCP to initiating and facilitating this change is widely acknowledged.

Institutional Arrangements

The roles and responsibilities of government, the private sector and communities in governance generally, and urban governance in particular, can vary depending on ideology, tradition, government stability, private sector capacity, and community expectations, and this variation will result in different developmental outcomes. Within governments, the way in which functions, powers, and responsibilities are allocated across different types of organizations will have substantial effects on management style, capacity, and developmental outcomes.

Recent decades have seen moves internationally to smaller government with greater reliance on markets and the private sector to deliver what were previously investments and services delivered by government. Australia took up this movement enthusiastically from the early 1990s until the Global Financial Crisis of 2008.

In reality, the relationship between government and the private sector lies along a spectrum of possibilities. Different governments can make arrangements that lie at different places along the spectrum, utilizing varying degrees of regulation of the behavior of corporations and individuals drawn from that government's perception of the interests of the community as a whole, and its ideological position.

At one end, the free market end, government is minimal, markets allocate resources through competitive market mechanisms, and individuals are free to pursue self-interest with minimal government regulation. Even at this end of the spectrum, however, institutions of the State and a strong legal framework remain essential, in order to create a stable environment in which markets can operate with confidence (World Bank, 1997).

At the other end of the spectrum, governments dominate resource allocation decisions and markets facilitate the achievement of collective rather than simply individual goals.

There is a similar spectrum in the governance and management of cities: from the seemingly deregulated development of some American cities—Houston is usually cited—to the tightly managed regulatory and participatory engagement of government in the management and development of many European cities.

The institutional arrangements for the governance of Australian cities lie somewhere between the American and European models.

Citizens like to have a say in the way their communities develop and change. Hence, State and local governments enact laws and regulations that govern planning and development, and make provisions for community engagement, facilities for expressing objections to particular developments, and processes for arbitration between parties in dispute over planning and development proposals.

They also provide local government or State institutions with the power to make plans—to establish policy, in effect—and then to implement those plans through regulations that have force in law and impose penalties on those who do not follow them.

Alongside these organizations sit a range of other key urban actors. Within government, transport authorities are among the most important, but are closely followed by utility authorities or companies.

Cost-effective (or profitable) supply of water and sewerage services is essential in every city, and can limit where urban development might feasibly take place. Where private companies are responsible for water services, there is an incentive to maximize the sale of water and hence to supply it wherever consumers are prepared to meet the relevant costs. Where utilities are in government hands, a more conservative approach is normally taken reflecting governments' more cautious use of (often scarce) capital with, consequently, more constraints on where development supplied with reticulated water and sewerage might go.

In institutional arrangements some governments separate transport planning from urban planning. Others combine the functions (as in the Victorian Department of Infrastructure from 1999 to 2002) and sometimes there is facilitated collaboration between transport institutions and urban planning institutions. In Victoria after 2002, the role of Coordinator-General was created to link transport planning and land use planning after land use responsibilities moved from the Department of Infrastructure to the Department of Sustainability and Environment.

In Australia, the major cities each have a government-owned development company of some significance, undertaking land development at the fringe of the city or leading urban renewal. These agencies are there to create some disciplined competition in what can be a very speculative land development market. VicUrban in Victoria has both urban renewal and new land development responsibilities. LandCom in Sydney is focused on urban renewal.

Over recent years, there has been greater experimentation, with generalist, place-based institutions of government that focus on the development or renewal of key parts of the city. Examples include the Sydney Harbour Foreshore Authority and the Darling Harbour Authority in Sydney; the former Docklands Authority in Melbourne (now incorporated into VicUrban);

Melbourne's Growth Areas Authority, focused on new development at the urban fringe; and the East Perth Redevelopment Authority.

Decisions to create new institutions or change powers and responsibilities of existing institutions are made frequently by governments, normally in response to either a specific need, or a reform agenda, or simply because it is a political necessity of power-sharing within governments. The effects can be profound. Powerful road-oriented transport agencies can dominate urban development and drive the form and character of cities. At the same time, government control of land markets can have the opposite effect, creating compact, carefully managed cities, much like those in Scandinavia.

Place-based authorities can be transformative—the Inner Brisbane Urban Renewal Authority and the East Perth Redevelopment Authority are leading Australian examples, where old and rundown inner city precincts of significant scale have been turned around within a decade into lively, flourishing, inner city mixed use.

The institutional instrument is one of the most significant in urban management, and needs to be used purposefully to drive toward outcomes, especially when the existing system is inert or incapable of adapting to a new strategic environment or to needed policy changes. The third case study, the creation of the Growth Areas Authority in Melbourne, was motivated by just such circumstances.

Institutional Case Study: Growth Areas Authority

In 2002, *Melbourne 2030* provided a clear definition of the areas intended for future urban expansion and those where significant urban development was not to be permitted. Part of the means of doing this was to define an Urban Growth Boundary. The Boundary had statutory effect and changes to it required the approval of Parliament.

The intention of the measure was to manage urban sprawl by channeling new development into growth corridors aligned with the main transport links (road and rail) between Melbourne and other parts of Victoria. This was a long-standing approach to managing growth in Melbourne but had been abandoned for some years under a conservative, market-oriented government.

At the same time, a variety of measures were put in place to encourage urban consolidation—utilizing old industrial sites, intensifying development around the tram and train networks, special policies for activity centers, and the nomination of a number of Transit Cities where government would assist municipalities in managing urban renewal and mixed-use development.

A key challenge in the areas where new urban growth would continue (the Growth Areas) was that the developers and municipalities were frequently at loggerheads over planning issues. The municipalities (with the exception of Whittlesea) had no clear framework or structure plans for new development areas. Instead, they received proposals from developers and battled over them for months and sometimes years, often with the disputes being referred to the planning division of the Victorian Civil and Administrative Tribunal (VCAT) for resolution. VCAT hearings are legalistic, ordinarily involving barristers and expert witnesses, and can take considerable time. Developers were unhappy with the length of time taken to have new developments approved, and the State Government was unhappy about the inefficiency of local government decision-making and its implications for housing affordability.

An institutional intervention to address the weaknesses in the process of managing new development in the Growth Areas was clearly needed.

In 2005, the Victorian Government, concerned to maintain an adequate and affordable supply of residential land in the growth areas, set out Growth Framework plans for each Growth Area, defining the broad uses of land, location of major transport infrastructure, environmental reserves, activity centers, and similar structural elements of the future development.

To provide the finer detail at structure plan level for each Growth Area, the government created the Growth Areas Authority, a statutory body that

> …can improve the development approval process and help create better planned, more liveable communities in the important growth areas around Melbourne. (Growth Areas Authority, 2006, p. 1)

The Authority was created by State legislation as a State Government statutory authority, reporting to the Minister for Planning.

While strategic planning at the metropolitan and regional scale had been a State Government responsibility for much of the past three decades, local government held responsibility for the approval of development proposals in each municipality. While local government approval responsibilities remained unchanged, the new Authority brought State Government influence to bear on forward planning for development in each growth area, rather than leaving this to a process of negotiation between developers and municipalities.

While the Growth Areas Authority was not initially a planning authority, it had strong influencing and facilitating capabilities as well as funding to support forward planning, especially the preparation of Precinct Structure Plans to guide development. It took on the process of preparing almost 40 such plans for Melbourne's Growth Areas.

In 2008, revised population forecasts, showing much more rapid growth of Melbourne than had been forecast at the time of *Melbourne 2030*, led to a further review of Growth Area planning and management. *Melbourne@ 5 million* indicated that more land was needed for rapid growth, especially if housing affordability was to be protected. Simpler approval processes for new development and streamlined planning processes were to be set in place. Contributions by developers to the cost of infrastructure for new development were to be clarified and simplified.

The Government also gave the Growth Areas Authority extended powers and responsibilities. In particular, the Authority was given additional government backing to take a firmer hold over the preparation of the Precinct Structure Plans that formed the backbone of development approval in the Growth Areas. Under new zoning arrangements, no land could become urban land without the preparation and approval of a Precinct Structure Plan. In the Urban Growth Zone, Precinct Structure Plans are required. Once such plans are approved, no further public advertising or review of development proposals consistent with those plans would be necessary. This *regulatory* change was estimated to lead to a saving of at least 12 months in the time taken for development approvals.

The Growth Areas Authority was designated as responsible for overseeing the preparation of all Precinct Structure Plans and advising the Minister for Planning on their approval. In addition, it was given the responsibility for preparing Infrastructure Plans in cooperation with other State agencies, local government, and developers, to underpin and inform the preparation of the Structure Plans, and to assist in staging development and financing infrastructure (Growth Areas Authority, 2009).

Some 40 areas have been defined as requiring Precinct Structure Plans for communities of between 10 000 and 30 000 people in each, and a program to complete these plans by 2012 was set in place. A new approach to growth area planning was thus firmly established, through the introduction of a new, specific purpose institution into the decision-making pathway.

Of additional significance was the simplification of developer contributions for infrastructure investment. While this is strictly a *fiscal* measure, it is significant in an institutional context in that it provides funding for the operations of the Growth Areas Authority as well as for provision of otherwise publicly funded infrastructure and services. The Growth Areas Infrastructure Contribution was initially a levy of A$80 000 per hectare on undeveloped land brought within the Urban Growth Boundary in 2005, and a levy of A$95 000 per hectare on land to be brought within the Urban Growth Boundary in or after 2009.
The contribution is allocated:

- Fifty percent to partially offset the costs of important infrastructure projects in the growth areas; and
- Fifty percent paid into a Growth Areas Development Fund as well as going toward the costs of the Growth Areas Authority and its outputs—the Precinct Structure Plans among them.

These measures consolidated the role and functions of the Authority in providing it with a dedicated income source—an important characteristic of any institution. It remains under government budgetary oversight and control. Subsequent changes have been made to the infrastructure contribution, in particular removing a requirement that it be fully paid before a development proceeds.

The establishment and evolution of the Growth Areas Authority has changed the processes of urban management in Melbourne quite dramatically in a very short time. It has given more authority to the State Government to manage the structural detail of new urban growth at Melbourne's fringe, and also to influence the performance of the land market and the competitiveness of the property development sector. If the Authority is able to assist in achieving a good supply of affordable land and housing well serviced by infrastructure, transport, job opportunities, and community facilities, it will have transformed the character of Melbourne's outer suburban development.

Advocacy

Leadership and advocacy lie at the heart of political processes. Communicating government policies to communities is a core requirement of the political craft. In urban management, being able to communicate and explain to communities the intent of urban policies and programs and/or the need to modify community and business behavior usually accompanies any strategic planning and implementation process.

Often the formulation of policy relies heavily on community attitudes and expressed ambitions, made evident either directly through political processes themselves or through the wide variety of means by which decision-makers consult with the communities on whose behalf they act. Advocacy is also the raison d'être of many community groups, lobbyists, and others interested in influencing the decision-making of governments to their advantage; so it is rarely, if ever, politically neutral. Importantly, advocacy is usually about winning a majority of influential people over to a particular point of view, and that 'winning' then enables action to follow that might not be in the best interests of a particular minority.

In an urban context, typical advocacy campaigns that have been common include:

- antipollution, antilittering campaigns;
- support for the use of public transport;
- support for walking and bicycle use;
- opposition to demolition of heritage buildings or assets;
- support for the protection of the environment against urban encroachment;
- opposition to high buildings;
- support for conservation of water and energy; and
- support for law and order in the city.

There are hundreds of examples internationally of the use and effectiveness of advocacy.

In urban management advocacy is a necessary instrument in gaining public support to manage urban growth and change in new ways. If governments, in the interest of pursuing more sustainable development across the city, want more people to use public transport, they will need, quite possibly, to:

- have a clear policy—for example, set out a policy framework that explains that the aim is to have 20% of motorized travel using public transport by 2020;
- use a regulatory instrument—for example, dedicated bus-ways on main roads, enforced by law;
- apply fiscal measures—for example, tolls on roads and attractive pricing of public transport;
- use financial capacity—for example, spend more on rolling stock and public transport operations; and
- change institutional arrangements—for example, create a single public transport agency for the city to integrate all modes.

They will also most certainly need a strong advocacy program to sell the message of greater public transport use to consumers of transport services.

An excellent example in Melbourne has been the *Our Water Our Future* campaign, a public advocacy campaign designed to encourage residents and businesses across Melbourne to reduce their consumption of increasingly scarce water.

The overall plan for water management in Victoria, *Our Water Our Future*, was published in 2004 and contained 110 initiatives to be implemented across the State to better manage water resources (Government of Victoria, 2004). Among them was a high-profile media advocacy campaign that included television appearances and advertisements by the Victorian Premier and senior Ministers presenting the case for Melbournians to reduce their consumption of water. The campaign also explained why restrictions on water use were being introduced to reinforce behavior changes.

The water restrictions were regulatory in nature, permitting watering of gardens only on certain days of the week and at certain times of the day. Penalties were in place and inspectors monitored household performance at random. So a regulatory instrument was used to reinforce the message on the need to manage water better and use less of it.

On their own, water restrictions would not have been effective—they were likely to raise community opposition and political concerns, so the advocacy campaign was planned to increase community awareness of the need for responsible, shared action in the interests of the community as a whole. This made the restrictions easier for all to accept, as a measure in which all shared.

In 2004, the Government set a target of reducing per capita consumption of potable water in Melbourne from 423L per person per day to 360L per person per day by 2010—a permanent reduction of 15%. Extensive publicity around possible ways of achieving these savings accompanied the advocacy campaign along with numerous other initiatives—subsidies for water savings devices (financial measure), information packages (knowledge management), restrictions on water use (regulatory), changes to the commercial performance objectives of water retailers (institutional), and others.

By 2005–2006 a reduction in per capita consumption to 331L per person per day had been achieved. A new target was set of 317L by 2015 and 296L per person per day by 2020. By 2008 water supply levels were so low that a drastic new target of 155L per person per day was set for Melbourne, and a further strong advocacy campaign, supported by other initiatives, was launched.

By May 2009, monitoring websites (http://www.ourwater.vic.gov.au/programs/owof) were reporting per capita daily consumption of as little as 135L per day, a reduction of 68% from the base level used when the campaign was launched in 2004.

The desired outcome, reduced water consumption across the city, was achieved, although the long-established garden city character of Melbourne has probably been changed forever. The effectiveness of these examples highlight how important the advocacy tool can be in urban management and how, supported by other instruments, major changes in individual and community behavior can be achieved. These behavioral changes are essential elements of moving toward more sustainable urban development.

Knowledge Management

Sharing knowledge and experience is a powerful tool for impacting the speed with which changes occur in cities. There are two major sources of information, information coming from across the city itself through improvements in communications technology and information from other urban managers.

The rapid development of communication technologies has opened up new areas of interest to urban specialists, ranging from community building via the web to transport logistics. A recent and developing field of urban informatics (Foth, 2009) is exploring the impact of these new sources of information on how cities operate, and is likely to provide new insights on the city for urban managers.

Learning how others have been successful and replicating their efforts are important in urban management, often shared through conferences and professional development programs. However, most decision-makers on urban governments are elected officials and representatives, who may come with no professional or other background in urban development. Sharing knowledge with decision-makers is a crucial part of urban management, and, while never easy, must be pursued. A relevant case study is the international forum, Metropolis.

Knowledge Management Case Study: Metropolis

Metropolis was established in 1985 as an international forum for examining issues and exploring knowledge and experience in the management of the world's major metropolises. Initiated in Paris, it has grown to include major cities in over 100 countries. Its mission and objectives are stated as follows:

> The mission of Metropolis is to accompany cities in mutual learning, innovation, governance, technical/financial assistance, international presence and debate.

The aim of Metropolis is to build a global alliance between metropolitan governments and their associates to promote urban sustainability; promoting a cross-sectoral approach on environmental, economic, social, and cultural issues; acting in developed metropolitan regions and those exhibiting strong urban growth; defining public–private action and cooperation between institutions and levels of government, and working to reduce the sustainability gap and promote innovation and metropolitan governance.

Objectives are to

- promote mutual learning and capacity building;
- support innovative solutions to city problems across government and the private sector;
- support a coordinated approach to metropolitan governance and address metropolitan imbalances;

- promote financial and technical assistance to metropolitan areas in developing countries for efficient investment and sustainable outcomes;
- provide an international forum for debate on city interests and concerns; and
- promote analysis of trends in city development and urban policy (http://www.metropolis.org/metropolis/en/node/15).

Metropolis pursues its objectives through establishing 'Commissions'—in effect thematic working groups formed among interested cities to pursue particular subjects of interest to them. These Commissions meet, gather data from representative cities, and develop reports and recommendations on best practice and ways forward that may be taken up by any or all of the member cities.

In addition to the Commissions, the Metropolis General Secretariat maintains data bases and conducts research on major metropolises, with the aim of eventually covering all 400 metropolitan regions of more than 1 million people. Thus far the research has covered over 50 of the largest cities and includes a geographic representation of all continents.

The particular value of Metropolis is that it is an organization that is intended to consist of political representatives of the cities involved, and hence, in theory, the decision-makers in society who can influence a city's future. City Mayors, Governors, or Government Ministers are commonly the representatives at Metropolis' major international congresses.

The effectiveness of Metropolis as a knowledge management network is apparent from its longevity, its continually expanding membership, the practical focus of its activities, and the high-level engagement by urban leaders internationally in its governance and its activities.

Conclusions

This chapter has introduced policy-making and instruments used in policy implementation, all of which can be applied, singly or in concert, to achieving desired urban outcomes. Each instrument has its own outputs, and its own inputs that generate those outputs.

The predictability of complex results in an urban setting is often weak, because government is one among many actors in creating urban development, and because the interaction of factors that operate in the development market can produce unanticipated outcomes. Time plays an important part as well. Hence, it is important to quantify outcomes and outputs, and monitor progress toward achieving clearly measurable changes in direction or absolute targets.

Planning is essential to set directions and targets, and to understand the urban systems being impacted by plans. Just as few successful business enterprises operate without a business plan and strategy, no successful city should do so either. The task of setting plans and strategies in place and then choosing, monitoring, and changing outputs, to effectively produce desired outcomes, is what urban management ultimately is all about.

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3

Urban Infrastructure: Productivity, Project Evaluation, and Finance

Kath Wellman and Frederik Pretorius

Introduction

The first chapter introduced the concepts of economic and social infrastructure, the global context which impacts on these and microeconomic reforms that have been utilized to drive efficiencies and innovation in the finance and management of urban infrastructure. The second chapter provides the broad context of urban management principles to introduce policy development and the instruments that can be used to implement policy decisions. This chapter builds on these concepts, and introduces further theoretical constructs that underlie all public finance activities. These constructs, including the intuition supporting current public sector project evaluation methodologies, form an important context for the questions of infrastructure investment and financing, given that the efficiency and effectiveness of and equity of access to urban infrastructure are important determinants of the livability and productivity of cities, regions, and economies of nations more generally. Recent Australian infrastructure investment and coordination initiatives are considered, including most recent developments in infrastructure investment decision-making in Australia, notably the *Nation Building for the Future* initiative and supporting investment evaluation frameworks developed by *Infrastructure Australia*. Although there is specific reference to economic infrastructure in keeping with the book's purpose, the principles outlined in the chapter apply to decision-making for both economic and social infrastructure.

The services provided by urban infrastructure generate significant economic benefits and can enhance overall community well-being. They are credited by governments with a range of positive attributes, including

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

improving the livability and sustainability of cities, reducing the avoidable costs of congestion, lowering greenhouse gas emissions, providing accessible and reliable public transport, supporting sustainable urban development and economic growth, increasing productivity, and generating jobs. Recognition of the productivity benefits of efficient infrastructure can be found in the 2009–2010 Australian Government Budget Overview titled *Nation Building for the Future* (Australian Government, 2009). The principles contained in this overview have come to form a reference point for infrastructure investment decisions in Australia, and it states:

> Efficient infrastructure is essential to promoting Australia's future productivity and prosperity.
>
> The Government's commitment to realising world-class infrastructure will drive a more diverse, competitive and sustainable economy that generates substantial and lasting economic, social and environmental benefits.
>
> The Government's investment in nation building infrastructure will support an average of around 15,000 jobs each year, peaking at around 18,000 in 2011–12. (Australian Government, 2009, p. 2)

Ken Henry, Secretary to the Australian Treasury later noted:

> … governments can play an important role in the wealth creation process, facilitating productivity growth through creating the conditions for integration and specialisation, by getting infrastructure and planning decisions right.
>
> (Ken Henry, 2010, p. 5)

Well-considered urban infrastructure investment thus generates extensive benefits to society, but there is a cost and societies do not have limitless resources. How then are decisions made to invest in particular urban infrastructure developments and not in others? While the benefits of any infrastructure investment can be significant and worthwhile, as outlined in Chapter 2, when viewed as isolated investments these benefits can fail to match the costs of planning, constructing, and operating the infrastructure. Further, there is an existing stock of still functional legacy urban infrastructure that affects the potential of new assets added to the stock. The physical structure of Australian cities and much of its economic infrastructure, particularly transport infrastructure, had been established more than a century ago and determines to a significant extent the productivity of incremental investment decisions. This path dependency makes it essential to ensure that each decision to invest in urban infrastructure has been fully analyzed to assess the efficiency with which it produces its service outputs, the effectiveness with which it achieves relevant outcomes, and the distributional consequences of the investment. The first section of this chapter discusses how these decisions are approached. The basic staple of public sector project evaluation techniques internationally continues to be cost-benefit analysis (CBA) in its various guises, and we point out its advantages and disadvantages in Australian urban settings. These project evaluation techniques form the subject area for the second section of the chapter. Under ideal circumstances, once a decision has been made to invest in infrastructure a separate decision needs to be taken on financing the project, irrespective of whether the project is undertaken by the public or private sectors. Decisions on project financing depend on efficiency, the form of finance, and the influence public sector capital constraints may have on financing options. This is the subject area for the third section of the chapter. Overall, this chapter is concerned with what may constitute productivity in urban infrastructure investment projects, which projects to choose and how to evaluate them, and consideration of how these possibly may be financed.

Which Investments Should Be Undertaken?

We see the question in the section heading to suggest at least two implicit subquestions. The first concerns the general economic policy imperative that will guide decision-making, and this dictates that the investment be of net benefit to society. For now, with economic infrastructure investment we could interpret this loosely as requiring a net productivity benefit to the economy (we will broaden the criteria, of course). Efficient infrastructure is seen as enabling members of society to improve their welfare (broadly taken to mean living standards and general well-being) given the resources available to the economy. The second part of the question relates to the political philosophy that constrains the first requirement, and this broadens the productivity requirement to include efficiency, effectiveness, and equity considerations. We elaborate on the criteria below, but it is necessary to establish the constraints on making 'first best' infrastructure investments, created by the constraints imposed by the existing physical structure of Australian urban centers.

According to Roland-Holst (2006), research on the impact of infrastructure and infrastructure investment on economic development considers broadly three matters: first its role in facilitating economic growth through direct stimulus, second, through facilitating efficiency in trade and distribution by reducing costs and margins, and third through stimulating endogenous growth factors (economic conditions that facilitate readiness for growth and can accelerate it when they are present in an economic setting). The contribution of infrastructure to economic development is especially impressive in developing countries, suggesting that the returns to infrastructure investment are highest during the early stages of economic development when the stock of infrastructure is small and basic networks are incomplete, but that returns on infrastructure investment tend to fall as economies approach maturity. As could be expected with respect to the second category, it was also found that the stock of public infrastructure is a significant factor in reducing the costs of trade, and an important determinant of aggregate total factor productivity (Aschauer, 1989). The third kind of economic impact, namely regional gains, relates to regional economic benefits that may result from infrastructure integration that functions to reduce interregional barriers and costs of trade, and also because it facilitates interregional competition. Overcoming geographic obstacles and so decreasing resulting trade and transport costs and margins is thus crucial to trade expansion and growth (Roland-Holst, 2006).

These observations are important when the economics of infrastructure investment is considered in the Australian spatial context. Australia is a developed country with unusual infrastructure economics challenges. As noted in Chapter 1, the large distances between Australian cities and the diffuse nature of housing in these cities mean that when compared to other more dense (European) OECD urban areas, infrastructure investment generates lower returns from larger and less intensively used networks. Not only do large distances between urban centers generate relatively poor economic returns to the development of regional infrastructure, they also function against the development of large functional economic regions that are so economically efficient, such as those centered on New York, Tokyo, the Pearl River, and Yangtze Deltas or the Ruhr valley, indeed, so much so that the economics of most investment in infrastructure aimed at regional integration in Australia remains questionable.

Despite the daunting geographical challenges, many potentially attractive infrastructure projects exist, particularly at the urban level. How best to evaluate and prioritize competing proposals is a problem that has vexed societies' decision-makers and public finance officials for as long as there has been social organization. In Australia, evaluation of the desirability of infrastructure projects has generally settled around a few core criteria. Infrastructure projects should

- be efficient and produce a net social benefit,
- produce a greater net social benefit than feasible alternatives,
- achieve the greatest effectiveness of those projects of similar (high) net benefit, and
- not generate unacceptably inequitable outcomes in terms of the distribution of costs and benefits.

While the criteria are simply stated, the conduct of analyses required to come to decisions involves complex methodological issues and decisions that often require judgment. Also, often a desirable single project may generate suboptimal network (systemic) effects, and therefore potential network effects are also critical project characteristics. To be sure, there is no accepted methodology that could satisfy all requirements of society's stakeholders to infrastructure investment decisions, and decisions invariably also require consultation, negotiation, and compromise. We examine below how the criteria of efficiency, effectiveness, and equity (distribution of costs and benefits) are generally conceived of in Australian urban infrastructure project decision-making. We then also consider briefly the additional economic factors of network effects and externalities, before we turn to project evaluation methodology.

Infrastructure: On Efficiency, Effectiveness and Equity, Markets, and Further Economic Concerns

Evaluation of infrastructure projects is thus underpinned by the concept of and search for efficiency and its contribution to productivity, and also for positive distributional effects. There are at least three widely recognized dimensions to efficiency, and each has relevance to the evaluation of infrastructure projects—these are productive, allocative, and dynamic efficiency. Most structural reforms in the economy generally and infrastructure services specifically since the mid-1980s were aimed at improving these efficiencies.

The concept of *productive efficiency* is possibly best theorized at project or firm level, but it has clear wider impacts on economies. The essence of productive efficiency is the production of a given value of outputs, in the form of goods and services, from the minimum value of inputs of capital, labor, and know-how or, equally, the maximum value of outputs from a given value of inputs. Productive efficiency is the primary focus for individual projects and firms, and if it can be improved, the cost of the inputs can be reduced and/or the project output (and usually revenue) increased. Either way, the project can be more profitable for its owners, private or public. The microeconomic reforms undertaken by many infrastructure services in Australia in the 1990s were primarily directed at improving productive efficiency, and aimed at investing in more technologically advanced equipment, and reducing inefficient use of and increasing the skills of the workforce. All in line with the National Competition Policy (NCP) reforms, reforms at government agency level were supported by more systemic reforms by State governments, including in industrial relations, the separation of policy from production and regulation, corporatization and privatization, pricing reforms, competition policy more generally, and in reductions in regulatory burdens. Some of these reforms were also aimed at improving the allocative efficiency of the economy more generally.

The concept of *allocative efficiency* is best understood at the level of the wider economy, rather than at project or firm level. It assesses the extent to which the resources of the economy are being used in ways that contribute most to overall community well-being. In an open and well-functioning market economy, the individual interactions of competition, purchaser demand, and producer supply collectively serve to allocate resources through the price mechanism. Prices signal what may constitute efficient combinations of resources not only to production, but also to infrastructure owners and potential investors (including governments) where constraints exist in services and where new investment may be warranted. But whether markets work efficiently depends on many additional factors, and whether the outcomes are effective and equitable is often debatable. Infrastructure has characteristics which exacerbate these limitations, such as significant differences between private and social rates of return, and which restrict private sector willingness to invest in infrastructure. Investing in infrastructure to integrate Australian regional economies reflects one such divergence. What has emerged is a logical public–private sector divide between regional and urban areas with infrastructure investment, as demonstrated with the Australian Government–led AusLink national/regional transportation infrastructure development initiatives on the one hand, and the high level of private sector investment in urban infrastructure such as tolled road transport facilities in Melbourne, Sydney, and Brisbane, on the other hand (For more on this see Chapter 8).

The concept of *dynamic efficiency* recognizes that innovation has value and that allocations of resources will alter over time in the quest for greater productivity. At a firm level, innovation also relies on educational and skills development, research and development, and ranges from 'new to the world' innovations to 'new to the firm' adaptation and adoption of technologies, processes, and managerial approaches that have been pursued elsewhere. At an urban, regional or economy-wide level, dynamic efficiency captures the capacity of a spatial economy to allow firms located within its functional boundaries to change their allocation of resources and remain competitive and relevant. It is precisely this aspect of infrastructure investment that requires farsighted public sector strategic vision and leadership—the large stock of fixed and irreversible investments in urban infrastructure makes it imperative that additional investments consider dynamic efficiency in the urban economy as an important investment criterion. Often, and possibly even unwittingly, institutional and regulatory inertia at all levels provide the biggest obstacles to dynamic efficiency at the firm, industry, spatial, and economy-wide level. Again, the structural reforms set upon in the 1980s and 1990s recognized and attempted to address the various dynamic efficiency constraints in the structure of the Australian economy generally, particularly in the way infrastructure investments were made and services delivered.

The *effectiveness* of a program or investment is a statement about the extent to which the outputs (goods and/or services) meet the intended objective of their utilization. Clearly a highly efficient new road can lead nowhere, and is thus totally ineffectual. Outcomes can be expressed as a set of government policy objectives, or more specifically as a series of impacts on individuals, target groups in society, industry sectors in the economy, or events and transformations in the environment. The separate identification of inputs, outputs, and outcomes marked a very early step in the Australian reforms undertaken during the 1980s. In the initial stages, it transformed budget formulation from a preoccupation with controlling inputs to understanding and measuring outputs. This gave managers some freedom to arrange capital and labor in ways that improved the efficiency of their operations.

One rationale for government intervention in a market economy is that markets do not exhibit concern for *equity in the distribution of benefits and costs*. Governments, on behalf of the people, are entrusted with the responsibility of ensuring that there is concern for equity in distribution and an acceptable living standard for all citizens. The most common forms of government intervention on grounds of equity are the redistribution of income, particularly in developed economies, by way of taxation and social security. There is also the provision of a minimum standard of social infrastructure to support education and public health. At an urban level, governments also aim to achieve universal access to essential urban economic infrastructure services such as clean water, sewerage, reliable power, and public transport, often with mixed results. On balance, the economic reforms over the last three decades may not have generated ideal equity in outcomes, but the quest for equitable outcomes remains one of Australian society's greatest strengths. The search for equity is deeply embedded in political processes and is an ingrained objective of social policy, but also does find strong expression in economic policy. We return to some challenges to the distribution of costs and benefits with infrastructure investment when we consider cost-benefit analyses.

Urban infrastructure covers a wide range of types of facilities, but their most important economic benefits to communities are generated by infrastructure *networks*, and not individual facilities. Developing robust and efficient networks is thus generally the aim of public policy, as urban traffic planners everywhere know. Efficient networks have the strategic ability to reroute demand when individual links in networks fail, a case often demonstrated in the negative with inefficient road networks and traffic bottlenecks, whereas the Internet easily routes traffic around inoperative links. Often individual project feasibility is therefore less important than the additional beneficial network effects generated by the project's development—this provides the economic rationale for governments proceeding with projects that might otherwise not seem feasible. Secondly, infrastructure networks are developed through the cumulative effects of individual infrastructure developments, or projects, into networked systems. In the case of urban economic infrastructure, these networks can be classified based on their particular characteristics. The most common network is characterized as *many to many*. Telephone networks are the classic example. Each user of the service benefits through greater coverage when additional users connect to the network, and the larger the network, the greater the incentive for current nonadopters to join. A second common network is *one (or few) to many*, which typically applies to such services as water supply and electricity generation. Significant economic characteristics of such services are the high (lumpy) capital costs (a dam, power station, initial trunk transmission) compared to low marginal costs of distribution to the next networked additional user. In these cases, charging regimes need to reflect the total service, long run, incremental costs of supply. The transmission and distribution systems are interconnected grids, reflecting the need for security of supply and load balancing, and remain a public regulation focus even with unbundled and privatized generation, transmission, and distribution services. The third network type found in urban areas is *many to one*, typical examples being stormwater and sewerage systems, although waste collection shares similar characteristics. Within individual urban catchments, urban transportation networks exhibit a similar spatial pattern, but with two-way flows, and with some strategic links (e.g., harbor crossings). These different types of networks differ in the incentives to service users, infrastructure owners, and in the assessment of the costs and benefits of the various types of infrastructure.

Even with all the positive and negative economic rhetoric surrounding markets, it can be stated with some confidence that the economic discipline enforced by competition in *well-functioning markets* is inescapable.[1] In terms of improving efficiency, competition in well-functioning markets brings with it many advantages, and it has been Australian policy since NCP to draw market principles into the provision, financing, and operation of infrastructure at all levels where potential for efficiency gains exists. It facilitates productive efficiency through strong incentives for suppliers to produce goods and services at lower costs than competitors, it facilitates allocative efficiency because producers and consumers respond to price signals to maximize their welfare, and it facilitates dynamic efficiency through the incentives for producers to be innovative in competing (new products or services, new processes, changed resource combinations, functional substitution, and more).

As noted, however, there are several characteristics of urban infrastructure that inhibit the development of an open and competitive market, and governments face complex issues where intervention is warranted in the public interest. The first is that many infrastructure facilities, whether social or economic, exhibit *natural monopoly characteristics*; the productive process requires operation at significant economies of scale and/or scope across a material range of outputs. Economies of scale is a common feature of infrastructure where there are large fixed costs and low marginal operating costs, possibly best illustrated by power generation and water supply. As argued in Chapter 4, infrastructure facilities often also have functional local monopoly characteristics. Where the existence of monopoly characteristics in urban infrastructure (and especially in essential services) once argued for government ownership and operation, over the last two decades there has been a fundamental change in the delivery and financing of physical infrastructure in Australia, generally following privatization initiatives and in pursuit of efficiencies in the infrastructure sector. The NCP established a legislative regime to 'unbundle' service provision into supply and distribution, to facilitate third-party access to both provision and operation of infrastructure facilities, with early 'deregulation and unbundling' services including electricity and telecommunications networks, gas and water pipelines, railroad terminals and networks, airports, and ports. In urban roads, government actively sought private sector participation in the development and management of urban toll roads through Build-Own-Operate Transfer initiatives, which allowed time-limited functional local price-regulated monopoly operators, subject to strict public sector regulatory oversight and ultimate return of facilities.

1 'Well-functioning' markets do not equate to the much maligned 'perfect' markets for its assumptions—it needs to be appropriately regulated, with clear property rights and low information and transaction costs, be contestable, and not be open to manipulation by parties on either the demand and supply side (or by governments, or labor, for that matter). Well-functioning markets remain a public policy goal in all mixed market economies with well-developed democratic institutions (Pretorius and Ng, 2010).

There are few better examples than TransUrban CityLink in Melbourne of such arrangements (Chapter 4), but similar arrangements operate in other sectors. In general the State of Victoria led many of these initiatives in the 1990s.

Criteria for Choice in Action: Nation Building for the Future

The economic and social criteria isolated for brief review above are currently explicitly incorporated in Australian infrastructure investment decision-making. The *Nation Building for the Future* (Australian Government, 2009) initiative recognizes the productivity benefits of efficient infrastructure. In the 2008–2009 Budget, the Australian Government announced the creation of three funds—the Building Australia Fund, the Education Investment Fund, and the Health and Hospitals Fund—as vehicles for investing in Australia's long-term future needs. As stated in the Treasurer's Budget Speech:

> Both the capital and earnings of the funds may be drawn down over time after specific infrastructure projects have been identified. This … ensures substantial funding is available for capital investment in infrastructure over the next few years. All spending from the funds will be subject to rigorous evaluation criteria. The Government will make further contributions from future surpluses as appropriate.
>
> To improve processes around the assessment of infrastructure investment decisions, the Australian Government established Infrastructure Australia (IA) to advise governments on nationally significant infrastructure. IA's advice will be based on rigorous analysis of the costs and benefits of various infrastructure proposals. IA will identify strategic investment priorities and policy and regulatory reforms to facilitate timely and coordinated delivery of infrastructure investments of national importance between all levels of government and industry.
>
> (Australian Government, 2008, p. 13)

Infrastructure Australia thus plays an important role in applying these criteria as advisor to the Australian Government on desired infrastructure investments that could fill gaps and reduce bottlenecks that hinder economic growth and prosperity. Box 3.1 sets out the four evaluation criteria that Infrastructure Australia applies when advising on transport, communications, energy, and water project proposals for funding from the Building Australia Fund.

Further, in Statement 4 of the 2008–2009 Budget Papers, the Australian Government outlined its perspective on efficient investment (Box 3.2). Emphasis was placed on the importance of rigorous CBA, use of social rates of return as a guide in decision-making, and the importance of relative rates above a minimum benchmark to prioritize the funding of projects. Efficient investment is clearly a fundamental prerequisite to enhancing community well-being, but as can be expected, it is a complex multifaceted concept.

Box 3.1 Building Australia evaluation criteria.

Evaluation criterion 1: Extent to which projects address national infrastructure priorities.

- Projects are assessed for their contribution to national productivity and growth, development of cities or regions, enhancement of international competitiveness, and/or climate change adaptation.

Evaluation criterion 2: Extent to which proposals are well justified with evidence and data.

- A cost-benefit analysis should demonstrate that the proposal represents good value for money. There should be long-term public benefits, taking into account economic, environmental, and social aspects.

Evaluation criterion 3: Extent of efficiency and co-investment.

- The project should deliver an effective and efficient response to addressing an identified infrastructure need, should take account of relevant market structures and pricing mechanisms and leverage private or State/Territory funding.

Evaluation criterion 4: Extent to which efficient planning and implementation has occurred.

- Project risks have been analyzed and planning approvals, land acquisition, and planning have been considered.

Source: *Nation-Building Funds Act 2008*. Schedule to Section 120 (1).

Box 3.2 Efficient investment.

The expected return on investment is generally relied upon to guide commercial investment decisions, with respect to how much to invest and in which areas. Expected social rates of return can be used as a major guide in decision-making with respect to public infrastructure projects, to help ensure that both the level and composition of public infrastructure investment are consistent with achieving maximum possible well-being. Only public infrastructure projects which at least meet a minimum benchmark social rate of return—determined through rigorous cost-benefit analysis, including ex-post evaluation and review—should be funded, and relative social rates of return above the minimum benchmark should be used to prioritize the funding of projects. While there are differences between the private and public components of the physical capital stock, there is a clear role for expected rates of return to drive investment decisions in both cases.

Source: Australian Government 2008, p. 5, 6.

Assessing the Benefits and Costs: Project Evaluation

As representatives of society's interests, governments are expected to undertake a detailed analysis of projects before deciding which ones to invest in. This section outlines the most common formal method applied in Australia to conduct public sector project evaluation, namely, CBA. While CBA has been used in various forms since the Great Depression, in its current form it draws on welfare economics principles, itself a subset of conventional neoclassical economics, and for its 'accounting' function it relies on Discounted Cash Flow methods as most commonly applied in private sector project evaluation. So, to place CBA in a richer context we first outline its simpler private sector relative, financial evaluation. The methodology employed to evaluate infrastructure projects depends essentially on whether the evaluation is being undertaken from the perspective of an individual private firm or from that of the society as a whole. It transpires that financial evaluation within a private sector environment is significantly less complex than conducting CBAs for public sector projects.

Financial Evaluation

For present purposes, we term a private sector enterprise's evaluation of a potential investment project 'financial evaluation', as this has become commonly understood to reflect a narrow evaluation of a project's feasibility reflecting only financial analysis without taking into account wider social and systemic impacts. Private corporations have long settled on Discounted Cash Flow methods, in particular the Net Present Value (NPV) rule, as primary financial decision-making methodology to select between competing projects. Following Pretorius and Ng (2010), the logic of financial evaluation simply formalizes economic accounting of costs and benefits to the enterprise of a proposed application of corporate capital (a project), discounted at the appropriate risk-adjusted discount rate for the corporation and the activity. The NPV rule is simple—for a project to be funded its (private) discounted inflows (benefits) must exceed (private) outflows (costs) to the company. Possibly the most critical difference between private and public sector project evaluation is that generally in the private sector the range of variables and prices required to conduct credible financial evaluation is confined to economic variables in the enterprise's immediate economic environment. This is determined by the enterprise's nature of business, and in established industries relatively good price information derived from markets is typically used at the time of project evaluation. Further, in practice, private sector financial analyses are typically conducted within relatively clear regulatory environments, with clear stakeholders/beneficiaries—the shareholders. Private sector enterprises take commercial risks and evaluate their project proposals within this relatively well-defined environment.

Over time, some of the externalities that impact on a community, such as pollution, which were not factored into an individual firm's evaluation private costs or benefits for reasons of incomplete markets, incomplete knowledge, or incomplete regulatory frameworks, are now being given financial or regulatory form. Examples of the former include charges for pollution, water charges that reflect the opportunity cost of water, and, prospectively, a broad-based charge to reflect the environmental impact of carbon emissions. Many firms increasingly assess separately additional social or environmental consequences of undertaking a project, to the extent that these could affect its long-term value—including the value of the enterprise's reputation as a good corporate citizen—the so-called 'triple bottom line'.

Cost-Benefit Analysis

Unlike financial evaluation, CBA attempts to give financial expression to all of the costs and benefits of a project to the community as a whole, including costs to and benefits for those who are indirectly affected by the project. The intuition underlying CBA is derived from welfare economics, and it purports to formalize economic accounting of (ideally, all) costs and benefits of a proposed project with public sector capital or interest, discounted at the appropriate discount rate (social cost of capital). In essence, the CBA decision rule is that for a project to be funded, benefits must exceed costs to society—similar in logic to the private sector financial evaluation rule that private benefits must exceed private costs for a company to fund a project, except the scope of evaluation is all of society, and not only that of private interests. As a consequence, CBAs are significantly more complex than private sector financial evaluations described above, despite both drawing on discounted cash flow methodology. Thus, CBA provides an assessment of the net social benefit (which may be negative) of a particular proposal. Two key concepts are social costs, that is, the opportunity cost where resources are priced at their value against their best alternative use which has been forgone, and social benefits, that is, the aggregation of the individual consumer's willingness to pay for the benefits generated by the project. Values for variables used in CBAs are not limited to the prices of those goods and services which are traded in the market, but can be expressed as shadow prices to reflect the broader societal values of externalities, and include values attributed to such benefits as reduced travel time, open space amenity, and noise abatement.

Australian Government policy is generally to commit to a rigorous analysis of all projects before they proceed, as part of a wider adherence to the principle of evidence-based policy. It uses as reference point for the conduct of CBAs the current *Handbook of Cost Benefit Analysis* (CofA, 2006), which is the latest in various guidelines to the logic and conduct of public sector project evaluation issued since the 1980s. As noted in the *Handbook*, CBA is the traditional form of ex ante evaluation of economic infrastructure investments such as dams, roads, and power stations, but the methodology has been used far more widely and also in evaluation of social infrastructure such as hospitals and schools. Most recently, the legislative instrument attached to the *Nation-Building Funds Act 2009* requires that 'Projects should demonstrate through a cost benefit analysis that the project represents good 'value for money'. This efficiency objective is frequently undermined by the very complexity of the nature of many public sector projects, and in particular urban infrastructure projects where direct and indirect costs and benefits are difficult to identify, and where secondary multipliers and leakages in large open urban economies are impossible to specify. For further context, we outline below a few principal shortcomings of CBA.

Limitations of Cost-Benefit Analysis

CBA suffers for its noble objective, namely, to incorporate as many project impacts as possible, both positive and negative, into the analysis of projects, so that a comprehensive picture of the project's expected efficiency can guide decision-making. However, it also is in the unenviable position that alternative methods are probably worse, and have as many disadvantages. For example, with respect to allocative efficiency in particular, it may be suggested that a particular project may generate the highest net social benefit from among the options evaluated, but it cannot indicate if the funds could not be better applied for other purposes in the broader economy. In effect, CBA gives a bounded ranking of allocative efficiency within a constrained set of options. As there is a reasonably strong commitment from Australian governments at all levels to CBA, it is thus reasonable to point out the strongest disadvantages of the method, irrespective of problems in identifying appropriate project sets. We count under strongest disadvantages incomplete markets, external effects, incomplete knowledge and unintended consequences, and equity in distribution of costs and benefits.

Incomplete markets refers to a problem with all analyses that attempt to quantify costs and benefits and ultimately reduce it to only one answer expressed in financial terms. The problem is that CBA evaluations need as inputs good price information for costs and benefits—the method depends on (at least reasonably) efficient price signals for credible analyses. Market economies are not perfect, and prices do not exist for everything. An additional problem, of course, is that many infrastructure investments are extremely complex bundles of goods, and a complex information-intensive facility, such as a new line on a mass transit system, or even more complex bundles of goods, or services such as 'a sustainable urban environment', are not 'purchased' in well-functioning markets with many buyers and sellers. In the public sector, complex goods may well also be equated with projects that have poorly developed, ambiguous, or contradictory functional objectives, and thus have poorly developed and incomplete associated information sets—and end in poor value for money when investment occurs. Disaggregating values for different attributes subsumed into one bundled good is possible through hedonic price analysis, but for robust results such methods require large cross-sectional and longitudinal datasets. Dealing with projects as single information-intensive bundled goods, or breaking down such projects into their smallest costs and benefits, invariably ends with similar problems—everything does not (yet) trade on a well-functioning market with an 'efficient' price. What is the price of clean air, or amenity? Very few critics of conventional market economics are able to argue credibly against the benefits that may be derived from good price signals in guiding society's allocation of resources. There is some relief to incomplete markets and prices through using shadow prices in CBAs, but the reality is that without credible benchmarks for the valuation of a cost or benefit there will always be doubt about decisions based on CBA outcomes. Critics have argued, with some evidence, that in hard public sector applications, such as medical studies, CBAs yield useful results because the studies are narrowly conceived and there is no or little interaction with environments (see Barron *et al.*, 1998). The irony is that such studies reflect exactly the circumstances that apply to private sector financial evaluation—a narrowly defined set of private costs and benefits, and not an extensive intervention in an open urban economy that a new motorway or tunnel may represent.

External effects, or externalities, is also a problem that is related to incomplete information and markets. It refers to unintended effects that may be generated by, say, a particular infrastructure investment (say pollution from a power station) for which the owner of the process does not have to compensate society (negative externalities), or, alternatively, there may be impacts that are beneficial to society that may result from an investment in an urban railway (such as increased property values) that do not accrue to the developer of an urban mass transit railway (positive externalities). To be sure, externality problems have been debated for decades (centuries, in the case of the commons). Short of presenting two sides of an inconclusive debate that is presently raging in Australia (and elsewhere), with serious negative externalities with no market prices, many economists believe that adjusting the offending costs upward through taxation provides the simplest and best public policy option to change incentives quickly, for example, as many argue with emissions control initiatives. Taxes can be a blunt instrument because they do not necessarily represent a good estimate of actual costs. But how does one arrive at a price for, or what could be the cost of, neighborhood degradation following the development of a motorway nearby? Who is to pay to whom and how? These are complex problems, and, similar to incomplete markets, if known external effects are not somehow accounted for in CBAs, analyses have diminished credibility and are political liabilities.

There are other subtle forms of externalities that influence infrastructure investment more directly and are difficult to evaluate in CBAs. In addition to the monopoly externality characteristics of much urban infrastructure, there are other circumstances where externalities are generated and government intervention is warranted. For example, in certain cases the market value of an infrastructure service could lead to under-provision of that service from the community's viewpoint—that is, to a private supplier it would not be sufficient to warrant undertaking a project. A familiar example of this is public transport, where benefits to society from patronage exceed the private benefit of travel—and thus the fare that the passenger is willing to pay the supplier. This includes the extent of the reduced road congestion and air pollution that is associated with the individual forgoing the use of a private car to undertake the journey. Equally, some market value transactions can lead to over-provision from the community's viewpoint. Again, an often-cited example is air, water, or solid waste pollution generated by the operation of infrastructure which, if not regulated or taxed, will represent a private nonvalued externality which, nonetheless, incurs a cost on the community. A related issue is that of the provision of public goods—essentially those that the market would fail to provide. The reasons for this market failure are usually that the consumption of goods and services is nonexcludable (such as the enjoyment of national parks) or the provision of goods and services is nonrival (such as the provision of national defense). The public good characteristics of some urban infrastructure are dealt with in later infrastructure-specific chapters.

It is possibly unfair to suggest that *incomplete knowledge and unintended consequences* is a limitation of CBA, it is a limitation of knowledge and not of method. While it may be argued narrowly that lack of prices and informational problems may be the result of incomplete markets, knowledge problems may be presented as incomplete understanding of the behavior of complex systems and thus the long-term price structure of project impacts in an overall sense. Incomplete knowledge manifests itself as incomplete comprehension of causality and systemic impacts which may result eventually, with hindsight, in poor infrastructure investment decisions.

At a practical level, for example, one age-old problem with incomplete knowledge is how to account for project risks and uncertainties which manifest themselves in construction, operational, financial, and a variety of other risks. Informed CBA analysts usually assess the impact of risk and uncertainty through a thorough series of sensitivity analyses and extensive simulation analyses which result in an expected distribution of estimates of costs and benefits, where often the discount rate itself is treated as variable. Where there is strong and different interests competing, there is strong incentive to manipulate or contest the information presented in a CBA. Here it is important to not only look at the substance of analyses and information that is used but also the process of generating it. The strategy is not to cope with contested information but negotiate on what the right or appropriate information for correct decision-making may be (De Bruijn and Leijten, 2008). Problems also occur when costs, benefits, and risks are evaluated by proponents of particular projects. Research by Flyvbjerg (Flyvbjerg *et al.*, 2003; Flyvbjerg, 2008) on major transport infrastructure projects in Europe have shown that governments have generally underestimated risk and costs and overestimated benefits. Flyvbjerg argues that risk should be explicitly identified and that CBA including the identification of risk should be subject to peer and stakeholder review.

It may be expected that as the scope of infrastructure projects increase, and the more their impacts become structural and systemic, the greater could be their unintended impacts, and the greater the problems with unknowns and incomplete markets. For example, it may be presently unwise to invest in large-scale, often functionally inflexible, irreversible infrastructure investments with long economic lives, as these arguably defeat the objectives of urban sustainability by fixing the structure of urban development for generations. Yet decisions to proceed with such investments may well be the outcome of CBAs with maximum efficiency objectives. 'Planning for flexibility' seems sensible, given the future climate uncertainty and limited flexibility offered to future generations by inflexible, irreversible investments. Sustainability objectives would be better served by decisions to allocate capital away from single large projects with maximum present efficiencies, possibly toward a number of reduced scale and scope projects with diverse functions, which collectively may function to increase urban flexibility as complexity unfolds (Pretorius & Ng, 2010). Again, it is extremely difficult for CBAs to estimate costs and benefits of large interventions in human systems as complex as large cities. It is possibly fair to say that many past human actions have taken place with incomplete knowledge of their eventual impacts, and this likely will continue. While knowledge is cumulative, it may be hoped that learning is too. This all suggests that as the scope of projects increases, the ability to identify and value impacts reduces, the scope for unintended consequences increases, and overall the less likely it is that a CBA could yield credible results.

The next limitation of CBA is concerned with *equitable distribution of costs and benefits*. A limitation of CBA is that it does not provide guidance as to which project option generates the most equitable outcome. The conclusion from an analysis of a project—that it is likely to produce a net social benefit—masks the fact that there is a distribution of costs and benefits across subsets of the community. Individual groups may have particular socioeconomic characteristics or locations, or there may be specific impacts on particular industries, with flow on effects for owners of capital and workers in those industries. Impacts on the poor are weighted the same as on the rich, whether it be at the individual or community level, whereas the two groups have very different marginal utilities of money. At best, a properly conducted CBA can provide transparency as to how the costs and benefits are distributed. It is possible to assign weights to the values of the costs or benefits and so target impacted groups, in more depressed regions, who have particular ethnic or other (often minority) statuses that lead to disadvantage. Such weightings, however, are also matters of judgment and lead to extensive debate. Where such weightings are not fully disclosed, or improperly understood by decision-makers, there can also be inappropriate outcomes. On balance, unweighted analysis, transparently revealed, is least likely to distort decisions, and creates a platform for an overlay of efficiency and equity considerations.

In a number of instances of reform, it may happen that disadvantaged groups are concentrated (such as a community close to a waste facility or port) and those who benefit are widely distributed (such as the regional population). The incremental value of the gain to each of the beneficiaries may be insufficient for the group to support such proposals, even though the net social benefit clearly justifies the reform. Such cases often generate significant protest to decision-makers because the concentrated loss for the smaller number could be significant. A full exposure of the distribution of costs and benefits can ensure that these reactions are anticipated ahead of the decision, the protests seen in a balanced light, and ameliorating policies put in place where general redistributive mechanisms such as taxation and social security are insufficient.

There are practical methods to assist in decisions about equitable distribution. Measurement of the specific impacts of proposals on groups, regions, and industries, and transparent results, enables decision-makers to consider the most efficient ways of achieving specific distributional policies. Some projects are specifically designed to improve equity, such as the upgrading of infrastructure services to a depressed part of an urban area. Equally, projects may generate unintended distributional consequences for particular groups or areas, and revelation and assessment of those impacts can help decision-makers ameliorate the consequences. There can also be income transfers between groups as a consequence of a change in the prices charged for service delivery (through the unwinding of prior cross-subsidizations, e.g.). Similarly, there can be changes in the distribution of employment and economic activity across an urban area as a result of, for example, investment in transport projects which result in changed ease of access, reduced congestion, or shorter journey times to one area relative to another (see Chapter 9).

There are two further serious problems with equitable distribution, both most evident in projects with long intended economic lives, such as infrastructure investments. The first problem manifests itself as a question of intergenerational equity in the distribution of costs and benefits of such long-lived projects. It has been argued that the equity of arrangements where a current generation (of taxpayers, say) invests in assets that may mostly benefit future generations is questionable. There is an opposing view which suggests that substantial current investment may be required to ensure that future generations may be sustained, which is considered to be equitable as it generates options for future generations (see Pearce *et al.*, 2003). Either way, as a method CBA cannot address the timing of impacts, it is likely that project planning could only address early project costs and benefits marginally. The second concern is a practical consequence of discounting mathematics, and this is that under current public or private sector project evaluation techniques and discount rate conventions (private costs of capital or social discount rates), it is unlikely that capital will be allocated to projects with expected lives exceeding one generation. Unless social rates of return are considered to be very close to zero (this is manifestly not so), benefits that may occur more than three decades into the future weigh very little in aggregate project present values. The question surrounding the intergenerational distribution of project impacts is a fundamental challenge to public policymaking and allocation of public sector capital when sustainability or sustainable development is an objective. This indicates that sometimes societies simply have to allocate capital to projects that may be considered investments in the future, without the ability to defend the distribution of costs and benefits that may be embedded in the project's economics. Unfortunately CBA is not a technique that could help directly with the choice of such investments.

A Case in Point: Questions about Project Evaluation in Practice

Overall, a limitation of CBA is that it does not provide an assurance that the highest ranking project is the most effective in achieving the outcomes that have been set by project sponsors, or, as indicated before, that the constrained set of projects being evaluated contains the best possible candidates. At one level, the results of CBA provide a ranking which enables the sponsor to then choose, from among the highest scoring, the particular project which is most likely to best achieve the intended outcomes. At a broader level, however, it may be possible that the intended outcomes are best achieved from an entirely different form of intervention. Best practice policy formulation would require, at the outset, that the widest possible range of solutions to a given problem be explored, including regulatory reform, taxes, transfers, and other interventions, in addition to proposals to construct or modify infrastructure (see Chapter 2 on the range of policy instruments available). At least CBA does provide transparency as to what options have been examined, but policy analysts have to ensure that the range of options, including those not requiring the construction of infrastructure, is adequately explored.

After this somewhat lengthy discourse about limitations of project evaluation generally and CBA in particular, it is useful to illustrate how mistakes in decision-making can actually be made despite the known benefits and limitations of CBA. In the process of bringing to fruition the recently conceived National Broadband Network, the Australian Government has relied on evidence from elsewhere, rather than undertaken a CBA of the project itself. The financial cost of the project is assessed by the government as being up to $43 billion. As a number of the submissions to the Senate Select Committee on the National Broadband Network attest, there are many supporters of the government's decision to invest in the network. They note that the benefits will extend beyond those traditionally ascribed to telecommunications to include tele-health, tele-education, intelligent utility networks, and regional development more broadly. But there are also critics. Two economists who raised concerns about the project, Henry Ergas and Alex Robson, prepared a critique of the project (Box 3.3), along with a similar critique of a Victorian rail link.

Their work, apart from dealing with specific issues relating to the two projects in question, demonstrates the more general point that CBA involves matters of judgment. This is reinforced by De Bruijn and Leijten (2008) who concur with Flyvbjerg *et al*. (2003) that there is rarely a simple truth in CBA.

> What is presented as reality by one set of experts is, in many cases, a social construct that can be deconstructed and reconstructed by other experts. (De Bruijn and Leijten, 2008, p. 84)

Overall, it can be concluded that when a sound CBA is conducted, despite the complexity of some of its methodology, it produces a reasonably robust basis for identifying whether a project is likely to provide a net social benefit

Box 3.3 Critique of the use of cost-benefit analysis.

In 2009, Henry Ergas and Alex Robson undertook detailed analyses of two significant infrastructure proposals, and critiqued the evaluations that had been undertaken for the government.

To assess the quality of project evaluation undertaken, the two economists examined the construction of a new National Broadband Network—and found that in present value terms, its costs exceed its benefits by somewhere between $14 billion and $20 billion, depending on the discount rate used. They concluded that it is inefficient to proceed with the project if its costs exceed $17 billion, even if the alternative is a world in which the representative consumer cannot obtain service in excess of 20 Mbps and even if demand for high speed service is rising relatively quickly. This amount of $17 billion is well below current estimates of the costs the NBN will involve, especially if the National Broadband Network (NBN) is to serve nonmetropolitan areas.

The economists also examined the cost-benefit assessment undertaken for the construction of a rail link in Victoria. They found that lower-cost alternatives to the project were not taken into account in the evaluation, in particular the option of increasing capacity through improved efficiency and better governance of the rail network. Even taking that exclusion on board, they found that the (available) appraisal that was approved by Infrastructure Australia was seriously flawed, including errors of double counting and manifestly incorrect estimates of project benefits. In their view, absent these errors, the project would generate benefits that fall well short of its costs.

Source: Ergas and Robson, 2009.

to the community, and whether that net benefit is likely to be greater than that produced by alternative project proposals. For major infrastructure investment, it is important that CBA be conducted on a number of alternative strategies at an early stage of decision-making, before being locked in to any one approach (Priemus, 2008). Inefficiency and waste associated with not considering alternatives early is demonstrated in the Victorian rail link case (Box 3.3).

Further Methodological Challenges: Multicriteria Analysis

To be sure, project analysts are aware of the potential problems with CBA, as well as the multiple ways in which results can be gamed and manipulated to indicate support for various points of view, and the more complex the project being evaluated, the easier it is to game CBA. It is unfortunately also a fact that there are not many substitute methods of analysis that have at least the technical coherence of CBAs, irrespective of how people select variables and their values. Other methods have developed, however, and we single out for mention multicriteria analysis (MCA). In essence, project proponents identify a set of aims (or impacts) to be achieved, across a range of relevant issues whether they are financial, social, and/or environmental. These aims may be prioritized and assigned weights accordingly. As many options as could realistically achieve the desired project objectives are then generated, and each project option is scored according to how effective it is in achieving each aim. The result is multiplied by the weighting each particular aim is given out of a total weighting of 100, according to its assessed importance from the perspective of the proponent. The overall procedure produces a weight-adjusted score for each project option. MCA can be used in combination with CBA, or on its own. The MCA process aims to inform decision-making by generating a recommendation after consideration of a wide range of quantitative and qualitative criteria in a structured analysis. An important contribution that MCA adds to project evaluations is that it allows some indication of the effectiveness of each proposal in achieving the (possibly limited) set of outcomes. This is a useful additional perspective when applied to proposals that have already been assessed through CBA as producing a significant net social benefit.

Unfortunately MCA is also prone to manipulation, particularly from those who design and execute the study. One concern is that the set of impacts chosen for analysis may be unduly limited, particularly if an infrastructure operator (water authority, road authority, etc.) is both the project proponent and evaluator. A proposal may rate highly on a very limited set of operational impacts, but may fail to take into account a wider range of social or environmental impacts. At the margin, this may result in one option being given preference over another, whereas a reverse result could arise through the selection of a different set of impacts. At a more fundamental level, the project may actually produce a series of adverse impacts on seemingly unrelated stakeholders, whether they are third-party groups, the environment, or the body of general taxpayers. In this respect an independently conducted, and transparently published, CBA is more likely to take all relevant issues into account.

Another potential source of bias is the process of allocating weightings to the importance of each of the impacts. The weightings are highly dependent on the perspective of the assessor. There may be a whole of society perspective if the weighting is the collective consensus of a whole of government process or the weightings may reflect the views of a particular infrastructure agency, for instance, or a number of like-oriented bodies. Dobes and Bennett have undertaken a critical appraisal of both CBA and MCA. They come to the view that:

> Although cost benefit analysis has a number of practical and methodological limitations, multi-criteria analysis is fundamentally flawed. The lack of a coherent analytical framework also makes it susceptible to misuse by analysts and special interest groups. (Dobes and Bennett, 2009, p. 25)

They note that attempts to reconcile the two methods have not proved successful and claim that ‘there is no indication that an acceptable synthesis is any more likely to be achieved in the future either'. Nevertheless, MCA has been used with some success in social infrastructure project evaluations, for example, with planning hospitals in Queensland, with much of the success ascribed to community participation in the structuring and evaluation of project aims and priorities.

How Should the Investment Be Financed?

The first section of this chapter addressed the question of 'What investment should be undertaken?' followed by a short discourse on project evaluation. This section moves on to the question of 'How should the investment be financed?' The comments made in this section first require some institutional and public finance context relevant to Australia. To commence, the Federal and State governments remain the key decision-makers in infrastructure, and even with private financing (as with public–private partnerships (PPPs) concession and pricing arrangements), the governing frameworks are jointly negotiated with mandated governments at various levels. Infrastructure financing directly reflects important aspects of Australia's federal constitution and institutional changes since the 1980s. The Australian Government is financed through taxation and federal borrowing, and is the only institution that is mandated to raise income tax. Federal funds are in turn distributed to States and Territories for various normal State government purposes including infrastructure investment. Certain infrastructure sectors are regulated at the Australian Government level, while others (PPPs in transport and water and electricity, e.g.) are regulated through concession agreements at State and local authority level. Postal and telecommunications services are federally regulated and controlled, although partly privatized, while the Australian Government also retains overall regulatory control over air transport infrastructure and services (although airports are also privatized under PPP-type arrangements). State governments deliver the remaining infrastructure including rail, roads, ports, gas, electricity, and water services, at present all partially privatized, with the private sector a significant participant in providing electricity services (Makin and Paul, 2007). The States are responsible for social infrastructure, including schools, hospitals, prisons, and libraries, and private sector participation delivery mechanisms are increasingly used to provide these services. In addition to States and local governments financing infrastructure development, the Australian Government further provides significant funds to States and local governments for the development of qualifying physical and social infrastructure projects under a federal tax-sharing arrangement, such as the 'AusLink' initiative for transportation infrastructure.

Since the adoption of the NCP in 1995, there has been a fundamental change in the delivery and financing of physical infrastructure in Australia in pursuit of efficiencies in the infrastructure sector. The NCP established a legislative regime at Federal and State levels to facilitate third-party access to the provision and operation of infrastructure facilities, including electricity and telecommunications networks, gas and water pipelines, railroad terminals and networks, airports, and ports. Following these reforms, few countries embarked on a larger scale initiative than Australia to privatize delivery and management of public infrastructure at all levels of government. While some 30 years ago most infrastructure projects were practically procured through public works programs and financed either at a State or Federal level through conventional public sector revenue and/or borrowing, in the 1990s large sections of public infrastructure were privatized, including airports, power stations, ports, rail freight, gas transmission and distribution, and the process continued in the 2000s. An important fact is that with respect to public sector finance, all Australian levels of government remain constrained to within total public sector borrowing limits controlled by the Australian Government through a public finance regulatory institution known as the Loan Council. At present, it may be concluded that from an institutional and regulatory perspective at all levels, it is possible for appropriate financing sources and mechanisms to be chosen for all infrastructure investments.[2]

Against this background, we return to the consideration of investment and financing of infrastructure and productivity matters. The issue of financing is a second and separate issue to that of whether the investment will produce a net benefit—whether financing is considered from a private or public perspective. This separation may not be immediately apparent from an examination of public infrastructure projects undertaken during most of the twentieth century. Such projects were often owned by government, constructed by government, and financed either by government budget appropriations or by government (or authority or utility) bonds. Despite historical precedence, for example, the Panama and Suez Canals and numerous toll roads, until late in the twentieth century many States' role in providing infrastructure, often without consideration of cost recovery, was still not challenged. Spectacularly successful infrastructure networks, such as the United States Interstate Highway system, were built by public bodies in many countries. Indeed, many compelling reasons remain for continued State provision of many infrastructure projects and sectors, including those that support essential services such as health and emergency services. Many other services that depend on capital-intensive infrastructure facilities where indirect and secondary economic benefits are poorly quantifiable, such as efficient mass transit railway systems, possibly will continue to be dependent on State financial support of some kind. In the last two decades, however, in a number of countries including Australia specifically, there has been a greater understanding of the need to treat the issue of financing in its own right. Much of this has grown not only out of cost recovery principles, and/or user pays or polluter pays logic, but more broadly from a deeper understanding that infrastructure is not free. Financing is also a separate issue to that of government funding, the latter

[2] We offer this comment despite recent poorly conceived and embarrassing electricity generation privatization initiatives in New South Wales.

being one form of intervention by governments to use its constrained funds to achieve chosen policies.

In addition to having the projects that benefit society most, it is also increasingly recognized by governments that gains can be made by selecting a form of financing that is appropriate to the project over its lifetime. The evaluation of financing options requires an assessment of four broad components:

- the benefits arising from the introduction of capital market and governance disciplines into the project from the financiers;
- the cost of funds sourced from the provider of capital—being the interest rate, the required return on equity, or the opportunity cost of investing in the next most profitable project;
- the risk-weighted value of any contingent liabilities that have been retained; and
- the transaction costs of negotiating the financing vehicle (including the cost of the time involved) and of managing that vehicle.

Subsequent chapters (Chapters 6 through 8) demonstrate with respect to individual infrastructure sectors that there is a range of forms of financing for urban infrastructure. Chapter 4 is focused specifically on the current use of PPPs and the transaction process. This current chapter will, accordingly, be limited to a brief overview of the various forms of financing and a demonstration of the benefits that can arise from efficient financing. A more complete treatment of this topic has been published by the Productivity Commission in its Staff Working Paper: *Public Infrastructure Financing—An International Perspective* (Chan *et al*., 2009).

Forms of Financing

A survey of international practice in the financing of public infrastructure by Chan *et al*. (2009) demonstrates the considerable variety of financing mechanisms currently utilized in financing infrastructure worldwide. In part, this is explained by the political and institutional histories of each country. Other reasons include prevailing fiscal and macroeconomic conditions and broader societal expectations about the role of government in the delivery of services. Within the broad ambit of infrastructure, the selection of a particular financing vehicle is also affected by such factors as the degree to which user charging is applicable, the lumpiness of investment, the potential for assets to be stranded, the extent to which the vehicle contributes to efficient risk management, and the transaction costs that the financing vehicle incurs. However, for all the complexity and variety of sources, even in public finance we may revert to the old corporate finance adage: there are only two sources of finance, debt and equity (of course, within a public finance perspective, 'equity' is a somewhat more complex concept than in the private sector). If governments finance and develop infrastructure projects without charging users or recipients of the benefits for the service, it may be expected that financing will be entirely public finance. If no user charges is a policy preference, it is of course unlikely that private finance could be attracted for such projects.

Stretching the corporate finance metaphor further, in a sense this represents for a society a pure equity investment for returns that may be other than financial (e.g., an investment in equitable redistribution of benefits, or a strategic infrastructure investment to facilitate regional economic integration). Such 'all public equity' infrastructure investments are typically financed directly through two mechanisms: direct budget funding drawn from tax revenues and debt (borrowing on the capital markets). If revenue could be generated by charging for services generated by the project and this is supported by policy preferences, this revenue stream over time endows the specific project with capital value, and it becomes a potential candidate for private sector participation—in banking industry terminology, it becomes a 'bankable' project because a revenue stream represents potential debt capacity. Technically this is not government debt, but if guaranteed by government it is a contingent liability that will enter into an assessment of government indebtedness, so guarantees are used very judiciously and are generally frowned upon.

Nevertheless, there is no reason at all why a project with debt capacity needs to be executed by the private sector with private sector equity only—the deep and liquid municipal bond market in the United States testifies to the fact that 'privatization at all costs' is not an essential condition for private sector financing of infrastructure projects. Many financially successful infrastructure project entities are public sector 'equity' and private capital market debt financed. We turn now to consider aspects of financing mechanisms, and offer further insights into direct public financing, public utility financing, PPPs, and developer charges.

If a project is *directly funded from a government's budget*, whether it is appropriated to be tax financed and/or public debt financed, it of course implies that the government is also responsible totally for its procurement. To the extent that it outsources planning and procurement, as is conventional with infrastructure projects, governments may retain and have to manage most risks, although some such as construction risk can be transferred through a contract with a construction agent, and operating risk can, in part, be transferred to a private operator (although governments inevitably hold a level of contingent liabilities, especially for essential services). In any event, all financing to develop whatever facility the service is associated with remains with the government.

Public utility financing represents a somewhat different circumstance, because these entities are usually corporatized, though wholly or partially government owned, and most often trade as regulated enterprises. These entities of course also finance the provision of urban infrastructure (for an example of this see Chapter 6 on the Water Corporation, Western Australia). For practical purposes, their financing follows conventional corporate finance principles. Finance is sourced either from retained earnings on their balance sheets (Statements of Assets and Liabilities) or from bonds. In the latter case, specific purpose bonds were phased out in Australia by the 1980s, and have been largely replaced by borrowings by central borrowing authorities. The high transaction costs and operational risks of bond-raising by individual enterprises was one significant reason for the change. Under the centralized model, bondholders no longer depend on the agency which controls the infrastructure to maintain the value of the asset or the ongoing revenue stream, unlike the typical arrangement with revenue-backed bonds in the US municipal bond market. As such, bondholders do not impose a direct capital market discipline on the performance of the infrastructure agency; instead the central borrowing authority will normally impose an interest rate premium on forwarded funds. This premium reflects the risk retained by government that the agency will not maintain its assets to the extent that it will be able to service and repay its debt. The enterprise monitoring unit in the Treasury or other central agency scrutinizes performance on behalf of government (i.e., shareholders—the public), and thus has substituted capital market scrutiny for the benefit of scale and a lower overall public sector cost of borrowing. Such internal and external governance regimes on government enterprises are exemplified, for example, by the New South Wales *State Owned Corporations Act 1989*.

Public–private partnerships are the subject of Chapter 4. It is sufficient to note here that they provide an opportunity to maximize private sector management skills, bundle the scope of activities (design, construction, operation, and financing), and bring forward delivery where fiscal policy would otherwise delay the project. There is considerable scope to align incentives to manage project risk with the capacity to do so (see Chapter 4), but poor negotiation and contracting practice by government agencies can result in the government retaining unnecessarily high contingent liabilities. The cost of raising funds from the capital markets can be higher than direct government financing, but arguably this represents a more accurate reflection of a project's risk, and consequently a good source of information for governments that are faced with strategic choices in allocating constrained capital. Transaction costs are usually high, and thus PPPs are more appropriate for large-scale projects.

In many respects, *developer contributions* toward infrastructure investments, for example, urban roads, represent nothing more than the public sector eventually testing prices for aspects of development rights it previously granted for free. Fiscal constraints on governments and a greater reliance on user charging has led to greater reliance on and acceptance by all of developer charges to finance urban infrastructure, because in effect the present value of providing the infrastructure clearly far outweighs the cost of not having it and proceeding with a development. The imposition of such charges usually relates to the provision of infrastructure that is directly related to the development. There are some concerns, though. The incentive for governments is to impose high capital standards with lower, ongoing operation and maintenance costs, while developer incentives are to minimize initial capital costs and to pass the costs on to the purchasers of the developed land. Transaction costs can be high, and the level of charge imposed can be quite variable between differing local authorities for similar scale and standards of infrastructure. A detailed discussion on developer charges is given in Chapter 5.

Capital Markets and Infrastructure Financing in Australia since the 1990s

It would seem an incomplete view of infrastructure finance in Australia since the reforms commenced in the 1980s, if there is no indication of the vigor with which capital market finance and private sector interests have participated in infrastructure financing. It is fair to say that infrastructure financing through the banking and capital markets sectors in Australia has developed into a world-leading financial market sector, comparable in innovation if not depth to the United States and the United Kingdom, while also succeeding in exporting many best practices internationally (such as the infrastructure funds management model). It was an integrated development, probably not explicitly planned, with government creating the correct environment through deregulation of infrastructure services delivery, capital markets innovation also spurred by NCP and Superannuation reforms of the mid-1990s, and the response of a sophisticated capital market ready and with a demand for new forms of investments. The development of private infrastructure development and financing thus coincided with a number of important changes in attitude to public sector management and public finances. All these initiatives were complimented by the Australian State Governments also committing to private sector participation in infrastructure investment following the dictates of the NCP. Each State developed a dedicated 'PPP-Unit', which functions both to market private sector investment/development opportunities and explain policy. Thus we have in Victoria: 'Partnerships Victoria'; New South Wales: 'Working with Government'; Queensland: 'State Development—Public/Private Partnerships'; Western Australia: 'Department of Treasury—Partnerships for Growth'; South Australia: 'Partnerships SA' (Dept. of Treasury); Tasmania: Department of Treasury; Australian Capital Territory: 'Government Procurement Board'; Northern Territory: 'Territory Partnerships'; and The Commonwealth: Department of Finance and Administration. It certainly signaled widespread adoption of private participation in infrastructure financing and development at all levels of the Australian Government, as the reforms of the 1980s and 1990s became reality.

As stated, large sections of public infrastructure had been privatized in the 1990s, including airports, power stations, ports, rail freight, gas transmission, and distribution. As an example, the urban motorway sector in the main urban areas of Sydney, Melbourne, and Brisbane is possibly the most developed Australian infrastructure sector for private financing. Major motorway expansion and development particularly in Sydney and Melbourne, and more recently in Brisbane, had been financed through private sector participation, mostly through the Build Operate Transfer (BOT) family of PPPs (Fitch Ratings, 2005). Interestingly, while debt finance for such road transportation projects elsewhere have been mostly financed with project finance-type syndicated loans, a large proportion of debt finance for the Australian road projects have been through infrastructure bonds. The Australian private sector toll roads are characterized by long-term concessions (usually between 30 and 40 years) centered on the major cities of Sydney and Melbourne (Fitch Ratings, 2005). Between 2002 and 2007 alone, the toll road sector raised over AUD 10 billion under various debt structures from the Australian domestic bank and bond markets (Fitch Ratings, 2005).

The conventional project finance model of private sector finance participation in infrastructure worldwide, including Australia, is differentiating with particularly permanent project financing slowly developing towards bond market instruments. A large proportion of road infrastructure financing occurred through the capital markets based on a rapidly developing infrastructure bond sector (such as with complex bundled securities that were first used in the Melbourne CityLink project (Chapter 4)) as well as a pioneering infrastructure funds management sector. Evidence of the sophistication and maturity of the main participants in the private infrastructure project investment/development sector and in particular the toll road sector, are that they are major listed companies, with several infrastructure bond issues outstanding. The main Australian toll road companies are the Transurban Group, and the Connect East Group. Transurban was originally formed and listed in 1996 as a single-purpose entity to construct, finance, and operate the Melbourne CityLink toll road concession (Fitch Ratings, 2005). ConnectEast is a single-purpose entity which was established in 2004 to finance, design, construct, maintain, and operate the EastLink toll road project in Melbourne (Fitch Ratings, 2005). To some extent, the growth and development of these entities were strongly influenced by the superannuation reforms, which generated massive demand for investment opportunities that privatization initiatives helped supply through capital markets participation.

However, the most significant capital markets innovation facilitated by these reforms is probably the development of the Macquarie Infrastructure Group (MIG), a unit of the Macquarie Investment Bank. MIG is an Australian listed toll road investment fund which owns a global portfolio of toll road interests, but MIG has over the last decade established several infrastructure funds in various countries and regions, including listed units in Europe, Korea, and Singapore, and despite the recent Global Financial Crisis (GFC), has grown into possibly *the* world-leading infrastructure finance and management entity. Another highly active corporation in Australian urban roads is Cheung Kong Infrastructure (CKI). In Australia, CKI has other major investments in regulated utility assets (CitiPower, Powercor, ETSA Utilities, and Envestra). CKI divested its interests in the Cross City Tunnel and Lane Cove Tunnel in Sydney prior to these entities entering administration.

Overall, while a major international shock to financial systems everywhere, the recent GFC did not appear to cause any fundamental change to the infrastructure finance sector in Australia. Along with other countries, many Australian funds management activities, including infrastructure funds, started the necessary de-leveraging process, including infrastructure funds management pioneers like MIG. It is unlikely that the GFC will cause a structural change in the Australian capital markets participation in infrastructure financing, although some doubts have been raised about the ability of the capital markets to fund future investment requirements. A recent research paper by Infrastructure Partnerships Australia in 2009, however, did explore the consequences of possible capital shortages, as appeared to emerge in the 2008–2009 GFC (IPA, 2009). The paper examined the credit rationing that followed the onset of the financial crises and looked in particular at the impacts in Australia, France, the United Kingdom, and the United States. It noted that the crisis severely constrained the capacity of the private sector to secure the debt needed to deliver large infrastructure projects. The crisis also presented a significant refinancing risk for projects. Should there be infrastructure investment capital shortages in Australia, concerns were expressed about the physical capacity constraints on existing infrastructure which, if not addressed, would significantly limit economic activity and productivity growth. Accordingly, the industry proposed a range of temporary measures for government intervention in the financing market. This ranged from government being a co-lender to providing a mix of grants and debt guarantees. An issue with government being a debt guarantor is that it may relax pressure by lenders on project performance (World Bank, 1994; Flyvbjerg, 2003).

Conclusions

This chapter explored the issues of productivity and infrastructure investment and financing as they apply to urban infrastructure. Productivity is seen to comprise a complex interplay of efficiency, effectiveness, and equity concerns, and is by no means a simple objective in a nation's political economy. However, structural reforms in the 1980s and 1990s seemed to have set in motion a chain of economic changes that has resulted in a much more productive, efficient, and effective economy, including its infrastructure sector, while equity remains a leading objective of governments at all levels. Infrastructure project evaluation remains a problematic area, not least because methodological problems remain a cause for concern. Despite its disadvantages and the ease with which its suggested outcomes could be manipulated by vested interests, CBA remains the most appropriate form of project analysis, but neither it nor newer methods such as MCA is able to overcome poorly structured and/or opaque project analyses. The most cost-effective means of financing urban infrastructure projects is a separate decision, and there are a variety of financing approaches, each suited to particular types of projects, fiscal circumstances, and broader policy contexts. Overall, Australian financial markets have responded in a most impressive manner to the infrastructure financing challenges set in motion by the reforms.

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4

Private–Public Partnerships: Transaction Analysis and the Case of Urban Motorways

Frederik Pretorius, Sophie Sturup, and Andrew McDougall

Introduction

Over the last two decades, there has been a fundamental change in the delivery and financing of urban infrastructure in Australia. This has been in addition to the attempts to utilize the existing stock of urban infrastructure better in pursuit of greater flexibility and efficiency, and a perceived expanded role of the private sector in this objective, as outlined in Chapter 3. Both with respect to managing existing infrastructure and investment in new infrastructure, the form these changes to delivery and finance have taken has been similar to initiatives in other countries. Governance mechanisms have been established such that governments at all levels can benefit from various efficient private sector practices and draw on private sector capital. These developments opened the way for extensive private sector participation in economic infrastructure investment and financing, including electricity and telecommunications networks, gas and water pipelines and networks, railroad terminals and networks, airports, and ports. However, in Australia, there have been few sectors which have experimented as boldly with private sector participation in the delivery, financing, and management of public infrastructure as the metropolitan motorway sector. Indeed, the delivery, financing, and management of urban motorways, particularly in Melbourne and Sydney, have generated path-breaking public-private partnership (PPP) mechanisms to govern the development, financing, and management of urban road infrastructure.

It is a fact that a large proportion of the innovation in the urban motorway sector derived from the participation of the private sector. Such participation was made possible through an improved ability to access Australia's capital

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

markets, following deregulation in the 1980s and the extensive demand for investment portfolio assets generated by the superannuation reforms of the mid-1990s. Participation by Australia's highly developed banking sector and capital markets made the private financing of PPP arrangements in urban motorways possible. Such participation was made necessary because of the unprecedented scale of investment required to bring the seriously underinvested motorway system to the level required. But this was facilitated through a possibly greater innovation, namely, the institutional structures that made possible private sector involvement in design, delivery, and postconstruction management of extremely complex urban motorways through build-own-operate-transfer (BOOT) mechanisms. An analysis of metropolitan motorway development using BOOT structures since the early 1990s has shown Australian examples as somewhat of an international standard. It provides one of the best sectors worldwide to identify and categorize the nature and complexity of issues that underlie the economic logic of PPPs and BOOTs in infrastructure.

The overall aim of this chapter is to present a framework which may be used to identify and clarify the issues that arise when private sector delivery and financing of a public infrastructure facility or service is considered. An analytical framework of this kind will reflect the relevance, nature, and division of the rights that are embodied in privatization transactions. It will be flexible enough to be applied to compare different forms of privatization transactions, and to review proposed transactions. In order to make the chapter practical, we develop the framework here for a particular application, namely, a BOOT structure. BOOTs are a particularly complex form of the PPP transaction that has come to be somewhat of a standard for the delivery, finance, and management of new urban tolled road facilities.

Following economic logic, successful implementation of PPPs relies on the clear division and allocation of rights, risks, and management of incentive conflicts between the public and private sector participants. This particular observation helps to structure our chapter. First, we suggest that the various privatization arrangements that have evolved could be viewed as a continuum, in order to identify where the BOOT example we chose for analysis is located on the continuum. Then, drawing on institutional and transaction economics concepts, we present our framework which is designed to assist in the analysis of the division and allocation of rights, and to identify incentive conflicts in PPPs. We then use the framework to analyze the Melbourne CityLink, a first-generation modern era motorway PPP which followed the BOOT model. We identify and discuss particular mechanisms put in place in CityLink to manage incentive conflicts and align interests. In concluding, we relax the somewhat strict transaction cost/institutional approach and offer more subjective observations concerning the general success of PPPs and the Melbourne CityLink project. Overall, and notwithstanding debate about whether PPPs represent 'true partnerships' or not (see, e.g., Wettenhall, 2007), we follow a property rights perspective of PPP agreements and conclude that without defensible rights, strong institutions, and credible commitment on all sides, PPP transactions are bound to fail.

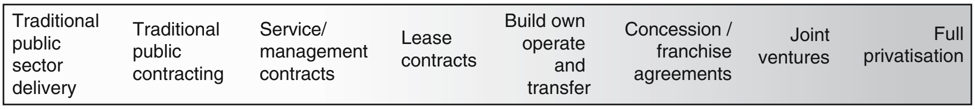

Figure 4.1 A private–public partnership continuum.

A Private–Public Sector Participation Continuum

PPPs for infrastructure provision and management feature prominently in a range of privatization activities being undertaken by Australian Federal and State governments. Because of the diversity of privatization, or private sector participation, and the diversity of privatization activities within single transactions, a clear definition or categorization of all cases is difficult. However, there is one common factor which does allow us to draw the diversity together. In all respects, privatization transactions are concerned with the division of rights and responsibilities for the delivery of defined services between public and private sector agents. Associated with this division are mechanisms to allocate rewards associated with the risks inherent in the allocation of rights, and mechanisms to govern parties' behavior during the transaction. In this respect, privatization may be viewed as a continuum of transaction forms proceeding from the public sector delivery through public contracting ('outsourcing'); service/management contracts; lease contracts; Build Own Operate Transfer (BOOT), Build Operate Transfer (BOT), and Build Own Operate (BOO) schemes; and concession or franchise contracts; to joint ventures (mixed capital partnerships); and then to full privatization (see Figure 4.1). Each of these forms are expected to generate conflicts resulting from the division of rights particular to that transaction form, and particular transaction governance mechanisms to manage incentive conflicts.

This chapter considers in more detail a PPP transaction in the middle of this range, namely, an urban motorway BOOT. Depending on which definitions are used, at a broad level BOOT refers to the public sector transacting to purchase from the private sector some road infrastructure facility (still to be constructed) in exchange for revenues generated from user charges. The private sector typically finances the road's construction and operates the facility for a period long enough to collect the transacted revenues. Any of the activities in this transaction could potentially form the subject of private sector participation in separate transactions, or all activities may be contained in one transaction (as with the Melbourne CityLink described below). For present purposes, a flexible definition of a BOOT-form of a PPP may simply be:

> PPPs are agreements between public and private sector entities for the provision, operation and financing of public infrastructure. (Chan *et al.*, 2009, p. xiii)

This definition may practically be expanded to explain the concepts. *Provision and financing* is by the private sector, and rights to *possession and* *operation* are assigned to the private sector in exchange for a share of operating returns, for a specified concession period. Possession and operation of the infrastructure facility itself reverts fully to the public at the end of the period of this concession. Governments thus facilitate private sector investment in infrastructure assets by assigning property rights to the facility itself and contractual rights to income from selling services generated by operating the facility. This is typically for long enough terms under regulatory, operational, and pricing conditions favorable enough to ensure a feasible private sector infrastructure project.

An important difference between typical PPP transactions and economics textbook 'market transactions' is that they are typically for the procurement and operation of a complex, nonstandard, capital-intensive, physical infrastructure facility, and not a standardized, mass-produced product. The focus of public attention is drawn to the infrastructure facility because of its capital intensity and public good nature, and the fact that public resources are expected to form some of the inputs into delivering it. Public attention is equally drawn to the process adopted for the transaction because complexity is a potential source of transaction inefficiency—and cost. The performance of these transactions is thus keenly scrutinized. Ideally, scrutiny is expected to encompass at least three concerns: performance against overall public objectives; performance against functional objectives of the infrastructure facility itself; and the performance of the process and institutional mechanisms that were adopted to deliver, operate, and finance the facility. In Australia, an attempt to evaluate project performance against overall public objectives and functional objectives has been made by the Fitzgerald Review of a number of Victorian State PPPs (2004). This type of review is not central to the focus of this chapter. Alternatively, strict interpretation of the performance of PPP participation by private sector interests is by actual return earned on private capital invested over the development and operational terms of the PPP projects. We also do not address the performance of private interests in PPPs. Instead, this chapter focuses on an appropriate framework to evaluate the performance of the process and institutional mechanisms that were adopted to deliver, operate, and finance the PPP.

A General Framework for Analyzing Private–Public Partnerships in Infrastructure

Conceptualizing PPPs

Present PPP arrangements which govern many private sector activities in infrastructure all reflect attempts by public and private sector entities to craft efficient transactions to provide public infrastructure in highly complex circumstances. In this respect, an 'efficient transaction' may be one that creates an agreement that delivers the functional objectives (social, environmental, economic) of the completed facility, while economizing on the costs associated with the transaction process. Such a process includes the search for and screening of counterparties, the process of crafting the transaction

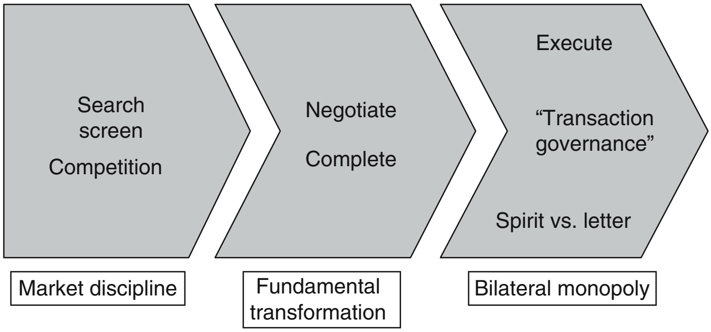

Figure 4.2 Typical complex nonstandard transaction process. (Following Pretorius *et al.*, 2008.)

(the contractual agreement), and the execution of the transaction (governing delivery of the facility and governing ongoing obligations over a period of time). These three stages of the process are sequential, as illustrated in the three large block arrows in Figure 4.2. The sequence is essential to facilitate competition in BOOT transactions through precontract bidding. It also carries within it the seeds of potential failure through a phenomenon known as 'the fundamental transformation', as will be explained below. Managing the risks and problems generated by the sequential nature of the typical BOOT transaction process is thus fundamental to achieving efficiency in such transactions. Our view is that *transaction completeness* of any particular PPP agreement is key to successful delivery, operation, and return of any facility so provided, and provides insight into what may be considered an efficient transaction. In our context, transaction completeness is taken to mean that the integrated structure of the PPP agreement significantly facilitates the management of incentive conflicts, as well as alignment of interests between parties. Naturally, this is an imprecise measure, and we recognize that operationalizing it would likely require subjectivity.

Which elements may then be considered key to efficiency in structuring a typical PPP agreement? We suggest that at least three elements are critical to inform the structuring of any PPP transaction. They are (1) the nature of rights to any assets and services generated by the assets that form the subject of the transaction, (2) the nature of incentive conflicts generated by the transaction process and by the division of residual returns and residual rights between the public and private sector, and (3) the arrangements set in place to manage the transaction over its term, which we may term 'transaction governance'. The completeness of a transaction may be viewed as the success with which it manages these elements—it could only be fully assessable upon completion of the term of the transaction, but we will in any event explore the Melbourne CityLink BOOT using the framework.

In order to facilitate a compact description of the three key elements, we present diagrammatically in Figure 4.3 a summary of concepts that are seen to influence each element. The top part of Figure 4.3 presents detail of the first two stages of the transaction process illustrated in Figure 4.2, while the bottom part represents governance of the operational part of the transaction (i.e., the project in operation). This section refers only to the top part of the diagram, while the bottom part will be considered under Transaction Governance and the Melbourne City Link Build-Own-Operate-Transfer Project below. The heavily framed and bracketed box (the 'transaction box') represents the content of the BOOT agreement itself—*what* has been agreed. This includes the construction of a facility; its possession and operation, and regulation, for an agreed term; mechanisms to manage parties' actions during the term; and all conditions and regulations surrounding transfer of the facility upon completion of the term. The transaction box covers what may typically be included in a 'concession agreement'. The concepts outside the transaction box may be viewed as the transaction environment, that is, the social, economic, and behavioral factors that influence any and all PPP transactions.

The Nature of Property Rights and Their Allocation in PPPs

To elaborate further on the concepts framed by the top part of Figure 4.3, we consider first the distribution of rights to possession and ownership of the completed facility (the 'own, operate stage' column). The nature and allocation of rights associated with infrastructure assets are fundamental to the structuring of PPP transactions. Two sets of rights are central to understanding even the most complex PPP arrangements. They are rights of ownership over the facility itself, and rights that govern access to the services generated by the asset.

- Firstly, rights to ownership of the infrastructure facility may be viewed as located between two extremes (private sector or public sector, or a combination). Within a general corporate and public finance perspective, this reflects ownership rights—that is, *residual rights*, for example, as represented by equity investment. The rights to the residual value of the facility thus matters, both during operation and upon transfer.
- Secondly, how user rights to access the services generated by the facility are distributed between the public and the private sector, and how pricing of the services are regulated, also may be presented as located between two extremes: at one extreme, access may be controlled by market forces and the price mechanism only, between the extremes it may be regulated by constrained access and/or price control or cost recovery principles, and at the other extreme access may be free. Where access to infrastructure services is determined by user charges, the income so generated, net of operational and reinvestment expenses, forms the residual income generated by the asset—that is, *residual returns*. The division of rights to residual returns thus matters over the operational period prior to transfer.

In an uncomplicated private sector commercial environment, a company with no debt that owns capital assets controls all the residual rights and residual returns. When both sets of rights are controlled by a single entity, very little complication exists and is largely confined to internal conflicts

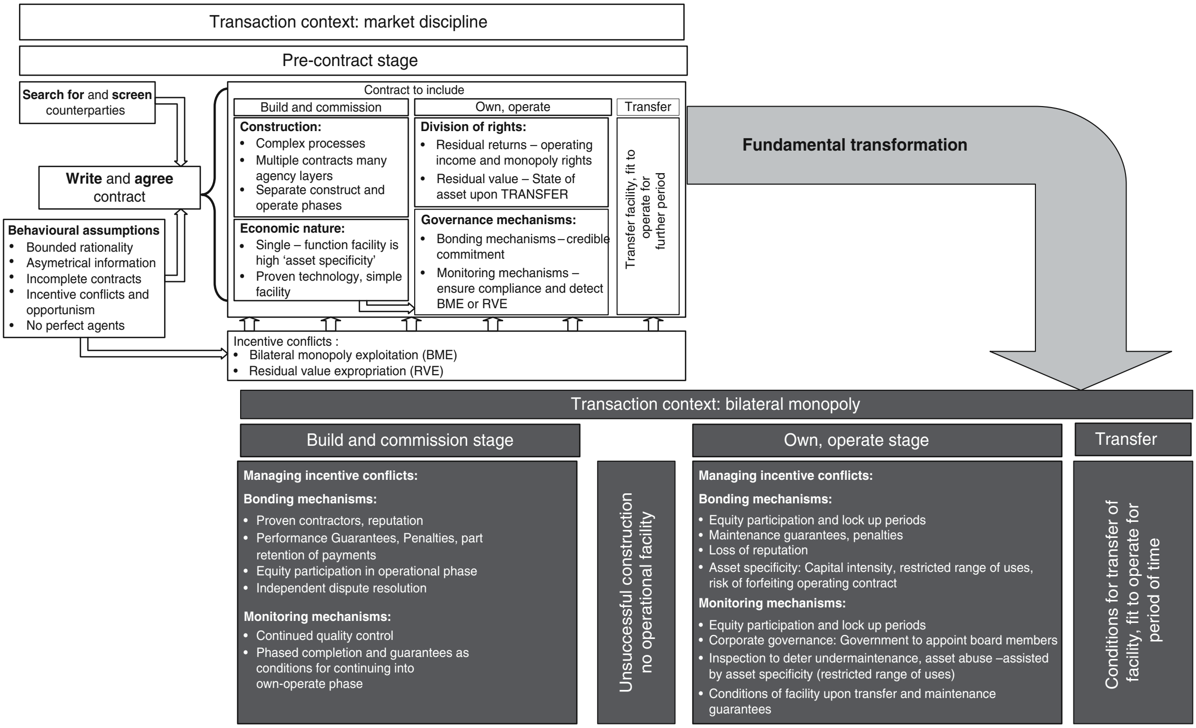

Figure 4.3 The PPP transaction context.

such as disagreement over payment of dividends to shareholders versus reinvestment in the business. However, with PPPs multiple parties either control or have interests in either residual rights and/or residual returns, and the share of control of both changes over the life of the contract. This creates a highly complex transaction environment. The allocation of residual rights and residual returns from infrastructure facilities directly influences how PPPs may be provided and financed.

Following this analysis, the property rights logic of a PPP agreement such as Melbourne CityLink may be explained as follows. The owner of the right to build and manage an infrastructure asset (e.g., a public sector roads authority) grants the exclusive right to a future Operator to build the asset, and to possess and control use of it for an agreed term. Technically, the residual rights (i.e., ownership) remain with the roads authority, even though the Operator has possession and control for the BOOT term (hence 'OWN' in BOOT). Conceptually, the Operator is never more than the government's agent, albeit for a very long term, as the asset has to be returned at the end of the contracted 'own/operate' period. The PPP transaction also allocates the right to residual returns generated by the asset from the owner to the Operator for an agreed term and under defined conditions. Thus, *residual returns are separated* from *residual rights* to ownership of the asset. The control over residual returns and the scale and duration of residual returns generated by any PPP is of critical importance for two reasons:

- Firstly, this revenue stream over time endows the PPP with capital value (the capital value of the residual rights); and
- Secondly, it provides the PPP with debt capacity—in banking industry terminology, it becomes a 'bankable' project.

Both factors are a direct function of the concession agreement that controls ownership and access to the services generated by the asset, and their pricing. A project entity's capital value and debt capacity (i.e., how much the banking sector or debt markets considers it could feasibly borrow) will be influenced by variables controlled by concession agreements: how long the project is expected to generate services and revenue, the nature of price regulation for the services, the structure of the debt contract, interest rates, and more. If the capital value of the PPP is less than it will cost to construct and operate (i.e., a negative Net Present Value (NPV) project), given the cost of capital considerations, the proposal is of course unlikely to attract private sector interest in the first instance.

Incentive Conflicts and PPPs

We now turn to consideration of the second key element of PPP agreements, the nature of incentive conflicts generated by the division of residual returns and residual rights. It does not require much imagination to observe that the hypothetical PPP transaction described above bears strong resemblance to a long-term operating lease, with some characteristics comparable to those commonly found in retail leases with revenue sharing ('turnover' leases). When the division of rights within BOOTs is viewed as similar to long-term operating leases, we can see that the explicit separation of ownership of an urban motorway, from its possession and operation, generates incentive conflicts between the roads authority and the Operator within a principal–agent framework. The motorway is assigned to the Operator, but after the PPP term is completed residual rights revert to the roads authority, while the Operator has the right to earn residual returns during the term as regulated by the concession. In this framework, the Operator functions as the road authority's *agent*, because it is the Operator's obligation to care for and maintain the road and to transfer it in an agreed state of repair at the end of the concession term. The incentive conflicts generated by the agency nature of this arrangement are fundamental to the economic and financial nature of PPP transactions. Two incentive conflicts between counterparties are identified, namely, *bilateral monopoly exploitation* and *residual value expropriation* (see Pretorius *et al.*, 2003).

Before considering the nature of the incentive conflicts, we have to identify the general behavioral assumptions that are seen to cause incentive conflicts in complex transactions. The first concern in analyzing incentive conflicts and agency problems in PPPs (and other supporting contracts within PPPs) has to do with the expected behavior of counterparties during the transacting process—first in representations made during the bidding stage ('search and screen'), then in writing and agreeing the transaction, and then also in executing the agreement over its term. Economic assumptions are notoriously devoid of sentiment, and in this respect we follow convention with the standard behavioral assumptions associated with transaction cost economics, summarized in the 'behavioral assumptions' concept box in the top part of Figure 4.3. The causal arrow indicates that behavioral assumptions influence incentive conflicts, which influences governance mechanisms. The first behavioral assumption concerns information, and is simply that there *will* be *incomplete or imperfect information* about the asset and transaction itself (see also bounded rationality immediately following). Information about the counterparties *will not* be evenly or even fairly distributed (*asymmetrical information*). This is because it may not always be in a party's best interest to divulge all relevant information in transacting, particularly not in the bidding phase of BOOTs. Further behavioral assumptions are *bounded rationality* (people do not know everything, and are not capable of always doing the right thing), *incomplete contracts* (it is impossible to draft a perfect contract, given the information concerns mentioned above), and *opportunism* (despite the spirit of the contract, a counterparty is *expected* to take opportunities to benefit from loopholes if technically possible—this is important in the asymmetrical information assumption because previous behavior and reputation is important information precontract).

There is at least one important additional observation that is concerned with the *self-interested behavior* of the parties to a contract which involves agency relationships, as BOOTs do. When acting on their own behalf, we assume parties to a contract act in their own best interest when concluding the transaction, and thus that the tensions that emerge in executing transactions over their term occur only between the incentives and motivations of *principals*. When one party acts as agent for another, however, matters become far more complex and a further level of incentive conflicts is introduced. If both the principal and agent are self-interested, it is commonly accepted that the agent may not always act in the best interests of the principal, but will favor its own interests instead (the assumption here is that *there is no perfect agent*). In typical BOOTs, the concessionaire is the government's agent first in the design and construction of the facility, and thereafter is also an agent as the Operator of the facility for the concession term. As the number of transaction layers increases, the complexity and magnitude of incentive conflicts associated with the transaction could be expected to increase as well.[1] It is clearly unreasonable to expect such transactions to be inexpensive or without problems.

It is now possible to return to the 'incentive conflicts' concept box in Figure 4.3, to consider the terms *residual value expropriation* and *bilateral monopoly exploitation* and explain their central role in the structuring and governance of PPPs. In a typical toll road BOOT, the Operator will take possession after successful completion of construction of all facilities, which represent its initial capital investment (recall the Operator also may have been the constructor). In exchange, it obtains the rights to any residual returns (over expenses and reinvestment) generated from toll revenue earned over the concession term. The road authority possibly shares in *residual returns* beyond an agreed level, but anyway receives the public benefit of a well-functioning road (which could also be expressed in financial terms). The government receives this benefit in return for temporarily assigning the rights to the road's *residual income*, while retaining *residual rights* (eventual ownership) and consequently the road's *residual value* upon maturity of the PPP's term. The party who decides how the road is managed during the term—the Operator—has control over it for the PPP period, but is not the residual value claimant. As an agent, it is directly responsible for its actions during its period of control only to the extent that the effect of its decisions on changes in the road's residual value *can be detected*. If the Operator is able to minimize the cost of operating (and maintaining) the road over the PPP term, it maximizes the residual income over which it has at least partial rights for the term of the lease. The Operator therefore has an incentive to economize on operating and maintenance costs during the term of the PPP, ideally to that level where the residual income is maximized over the full period of the term, given that the quality of services generated by the road are likely to diminish with under-maintenance, and may also be detected. Such actions reduce the potential flow of services from the facility to be transferred at the end of the term. Operating company decisions that adversely affect the residual value of the asset but go undetected (such as under-maintenance) are characterized as actions leading to *residual value expropriation*.

[1] On large complex construction projects, it is not uncommon to have as many as 30–40 subcontractors at a time—all agents. It is unrealistic to expect no conflicts or disputes.

The next main incentive conflict we have to outline is *bilateral monopoly exploitation*. This conflict is caused by a critical concept known as *bilateral dependency*, which is possible with any transaction where ongoing obligations are agreed—for example, where a road Operator in a BOOT has to maintain the road to specified standards over the term. The Operator may have been appointed under rigorous and competitive circumstances, but this does not necessarily mean that the benefits of competition or favorable pricing that may have been achieved during bidding and concluding the transaction are carried through into the operational phase of the transaction. After concluding the transaction, a 'fundamental transformation' occurs whereby the discipline and benefits of competition no longer exist—the counterparties have entered the phase of the transaction characterized as bilateral dependency, or bilateral monopoly, where they have contracted to deal with each other exclusively (following Williamson, 1985). It reflects a closed, exclusive postcontract condition between two parties where ongoing obligations exist. The road Operator may have contracted to maintain an agreed level of user access to the road, but will it honor the commitment according to the rules that will govern the ongoing phase of the transaction? Given the behavioral assumptions outlined above, exclusive dealings over a period invite opportunistic and self-interested behavior. Among other things, the road authority's expectation about the Operator's future behavior depends critically on existing information about it. This information includes the government's previous experience with the Operator, the Operator's general reputation, and so on.

All these types of information provide scope for hidden information, misrepresentation, and opportunism. With transactions that require both parties to perform ongoing obligations, there exists the risk that either counterparty could exploit the bilateral monopoly condition. In PPPs where the transaction also requires the infrastructure facility to be designed and constructed, such as in BOOT transactions, the problems associated with the fundamental transformation are particularly acute. The problems and contractual disputes experienced in complex construction projects are legendary, and one explanation (simplistic, admittedly) may be that contractors routinely exploit opportunistically the postcontract bilateral monopoly condition presented by the construction phase. Figure 4.3 places the 'fundamental transformation' at the right hand extreme of the top part, indicating that after the transaction details are agreed, and the agreement is concluded, the benefits of market discipline no longer exist—at best, counterparty behavior postcontract is expected to be according to what precontract information suggested.

Fortunately, parties to complex transactions such as PPPs have learned from a wealth of experience. Experienced counterparties are fully aware that all incentive conflicts introduce risks, and that unidentified incentive conflicts represent risks that may not be managed after the fundamental transformation. In agency relationships, principals will put in place mechanisms to manage agent behavior during postcontract execution as an integral part of transaction governance. Established mechanisms to manage the risks associated with incentive conflicts in transactions fall into two simple categories, *bonding mechanisms* and *monitoring mechanisms* (summarized in the 'governance mechanisms' concept box within the transaction box in Figure 4.3). The economic nature of each different type of transaction requires mechanisms appropriate to the transaction within each category, but experience with typical transactions over capital goods (leasing, BOOT, franchising) have resulted in the development and refinement of mechanisms over many transactions. This two-category simplicity belies completely the complexity these mechanisms may have to address, or the difficulties that may be experienced in execution, or indeed that executing these mechanisms effectively in transactions depends on the nature of the asset.[2] These measures are expected to be costly, and their cost and potential lack of effectiveness in managing incentive conflicts increase with complexity and number of transacting parties, and with the complexity of the asset itself. Unfortunately, trust does not feature prominently in this framework.

We may illustrate the nature of *bonding mechanisms* in a toll road BOOT transaction by answering the following questions: How can the roads authority make sure that the road that is being constructed conforms to that designed and agreed to? How can the roads authority ensure that the Operator acts in its best interests with respect to managing the road, namely, by not expropriating its residual value? The typical answer in most agreements with ongoing obligations over a term is to require counterparties to signal a *credible commitment* to the transaction, usually in the form of some financial consideration which is at risk in the event of Operator default or opportunism. Bonding counterparty performance can take an endless variety of forms, but is always intended to inflict a financial loss to the nonperforming or opportunistic counterparty. This 'bond' could be moneys retained in a construction contract pending successful completion—anything of value, such as a 'deposit' in lease agreements, performance guarantees from a third party in a BOOT agreement, or it may simply be based on reputation. The nature of bonding is that the agent risks a significant financial loss in the event of opportunism or some other preventable occurrence that results in a loss to the counterparty (such as nonperformance of obligations). An important form of bonding is through risking reputation ('my word is my bond'). Loss of reputation can be extremely costly in modern commercial activities, and immediate gain is expected to be at the expense of future loss.

The potential loss of residual value provides a point of departure for an explanation of *monitoring mechanisms*. Recall we stated that decisions by the road Operator that adversely affect its residual value and go undetected, for example, under-maintenance, are acts that expropriate residual value from the roads authority (the ultimate owner). How can the roads authority minimize loss of residual value during the term of the PPP agreement? Monitoring mechanisms aim to prevent such losses by detecting

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[2] There is an important additional information cost in agency relationships, which concerns the costs of uncovering the nature of incentive conflicts inherent in the type of transaction that the agent has been appointed to conduct—and of course the cost will be higher with new transaction forms before the economics of learning and experience function to improve the transaction form.

expropriation early, in order to institute remedial action as agreed under *governance mechanisms*. The typical answer in most agreements with ongoing obligations over a term is to require counterparties to inspect the facility for evidence of neglect or under-maintenance. In this respect, the nature and complexity of the PPP asset, its 'economic nature', matters greatly, because it influences directly what could be practically achieved in constructing the facility and the cost of monitoring the state of the facility when completed. While evidence of under-maintenance may be relatively easy for technical experts to detect in an existing urban motorway, or the technical (in)competence of a contractor may be detected early in a construction contract, it is not always easy to detect under-performance in more complex transactions.[3] Complex capital assets such as aircraft engines, which are typically leased, may require complicated equipment and measurement instruments to detect abuse early in their economic life. Monitoring is a collective term for all activities aimed at ensuring compliance during the term of a contract, including measuring the quality of maintenance of a road, the state of a machine, or compliance with restrictive covenants in debt contracts. In essence, as the requirement to bond performance is not without cost, so monitoring performance is also costly. The causal arrow between the 'economic nature' and the 'governance mechanisms' concept boxes in Figure 4.3 indicates that the economic nature of the facility in a BOOT will influence particularly the form of monitoring mechanisms, but with increased complexity it is also expected to affect the scale of bonding.

The economic nature of the particular infrastructure asset that forms the subject of a PPP transaction also matters for other reasons. In most sectors, physical infrastructure assets are not particularly complex facilities, and so are relatively easy to monitor for counterparty and facility performance.[4] Unlike many capital goods, such as say trucks, public infrastructure facilities are, however, highly purpose- and location-specific fixed assets, and rarely can fulfill more than one economic function. It is difficult to imagine that one section of an urban motorway can easily be turned into a theater complex or a shopping mall. This characteristic is known as *asset specificity*. Coupled to this single (or limited flexibility) use, infrastructure facilities often also have functional local monopoly characteristics that may be created or reinforced by concession agreements. The typically very large capital amounts committed to BOOT facilities cannot be diverted into other uses to generate revenue; it is represented by a fixed asset. Requiring the private sector to invest substantial amounts of capital in a fixed asset with no flexibility is an extremely powerful mechanism to bond counterparty behavior, given that the fixed nature of the asset also determines that the capital

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[3] This explains one major flaw in the logic of PFIs in social infrastructure—the fundamental problems of devising good performance indicators and monitoring mechanisms in arrangements of such complexity.

[4] This is not to suggest that such facilities are not complex to deliver, in case the point has not been sufficiently emphasized.

investment is sunk. That is, it is *irreversible*. Asset specificity thus forms part of the economic nature concept box in Figure 4.3.[5]

Transaction Governance

Given all the above, it is thus expected that transactions between private sector agents and governments to provide public infrastructure assets and/or services are complex and information intensive, with transactions within transactions and multiple agency arrangements. The PPP is a 'master transaction' specifying rules for the delivery and operation of an infrastructure asset. Referring again to Figure 4.3, this returns us briefly to the third block arrow, 'execution'. Once all aspects of the PPP are agreed between parties, 'transaction governance' is concerned with managing provision (i.e., delivery) of the asset and ongoing aspects of the master transaction under the agreed rules, often over decades. While the intuition conveyed by the term *transaction governance* is possibly best understood when concepts such as monitoring, reporting, remedial actions, and dispute settlement mechanism are considered within the framework of some *existing and operating* PPP facility, the realities of provision (i.e., constructing the facility) introduce critical concerns that influence particularly the structuring of new infrastructure projects. The critical observation is this: *No operating infrastructure facility exists before its construction is completed and is successfully commissioned*. This means that if the project development is unsuccessful, there can be no operational entity, no services can flow from the facility, no revenue generation is possible, and no conventional financing arrangements can be supported by the project. The bottom half of Figure 4.3 presents an ordering of typical mechanisms in PPPs and will be returned to under the Melbourne City Link Build-Own-Operate-Transfer Project below.

In project management practice, 'the project cycle' concept is often used to order risks (and risk management activities) that may arise in project delivery, and to then plan accordingly. Briefly, project delivery may be presented as a five-stage process: planning, design, and engineering; construction (also referred to as 'procurement'); commissioning; operation; and decommissioning. Each phase carries different risks, and thus requires different risk management actions. The first three phases can be grouped loosely as the 'development phase', and is thus invariably considered to be the most risky project phase. This phase jeopardizes the establishment of a functionally operational infrastructure asset. Infrastructure project risks are thus separated for risk identification and management purposes between

[5] Limited flexibility and local monopoly characteristics influence valuation and financing of PPP transactions, and are key requirements in project finance. Single-function and relative technological simplicity are desirable properties when project financing decisions are considered, because it is very difficult for borrowers to misrepresent information about a single revenue stream, such as that generated by toll charges. It is similarly easy for lenders to monitor such revenue generation during the facility's operation if debt servicing is secured against such single revenue streams.

development risks, operational risks, and decommissioning risks. In the case of a toll road BOOT, for example, there is typically one private sector concessionaire with overall responsibility, and managing the overall project risks through all phases typically follows a linear format. This is achieved through the establishment of milestones for completion of phases coupled with performance guarantees. Continuation into the next phase and release of guarantees is conditional upon completion of the previous phase; this is called 'phased bonding'. Similar logic applies to managing financial risks in project finance arrangements, through the separation of construction finance from financing project operation and making operating finance conditional upon successful completion of the development phase. It is thus clear why PPP contractors have to be reputable and experienced parties. The project cycle logic thus also influences the structuring and governance of PPP transactions, and has particular influence on bonding mechanisms aimed at ensuring successful completion of the 'build' phase in BOOTs.[6]

The Melbourne CityLink: A First-Generation Modern Era Build-Own-Operate-Transfer PPP

In this section, we present *selected details* of the Melbourne CityLink, an important first-generation BOOT, a PPP transaction between the Victorian State Government and Transurban CityLink Pty Ltd. It was a pioneering BOOT for Victoria both because of the size of the transaction (estimated at AUD 1776 million in 1996 (Russell, 2000)) and the complexity of the contractual arrangements. We present the discussion on CityLink in two parts. First, we describe vital characteristics of the BOOT, and give some details of its economic and social context at the time it was conceived, and thereafter we consider impressionistically selected aspects of the BOOT's logic following the framework developed above. The analysis presented covers the period from inception to around 2002–2003. After this period, several institutional changes occurred including a restructure of the Melbourne CityLink Act and Concession Deed (now called the Agreement), several iterations of changes to the arrangements for management at the government end, and a complete restructure of Transurban itself. As a case study to apply the transaction analysis framework presented above, we are concerned with the relationship between the mechanisms created in the market competitive precontract stage, and their effectiveness at managing incentive conflicts in the later bilateral monopoly stages. The changes after 2002–2003 represent a new set of mechanisms and a new operating environment and therefore are not particularly relevant to our intention here. The scale and scope of the project and the scope of this chapter allows a first and intuitive analysis following the transaction analysis framework presented above—deeper and more critical analysis of the project and whether the mechanisms now in place are sufficient to manage an effective handover of the project in 2034 are outside our present ambitions.

[6] For further insights into Incentive Conflicts and PPPs and Transaction Governance, (see Pretorius *et al*., 2008, Chapter 2).

The Melbourne CityLink Build-Own-Operate-Transfer Project

CityLink is a 22 km tolled roadway that comprises the Western Link and the Southern Link. They were officially combined and called 'Melbourne CityLink' in August 1994. The two links are separated by a portion of the Westgate freeway, which belongs to the State of Victoria, and is not tolled. The Western Link joins the Tullamarine Freeway to the Westgate freeway via a six-lane elevated road through West Melbourne and a connecting bridge over the Yarra River. The construction contract also included a substantial upgrade to the Tullamarine Freeway (to eight lanes) between Bulla Road and Flemington Road, with this section of the previously existing road becoming part of the tolled road. The Southern Link links the Westgate freeway to the Monash Freeway and comprises two new three-lane tunnels beneath the Yarra (3.4 and 1.6 km long, respectively) as well as an upgrade to the previously existing South Eastern Arterial (now the Monash Freeway) roadway to five and six lanes between the city and the city end of the Monash Freeway, just east of Glenferrie Road (VicRoads, 2008).

CityLink operates as a fully electronic toll road—there are no toll plazas. The roadways link seamlessly, that is, without an apparent change to surface. The beginning of the tolled section is marked by signs at the last spot where free exit is possible informing drivers that an e-tag or day pass is required to continue. Telephone numbers are provided to allow drivers to get a day pass if required within 24 h without penalty. In total, there are 16 entry–exit points to the tolled section of the road.

CityLink was built under a Concession Deed granted to a consortium of Transfield/Obayashi to design, build, finance, operate, levy tolls, and maintain it for 34 years until 14 June 2034. It will then transfer to the State of Victoria (Infrastructure Partnerships Australia, 2006) (Figure 4.4).

CityLink: Selected Transaction Mechanisms

This section is concerned with analysis of the delivery and operation of the CityLink project, using concepts outlined above and summarized in Figures 4.2 and 4.3. These figures were in large measure concerned with factors that influenced BOOT transaction details—what was to be delivered (a facility, its nature); what factors influenced transaction governance (identification and management of incentive conflicts, the fundamental transfer); and how it was going to be delivered (in phases: construct, own-operate, transfer). In this section, we present selected details of the structuring of the CityLink BOOT transaction and incentive conflict management mechanisms deployed, and comment subjectively on their effectiveness (helped by the benefit of hindsight, given bounded rationality). Recall earlier that in our context *transaction completeness* is taken to mean that the integrated structure of the PPP agreement significantly facilitates the management of incentive conflicts, as well as alignment of interests between parties. However, the measures in the agreement are influenced by the process through which the agreement is reached because this process provides context-specific realities which the agreement is

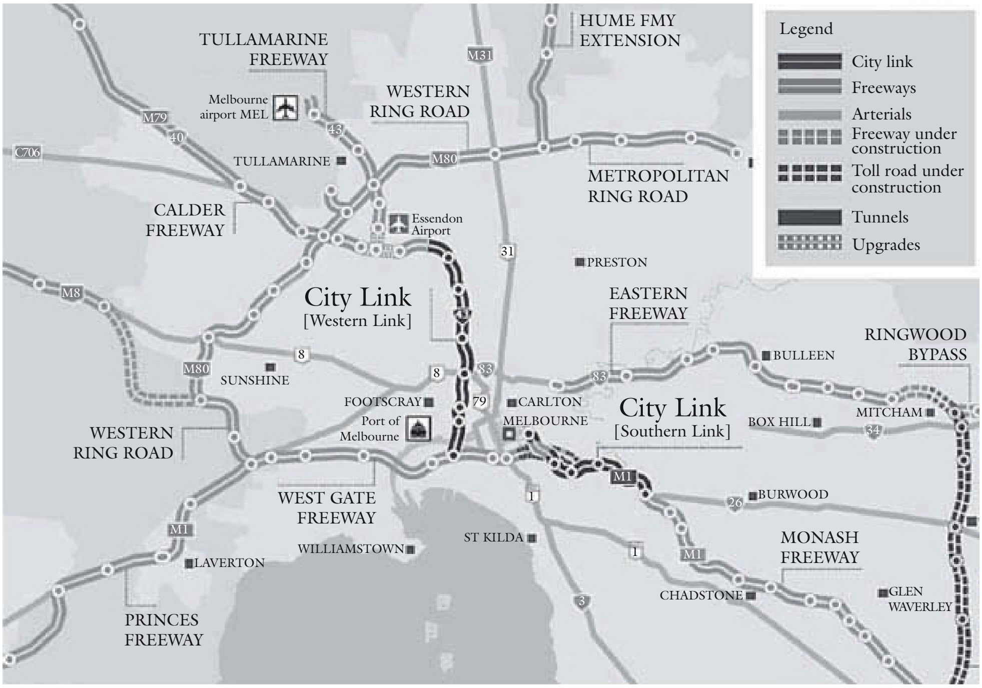
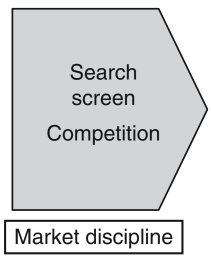


Figure 4.4 Map of the CityLink project.
Source: Reproduced with permission from Transurban (2008).

attempting to manage. Thus, we are exploring the extent to which the mechanisms in CityLink work together to manage incentive conflicts.

We commence by considering first the process of reaching agreement and the context-specific factors which relate to the way the agreement was formed. The first phase is the competitive phase, following block arrow one in Figure 4.2. This phase follows a transaction context of market discipline.

CityLink: Search, Screen, and Compete

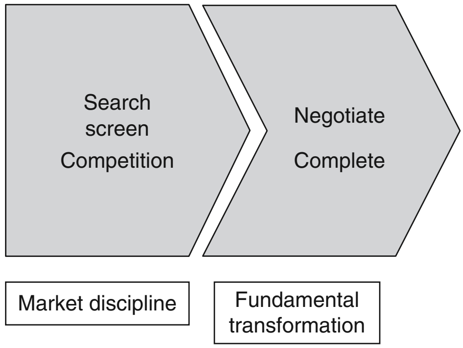


In May 1992, the Labor government called for expressions of interest in the bypass project, having already established private sector interest in infrastructure provision in May 1991. Five bids were received. Cognizant of the costs of developing and maintaining engagement in the bidding process, the government shortlisted two consortia to bid for the project in September 1992. They were CHART roads, and Transfield/Obayashi. A shortlist of two was considered sufficient in the final stages to maintain effective competition, and achieve some economy in bidding and negotiation effort, particularly on the government's part. The project was then put in abeyance due to the calling of an election for October 1992.

On winning government in October 1992, the Liberal party, led by Premier Jeff Kennett, announced a review of the bypass projects. The review was to focus on proposals for the physical dimensions of the project, and particularly on the economic and financial aspects of the proposal, including cost estimates. This review was completed in April 1993. VicRoads (the government department in charge of road development in Melbourne) was ordered to upgrade the environmental impacts study, and develop bid documents. A specialist project team within VicRoads was created to undertake this task. In July 1994, the Premier made a public announcement that the southern and western bypasses would be built, with construction to commence in the next year, and completion to be achieved by 2000. In August 1994, the Environmental Effects Statements (the key mechanism for public consultation) were placed on public display. The project team referred to above formed the core of the Melbourne CityLink Authority, formally established by an Act of Parliament in December 1994. This Authority was established functionally and physically separate to VicRoads, with the sole purpose of bringing to fruition the CityLink project. Through these actions, the government entered the negotiation phase with a clear commitment to produce the project one way or another.

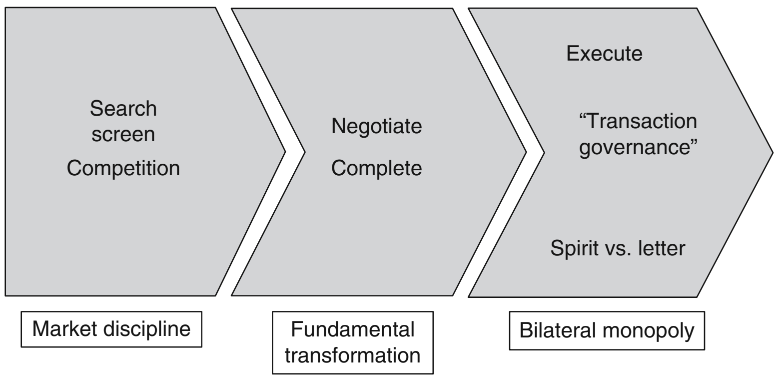
The government honored its predecessor's shortlist for the final stage of the competitive process; in May 1994 the two shortlisted consortia were invited to submit final bids. Following the announcement that the Western and Southern Links would be considered as the one 'CityLink' project, a new project brief was issued to both consortia in September 1994. Submissions were received from the two consortia on January 31, 1995. On May 29, 1995, Transurban was selected as the preferred bidder and contract negotiations were entered into. Transurban thus became the government's principal agent for the delivery of the whole project. To ensure contestability, however, CHART Roads were retained during the extended contract negotiation stage as a possible secondary bidder should negotiations fail with Transurban. In recompense for this 'holding' role, the government purchased the intellectual property in the CHART Roads bid for use in improving the project. The status of Transurban as the preferred bidder was functionally completed with signing of a Memorandum of Understanding between Transurban and the State in July 1995, and after some stalls in the negotiations, the Concession Deed was signed on October 20, 1995. The Concession Deed was then passed into law under the Melbourne CityLink Act, in December 1995. The contract reached financial close on March 4, 1996. Transurban listed on the Australian Stock Exchange in March 1996, and initial ground breaking commenced in that same month. This completed the transaction process depicted in block arrow 2 in Figure 4.2.

CityLink: Negotiate and Compete



To complete our consideration of the progression of the project, we now turn to the execution of the project from construction to operation. This is represented as block arrow three of Figure 4.2.

CityLink: Execute



The CityLink project consisted of constructing the facilities, followed by an operational and finally a transfer stage. Although the technical complexity of mega urban projects varies, these projects are notoriously complex to execute. This is in part due to the complexity of the legal framework of contracts by which risk is shared through the use of layered subcontracts. It is also often caused by the difficulty of managing construction under the constraint of the already operating urban environment, and the complexity of trying to minimize construction time over a large impact project. Where subsurface engineering is included, this is often the cause of technical problems. All of these circumstances were present in CityLink.

Construction commenced with the tunnels for the Southern Link at Burnley in May 1996, and work on the Western Link commenced on the elevated viaducts in West Melbourne in June 1996. This was possible in part because the construction of the Western Link had been subcontracted to

Baulderstone Hornibrook ('Baulderstone'), thus an agent of Transfield Obayashi Joint Venture (TOJV) (and representing the third principal agency arrangement in the project). TOJV undertook construction of the Southern Link directly. The full construction project was not completed until December 2000, although the Western Link was completed ahead of schedule and opened to traffic in August 1999.

The construction process was not without technical difficulties. The tunnels experienced significant difficulties due to much higher than expected water pressure in the Silurian mudstone. The tunnels had been conceived as membrane-sealed ellipsoids (flat on the bottom to allow for three lanes of traffic); however, after they were in place and the water pressure was allowed to return to the surrounding rocks, the floor of the tunnels buckled longitudinally down the center, necessitating the application of 15 000 pins to hold it down. Naturally, this pierced the membrane with the result that water management in the tunnel became much more of a problem than anticipated and required considerable adjustment to the management plans for the tunnels. On February 19, 2001, water pressure that built up against a flaw in the join of the side wall with the bottom of the tunnel resulted in a fairly spectacular blowout of a section of the wall and water flowing into the tunnel under full flow traffic conditions. This necessitated closure of the tunnels and further repair work. The incident instigated a review by the Melbourne CityLink Authority of the legislative and contractual arrangements with Transurban in terms of safety and traffic management. Another construction issue occurred with the construction of the bridge over the Yarra river (the Bolte bridge), when a large section of concrete fell into the river as load was applied to the tensioning wires for the cantilevered bridge. Both these technical difficulties fell within the responsibility of TOJV (and for the bridge Baulderstone through TOJV), and were their responsibility to resolve. In both cases, Transurban provided additional equity to ensure the project stayed on track. Despite being protected from financial liability for these difficulties, the government was not immune to criticism over the safety of the project and in particular the tunnels. Safety events in high-profile public infrastructure facilities remain legitimate public concerns.

Concurrent with the construction phase, Transurban, through its subcontractors, commenced work on its operational business plan. At the time, Melbourne had no operating toll roads. The only experience Victorian road users had had with toll roads was from the Westgate Bridge, which was tolled from its opening in 1978 until tolling was abandoned in 1985 because it was perceived drivers were taking other routes to avoid tolls. Thus, there was considerable work to be done to formulate a business plan which would encourage drivers to use the tolled road. Further, tolling on CityLink was to be entirely electronic, using transponders in vehicles to calculate tolls and automatically deduct amounts from accounts. This possibly constituted the most challenging technical part of CityLink, as the technology was unproven and had to be designed virtually from scratch. It also had to be reliable to a very high degree of accuracy because in addition to being the only recourse for the collection of tolls, it was also to be integrated with law enforcement for toll avoidance and with direct debit systems integrated with Australia's banking system.

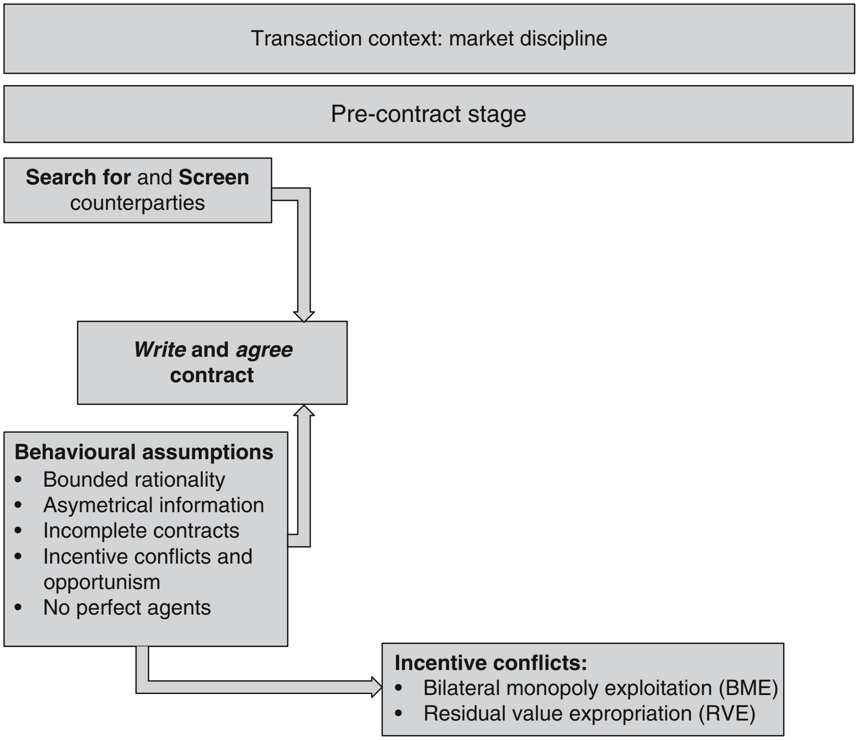
Transurban subcontracted the operation phase of the CityLink project and design of the business plan to Translink Operations under the Operations and Maintenance agreement, while the supply and construction of the integrated traffic management and tolling system was subcontracted to TOJV under the Design and Construct contract, and further subcontracted to Translink Systems. Accordingly, the Melbourne CityLink Information Centre opened in March 1997. The contract to supply the tolling system was let to Saab Combitech on April 1, 1997, who was engaged as a subcontractor to Translink and was thus a fourth-tier subcontract. In November 1997, a contract to build the electronic transponders was let to NEC Australia. Tolling accounts were finally opened on February 8, 1999, with the first e-tag delivered on March 29, 1999.

On May 17, 1999, Transurban announced that it had canceled the subcontract for customer service and operations with Translink Operations and would assume full control of the delivery of this part of the project. Due to continued problems with implementation of the tolling system, the Western Link opened to traffic without tolling on August 15, 1999, at considerable revenue loss to Transurban. In October 1999, the State government changed, with the election of the Bracks Labor government. The Bracks government introduced legislation to protect CityLink users against tolling errors and misuse of private information. Shortly afterward, on January 3, 2000, tolling commenced on the Western Link; however, tolling was delayed for the Southern Link commencing in part only in April 2000, and not fully until January 2001.

Since the completion of the construction phase, a number of changes have occurred in the relationship between Transurban and the State government. Apart from the initial concerns of the Bracks government over safety in the tunnels, which has been an ongoing issue in the media, the relationship settled somewhat. There is ongoing argument in the courts over a number of matters, the most significant is whether the development of Wurundjeri Way replicates part of CityLink and therefore creates a claim under the Material Adverse Effect (MAE) clauses. However, there has also been an agreement to pay out concession payments in return for widening the Westgate freeway at the city end, and the Monash Freeway through to Toorak Rd. Additionally, on September 19, 2001, the State government agreed to release Transurban from the 'single-purpose entity' restrictions in the contract. CityLink thus became a ring-fenced entity within the Transurban group, which allows it legally to continue functioning as a single-purpose entity with respect to its project obligations. Transurban has since invested in numerous toll roads in NSW and overseas.

With this more complete understanding of the timeline for the project, we will turn our attention to the elements in Figure 4.3 of the theoretical framework. We begin considering the precontract stage, including the search for and screening of counterparties, and the process of writing and agreeing to the contract. We will first consider how the behavioral assumptions and incentive conflicts of the theoretical framework played out in the CityLink project.

CityLink: Behavioral Assumptions



Behavioural Assumptions

If we view the above activities in the context of the standard behavioral assumptions in contracting, namely, bounded rationality, asymmetrical information, incomplete contracts, incentive conflicts, and no perfect agents, we can see that much of what was done in CityLink had the effect of addressing specifically these expected behaviors. To commence, it was clear that private sector contractors were far more experienced with large urban highway construction projects, and had a technical information advantage over government. The way the Kirner government originally set about establishing whether there was a willingness among the private sector to fund infrastructure could have resulted in the private sector capturing certain projects and possibly overly influencing the design and planning for the project, given its information advantages with respect to the complexities associated with the delivery of large projects. To counterbalance this, the Kennett government effectively took the opportunity afforded a new government to redress this potential imbalance. In ordering a review, they took the necessary time to ensure that the government fully understood the potential of the project, the revenue streams that would be generated, and the broader financial impacts of bringing such a large project to fruition. The government also purchased the intellectual property in the bid of the other proponent as a further measure to redress this potential imbalance. The government's actions were in part to do with a very strong ideological attachment to the neoliberalist view of private sector participation in infrastructure provision. But equally, the financial situation of the State was such that for the foreseeable future, the government's plans for infrastructure investment would be reliant on private sector investment. For both reasons, the government was almost as committed to success for the private sector investors as they were to the successful development of the road, and CityLink, thus, also took on the aura of a demonstration project. This position has shifted markedly in projects subsequently undertaken. In any case, one effect of the government's approach to the first stage of transacting was to lessen the impact of asymmetrical information, while another effect was to allow the government to think through the project from the private sector's point of view. In both respects, government benefited from additional learning brought about by an interruption in the tendering process from a change in government.

One consequence of this attention to ensuring the project had merit, as a private financial transaction, was that during the contract negotiations the government was left free to allocate the project almost entirely to the private sector counterparty. This was also fed by an ideological commitment to the relative efficiency of private sector participants, and an understanding of the need to separate the project from political interference. The bid documents provided to the consortia in 1994 were technically detailed in terms of performance specifications to be reached for the roads, volumes of traffic, surfaces, etc. From the government's perspective, the bid documents functioned in effect to deliver the facility by the contractor, with all design and construction risk, including cost and performance risk, allocated to the contractor. The method for reaching these specifications was left entirely to the consortium. This attitude was carried right throughout the rest of the project, with risks allocated virtually completely to the private sector, the exceptions being risks related to changes in government legislation and the road network. This attitude has assisted with the problem of incomplete contracts, in that the government did not attempt to itemize in minute detail every single item of the whole—it contracted to receive a functioning facility. The government's position, maintained in full by the Melbourne CityLink Authority, has been: 'it is not our problem'. Thus, even when the tunnel collapsed and pressure was brought to bear from the media to intervene in safety matters, the government limited its involvement to a review of the contract and mechanisms for monitoring safety rather than engaging directly with the solution to the problem. Government activity was to certify the solution was safe, not to design or implement it.

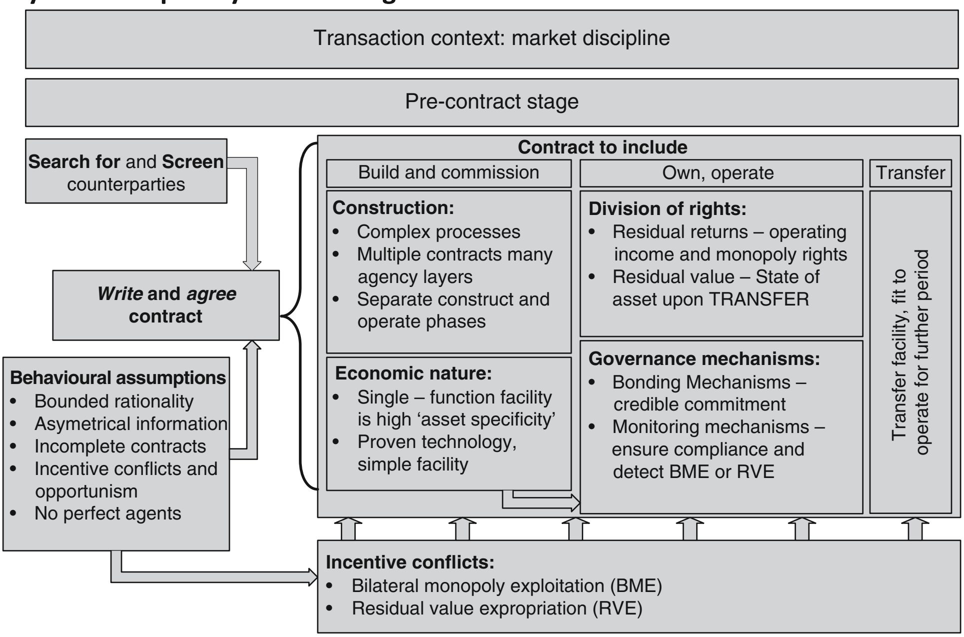
The development of an independent agency, the Melbourne CityLink Authority, to manage the project for the government allowed for an experienced team to be assembled who could understand and manage the project and negotiate from many different angles, in addition to facilitating important learning. While this to some extent functioned to address the problem of bounded rationality through the use of multiple contractors and assessors, it also reduced the multiplication of agents through layers of subcontracting for delivery of the project—managing such agency layers remained Transurban's problem. Importantly, the removal of the project from VicRoads eliminated an entire layer of complexity on the government's side. The independence of the agency could be better maintained because it was not as likely to be captured by other-interests, such as could happen if other road network objectives were incorporated in its brief, or if the project had been left with VicRoads. The Melbourne CityLink Authority was also able to ensure that the demarcation between the role of the contractor and the government as the principal contracting party was maintained, because issues of longer term agency status were avoided.

Incentive Conflicts

Following the review of the project, the Kennett government committed itself to the project. The construction completion date was set as a government priority even before the shortlisted consortia were given the project brief. This tactic was part of the government's strategy to remove political debate from the bidding process. Although it reduced the scope of the government's negotiating position (since it could no longer simply declare the project would not go ahead), this tactic actually helped to stave off the advent of the fundamental transformation and incentive conflicts resulting from bilateral dependency. By committing itself to the project, and then following that commitment with the purchase of the alternative bidder's intellectual property, the competitive nature surrounding the negotiation process was extended until financial close was reached. There were two occasions on which the Premier used this retained capacity to continue the project with another party to move stalled negotiations, one of them occurred on the evening of financial close.

Various elements of the deal were structured specifically to further manage the complexity of the construction phase, divide rights and risks, and manage the relationship into the own-and-operate phase of the contract. We now turn to these elements of the precontract stage of Figure 4.3.

CityLink: Complexity in Executing the Venture



The construction of CityLink was extremely complex, both in engineering terms and contractual terms. The engineering complexities were referred to earlier in this chapter, so here we focus on the institutional and contractual relationships developed to execute the project. These arrangements in effect established how CityLink as a functional business entity was to be instituted and governed until its transfer back to the State of Victoria upon termination. Transurban, under the Concession Deed, Transurban CityLink Unit Trust (the Trust) and Transurban CityLink Limited (the Company), contracted with the State to design the project, construct it, and manage and operate it for a period of 34 years. This legal structure under the Concession Deed can be shown diagrammatically as in Figure 4.5.

This structure was designed to allow the majority of income to be distributed to investors by way of pretax trust distributions, and to facilitate the use of an infrastructure borrowing program (Transurban CityLink and CityLink Management, 1996, p. 19). The infrastructure borrowing program had been put into place by the Australian Government in December 1994 under the Infrastructure Borrowing Act 1994 (Cth). Under the Deed, the Trust would be responsible for the design and construction of the upgraded sections of the project. It would lease the land for the upgraded roadways and then sublease them to the Company and raise funds under the Project Debt Facility and Consumer Price Index Bond Facility. The Company would be responsible for the design and construction of the 'new' parts of the project, the elevated road and bridge of the Western Link, and the tunnels of the Southern Link. On completion, the Trust would sublease the rest of the roadway to the Company, which would earn money from tolls on the whole link.

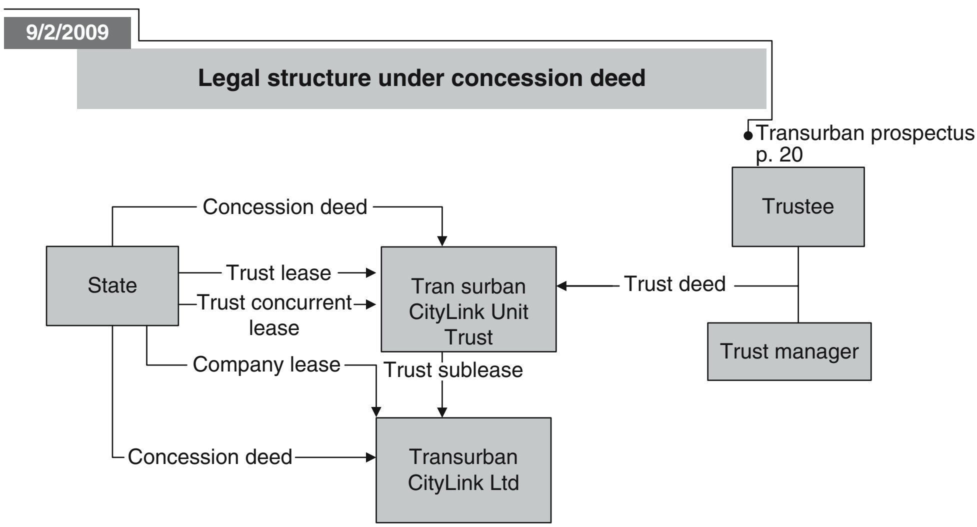


Figure 4.5 Legal structure of Melbourne CityLink Concession Deed.
Source: Reproduced with permission from Transurban CityLink Ltd and CityLink Management Ltd (1996, p. 20).

The Company and Trust were stapled entities with initial equity provided as follows:

Initial equity	**$ million**
Public issue	63.5
Institutional issue	206.5
Direct subscription	185

The direct subscription was provided as follows:

	$ million
Transfield Infrastructure Investments Pty Ltd	50
Hastings Funds Management Pty Ltd	40
Commonwealth Management Services Ltd	30
Infrastructure Investments Ltd	30
AIDC Ltd	20
Macquarie Corporate Finance Ltd	15

Source: Reproduced with permission from Transurban CityLink Ltd and CityLink Management Ltd (1996) 'Melbourne CityLink Prospectus' p. 32.

The Company board consisted of six nonexecutive directors, with a possibility to enlarge the board to eight members. The Chairman was a non-executive director, and day to day the Company was run by the Managing Director. Only two of the initial nonexecutive directors were related to equity investors, one from Transfield Holdings and one from Transfield Project Development. The Trust was established as a wholly owned subsidiary of Macquarie Bank Ltd. The initial board consisted of an independent Chairman and two nonexecutive directors one of whom was from Macquarie Bank. The trustee of the Trust was the Perpetual Trustee Company Ltd. The government had no influence or membership on any of the boards.

While remaining the principal counterparty to the government in the overall transaction, Transurban subsequently subcontracted most of the obligations regarding the construction and operation of the project through the Design and Construct Contract and the Operation and Maintenance Agreement. The structure of the legal agreements during construction and operation is depicted in Figure 4.6.

Under the terms of the subcontracts, TOJV agreed to undertake the design and construction of the link under the Design and Construct Contract. The design and construction of the State works are included in the Design and Construct Contract except that payment for them would be made directly from the State to TOJV. TOJV agreed to coordinate the integration of the State works with the construction of the Link. TOJV subcontracted the design and construction of the Western Link to Baulderstone Hornibrook Engineering Pty Ltd. The work of Transfield Construction was guaranteed by its parent company Transfield Holdings, and the work of Baulderstone Hornibrook Engineering Pty Ltd is guaranteed by its parent company Bilfinger+Berger Bauaktiengesellschaft. None of these arrangements undermined the principal counterparties' obligations, while the performance of TOJV itself (and its agents) was all bonded by the guarantees of their parent corporations.

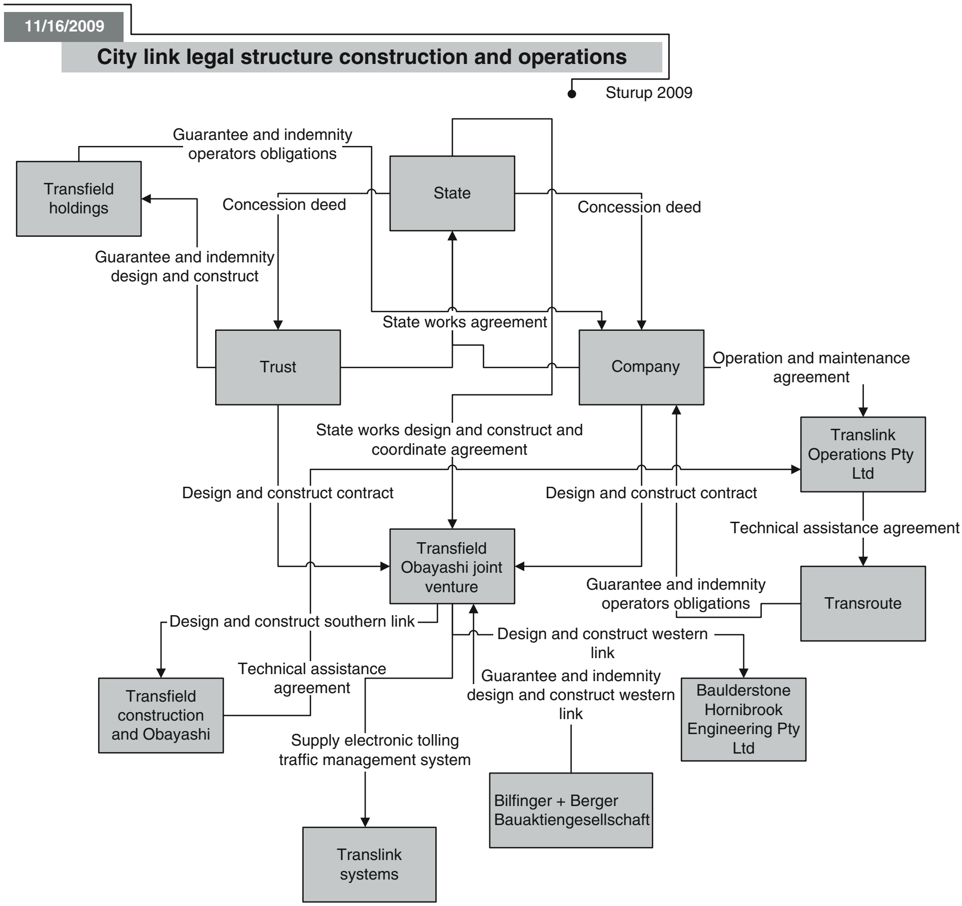


Figure 4.6 CityLink contract arrangements for construction and operation.
Source: Reproduced with permission from Sturup (2010, p. 238).

Originally, the overall operations and ongoing minor maintenance of the link was subcontracted to Translink Operations Pty Ltd, a wholly owned subsidiary of Translink Investments Ltd, under the Operation and Maintenance Agreement. Under this agreement, the Operator was responsible for the development of the functional specifications for the electronic tolling, and traffic management systems and the Link control site, as well as implementing an effective marketing program, ensuring smooth flow of traffic once in operation, collecting tolls, etc. The Company retained the obligation to carry out major maintenance such as resurfacing carriageways, major repairs to structural elements, and replacement of plant and equipment (which was not the operator's). Other maintenance was the responsibility of Translink Operations Pty Ltd. Responsibility for supplying the Electronic Tolling and Traffic Management System was with TOJV, who subcontracted it to Translink Systems, a subsidiary of Translink Investments which is 50% owned by Transfield Group and 50% owned by Transroute. Transroute and Transfield Holdings provided respective guarantees and indemnity to the Company relating to performance by the Translink Operations of its obligations.

In May 1999, following initial trials of the transponders, Transurban announced that it would be taking back direct control of the operations of the road. The Company had realized that outsourcing the interface with the customer, the only real source of earnings, was a fundamental strategic error. If the project was to be a success, a customer focus was necessary. Visits to other tolling companies internationally had shown that if done incorrectly the collection of tolls and management of accuracy of the system could become massively labor intensive and involve significant costs. The business plan put forward by Translink Operations had not advanced these issues, nor has it been successful at dealing with the particular customer circumstances in Victoria. The customer in this climate needed a seamless interaction with the tolling company, in order to overcome resistance to paying the tolls. Casual users needed a simple process for dealing with the Company. A stick approach, fining nonconformers, would be a disaster. The CEO took this opportunity to refocus the Company, from building a road, to operating a sensitive monopoly service—thus, also recognizing the PPP's fundamental public service function.

Economic Nature

CityLink is clearly a single-function facility with high 'asset specificity'. Initially, this specificity was demarcated by the government's insistence that Transurban be established as a single-purpose entity. Preventing Transurban from investing in other businesses secured the earnings from the project for the project and greatly facilitated auditing. This simplified the analysis of the project's earnings for both the investors and the government. It was important because under the Concession Deed, the State can terminate the Concession Deed on the 25½th, 27th, 29th, 31st, and 33rd anniversary after the date of completion if the notional initial equity investors have achieved a real after tax internal rate of return greater than 17.5% and all of the debt facilities (or any other debt facility taken out prior to the completion of the entire Link) have been fully repaid. Otherwise, the concession expires in November 2034. The single-purpose arrangements provided surety that earnings for the project would either go to maintenance of the road or to investors (in which case they would trigger early release of the infrastructure to the State). In the latter case, increasing or at least ensuring the residual value of the infrastructure was maintained.

The question of maintenance expenditure was managed under the Concession Deed in the following way. The Company was obliged to provide a maintenance plan to the government for the year of commencement of operations and within 6 months of opening for the year following. They were then to provide a monthly report on the actual maintenance expenditure, tasks undertaken, and quality, which was to maintain the road's capacity to meet the standards established under the Project Scope and Technical Requirements. The State also has a right to inspect all segments of the road monthly. Under these arrangements, it was difficult for the company to under-maintain and expropriate successfully residual value, while over-maintaining and thus exploiting bilateral monopoly was also technically subject to the same auditing scrutiny.

The economic nature of the project, however, failed in the test concerning proven technology and a simple facility. The agreement to toll the road solely via free flow electronic tolling was an enormous risk for Transurban. There was physically no room provided in the road design for any form of manual tolling (such as toll plazas), and no guarantee of revenue was provided by the State. In fact, the only earnings the State anticipated were a series of concession payments which were independent of completion of the road and earnings. Under the Concession Deed, the State was to receive $95.6 million per annum in Concession Fees during the construction phase and the first 25 years of the operations phase. This reduced to $45.2 million per annum from years 26 to 34 of the operations phase, and $1.0 million per annum should the concession period be extended past year 34 of the operations phase. The risk regarding revenue created an additional layer of complexity for investors, because it was possible that the road would be completed without revenue being able to be collected. To be workable, the electronic tolling system needed to be able to recognize to near 99.9% accuracy vehicles using the road with transponders and 90% for those without transponders (Allen Consulting Group Pty Ltd, John B Cox, and Centre of Policy Studies, 1996). The complexity of this, along with the levels of accuracy demanded by the banking systems for linkages between CityLink toll accounts and credit cards, for example, was enormous. At the point where the contract was signed, only one road in the world was operating with a fully electronic system and it only had one entry and exit point. The electronic tolling system thus represented a highly complex and new information technology (IT) project in itself, and the statistics for such projects meeting cost and timing targets were much less comforting than even for tunnel construction. The cost of this uncertainty was in fact felt firstly on the Western Link where tolling did not commence until 4 months after the road opened for traffic. The government, however, was not exposed to this risk, and from its perspective the single counterparty approach functioned well.

In most tolled road infrastructure concession agreements, governments recognize that some roads have locational monopoly characteristics, and attract private sector participation by committing not to undermine such benefits for an agreed time. This is then typically also accompanied by regulating road charges, so as to avoid exploitation of users. Both mechanisms are in the Concession Deed. One of the issues for single-function facilities which are inserted into networks, as toll roads are, is the risk that changes to other parts of the network, which affect the number of users of toll roads, will occur. The Concession Deed maintains provision for fair dealing with changes to income from changes to the broader road network through the MAE clauses. These clauses allow that some changes to the road network which have the effect of reducing the number of users of the Link will trigger negotiations regarding compensation for the Concessionaire for lost income. Similarly, changes which have the effect of increasing Transurban's revenue are to be shared with the government. The MAE conditions clearly form a mechanism that functions to control government behavior given its ability to exploit its bilateral monopoly power to affect traffic flows.

Division of Rights

Under the Concession Deed, Transurban is the recipient of all tolls collected and thus has exclusive rights to the residual returns of the Link, except for the payment of concession fees, or in the event of early transfer to government in circumstances where the notional initial equity investors have achieved the 17.5% real after tax return and all of the debt facilities have been fully repaid, as agreed to in the Concession Deed (see above). Tolls are regulated and calculated in accordance with Schedule 3 of the Concession Deed. Under the arrangements, an initial theoretical toll level was set for the quarter ending March 31, 1995, and a maximum theoretical toll was set for the same period. This theoretical toll can be increased in accordance with the greater of 4.5% per annum or CPI each quarter, but cannot rise more than 1.21 times more than the toll was in the previous quarter. Thus, the maximum that the toll can theoretically be is determined by the rules of the Concession Deed; although Transurban is not obliged to set tolls at the level of the theoretical toll, they may choose not to increase tolls for any period.

As noted above, the State is to be paid concession fees by the Company. The concession fees can be paid as concession notes rather than paid out, with the notes due for redemption at the end of the concession period. They can also be presented earlier if:

- A notional initial equity investor has received a real after tax internal rate of return on investment equal to 10% pa, where not more than 30% of the distributable cash flow for the previous year has been used to do so; or
- The concession period has been terminated earlier on the basis that a notional equity investor has achieved a real internal rate of return after tax greater than 17.5% and all debt facilities have been fully repaid.

In fact, as noted above, the concession fees for the project to date have been paid out to fund the upgrade of the Westgate Freeway/Monash Freeway upgrade to be completed in 2010. An agreement was reached as to the value of the concession fees in present-day dollars against the estimated date that they would have had to have been paid under the Concession Deed. This process was cause for considerable controversy.

At the end of the Concession period, the residual rights to the Link will revert to the State, along with an irrevocable nonexclusive license to use, and sublicense others to use the tolling system for the purposes of operating, maintaining, and repairing the Link. Similarly, the Company is obliged under the contract to make available other capacity on the transponders to other Operators for other purposes if such is asked of them. The transponders have six channels available in them, and these other channels can be used for a number of different purposes, such as future tolling of the inner city area via a congestion charge. In this respect, the transponders themselves, which the Company was obliged to make available to the public at no cost, represent a significant net gain to the community.

The Project Scope and Technical Requirements ('Project Scope and Technical Requirements', 1995) for the Link outline the condition of various elements of the Link at handover. The estimated lifespan of the elements at handover will be judged by an Independent Reviewer and must be as follows:

- Bridge and tunnels 80 years
- Road pavement 20 years
- Road surfacing 5 years
- Electrical and mechanical equipment 20 years
- Tunnel finishes 50% of product life
- Communications and control systems 10 years
- Renewable items 50% of life

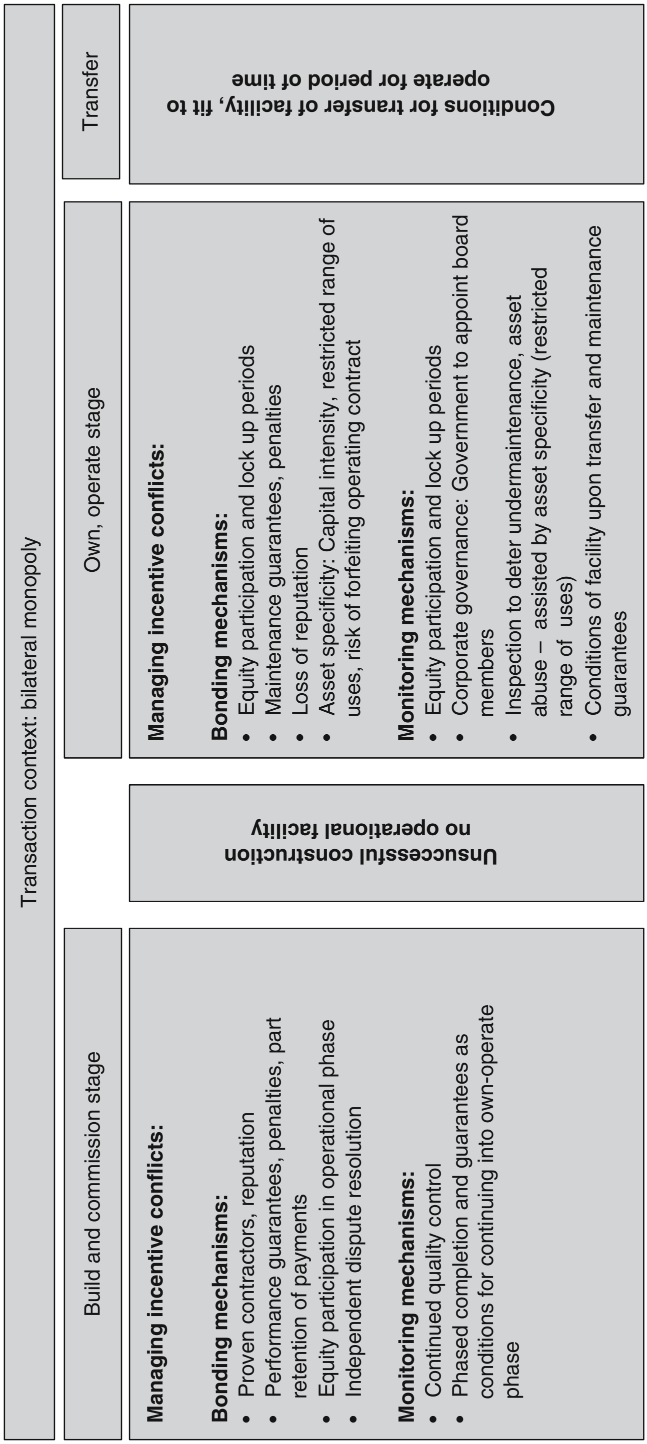
Governance Mechanisms

The primary monitoring system put in place during the construction phase of the project was the selection and appointment of an Independent Reviewer to undertake reviews and checks to verify conformity with Project Scope and Technical Requirements, provide monthly certificates as a basis of payment of progress claims, review and report on variations, and provide a certificate of completion for each section of the road. Payment for this Independent Reviewer was shared between the parties to the Concession Deed. Although the primary function of the Independent Reviewer was to act on behalf of the Concession Deed, by default they provided Transurban with an independent party to monitor and review the work of their subcontractors.

Article 16 of the Concession Deed ('Melbourne CityLink Act', 1995) provides conditions for the resolution of disputes through the selection of an independent expert who can either operate purely as an expert, or if the advice so provided is insufficient to resolve the dispute, an arbitrator can be appointed. This is a fairly standard set of clauses put in place to provide a mechanism for parties to the agreement to 'operate in good faith'. Indeed the Concession Deed demands such behavior. Naturally, there is recourse to the courts should such resolutions fail, a method which has been used by the parties to the Concession Deed on a number of occasions pertaining to MAEs.

We turn now finally to a consideration of the mechanisms provided for the management of incentive conflicts during the construction and operations phase following the fundamental transformation of our theoretical model. We consider how well the Concession Deed and other arrangements have managed the balance between residual returns and residual value. We commence with consideration of the incentive management processes under the build and commission column of Figure 4.3.

CityLink: The Transaction in Operation—Managing Incentive Conflicts



Bonding Mechanisms

The initial consortium of Transfield Construction and Obayashi Corporation had a long-established expertise in construction. Transfield had experience in Australia, while Obayashi brought significant tunneling experience to the project. The initial arrangements with Transroute as the Operator provided expertise in the operation of toll roads. At signing, a number of reputations were thus placed on the line. The weight and importance of this type of bonding mechanism was significantly increased because the project was one of the first and highest profiles for the new Victorian Government with its private sector friendly approach. The government had made clear that it intended to use this model of PPPs for other major projects in the State including the new exhibition buildings, Melbourne Museum, County Court, Docklands development, etc. Thus, the importance to the contractors of building strong and lasting reputations in Victoria was critical to gain future business. This was as true for the subcontractors as it was for the primary consortium members. In fact, for Transurban itself, limited as it was to a single-purpose entity, this bonding mechanism was perhaps less important, but it did affect materially the Transfield organization which effectively guaranteed performance of the single-purpose Trust and Company.

Performance Guarantees

The key performance guarantee in the Concession Deed regarding construction revolves around the fact that there can be no revenue earned until the road is completed and certified by the Independent Engineer as meeting all the requirements of the Project Scope and Technical Requirements. This was equally true for the government, since there would be no economic benefit, nor benefit to voters flowing from the road until it was completed. During construction, there was therefore considerable alignment between the parties in terms of intention. The fact that Transurban had subcontracted the design and construction, and subsequently reabsorbed in 1999 the role of Operator, promoted this alignment of intention. Transurban had refocused on the longer-term issue of operating the road—and costs associated with that, much as the government had—although not perhaps over quite the same timeframe.

There were more standard clauses in the Design and Construct contract, to provide alignment between the incentives for the subcontractor and Transurban during construction. The key points were as follows:

- Liquidated damages for loss of projected net revenue were payable by TOJV if not completed by the relevant date.
- A construction defects correction liability period allowed for TOJV to rectify faults for 12 months. Contractual liability for latent defects was extended to 10 years.

- A bonus payment of 65% of net traffic revenue was available to TOJV if the road was completed early, with investors to receive the balance.
- Security of 15% of Western Link subcontract price and 15% of Southern Link subcontract price plus 15% of State works is to be provided by TOJV by way of letter of credit of a bank with a credit rating of A or a performance bond of company (1/2 Southern Link security) with AA rating. Total security value was $180 m. Debt providers had first cut at this security.

The quality of alignment in intention created by these methods is apparent in the reactions generated by the original tunnel failure and bridge failure. In both cases, the government remained distant from the issue on the basis that it had contracted both design and construction risk to Transurban, and TOJV was Transurban's agent with which the government had no contractual relationship. The issue with the bridge, however, was a potential crisis for the subcontractor, and could have resulted in a breakdown of relationships between TOJV and Baulderstone. In both cases, rather than sticking with the premise of the subcontract, and placing the entire financial burden on the subcontractor, Transurban chose to finance the repairs immediately through investing ('bonded') equity into the project. This enabled a rapid response, with engineering solutions found quickly, and additional resources made available to solve the problems. The result was minimal disruption to the overall schedule of the project. To the extent that the Concession Deed provided these incentives, and the flexibility it allowed Transurban to act in this way with the subcontractors, this mechanism was a success.

In the initial arrangements under the Operation and Maintenance agreement, a number of similar bonding mechanisms were attempted. The Operator was to be paid a fixed minimum fee plus a variable amount based on volume of traffic. Fees were to escalate with reference to CPI and labor costs. Incentive bonuses were to be paid if traffic throughput or recovery of payments exceeded benchmarks. Penalties would be due if the Operator failed to maintain the tolling system to standard, or if the amount of revenue lost exceeded 1%. It was anticipated that this would provide an incentive for the Operator to align itself with Transurban's objective of generating maximum earnings, by establishing best possible business practices, minimal operating expenditures, and ensuring the successful uptake of use of the road. The fact that Transurban felt it necessary to take over the Operator's role and revoke the contract points to the failure of these bonding mechanisms. This reinforces the point made in *A Private-Public Sector Participation Continuum* above that service style outsourcing contains a much greater degree of risk, and that alignment between parties in such contracts is extremely difficult to obtain.

Monitoring Mechanisms

In the construction phase, several monitoring mechanisms were put in place. The key one was the appointment of an Independent Reviewer. The role of the Independent Reviewer was to sign off each phase of construction, determining whether it met all the requirements of the Project Scope and Technical Requirements documentation. The construction program was phased and the timetable recorded in the Concession Deed.

The government had established the Melbourne CityLink Authority as the agency responsible for the delivery of the project. This organization was responsible for liaising with any other government agencies affected by the project, and ensuring that the Company met its obligations to minimize disruption to the community during construction. This successfully managed a major risk to large construction projects, which are the delays that occur in dealing with unforeseen interactions with government agencies. The Authority was backed by the creation of a special cabinet sub-committee at the ministerial level of government, to which the Authority reported and which provided necessary coordination of other government authorities. An example of the success of this agency in managing these risks occurred in the design of the Western Link. Engineers initially concluded that the construction of the elevated road over the Upfield railway line would require closure of the line for several months. This was politically impossible, as the argument over the closure of the line had just been resolved in favor of it staying open, and closure would have meant reneging on that agreement. The construction program was redesigned, and successfully linked with the running of the trains, so that in the event the line was closed for only a couple of days (all on a weekend).

Although it was noted in the beginning of the discussion of *The Melbourne CityLink: A First Generation Modern Era Build Own Operate Transfer PPP* that the timeframe of the case study has been limited to the period 2002–2003, we turn now to a very brief consideration of how the mechanisms for managing incentive conflicts under the own, operate column of Figure 4.3 have worked during the own operation phase. The most important change which can be commented on relates to Transurban as a single-purpose vehicle. The Concession Deed was significantly rewritten following the decision to allow Transurban freedom from its single-purpose entity provisions. Obviously, this created considerably more complexity in auditing because CityLink is now a ring-fenced entity within a much broader group of companies. The capacity to ensure that revenues generated by the project remain within the CityLink Company and Trust is reliant on the effectiveness of the ring fencing put in place. However, the loss of reputation risk for Transurban has become significantly greater following the revocation of the single-purpose entity clauses in the contract. Transurban is now a multinational Company and consequently relies on its reputation in an ever-increasing way.

On many levels the CityLink project has been successful, and this has been in no small measure a result of the careful attention to detail put into place during the initial contract negotiations. The Concession Deed provided mechanisms that allowed the parties to successfully negotiate the transfer through the negotiation phase, construction phase, and into the operations phase, with a significant degree of alignment in the objectives of the parties. This alignment is vital once the project enters a bilateral monopoly phase to minimize the costs of disputes and risk of residual value expropriation.

Whether the reconstructed project documents since commencement of operations have made sufficient provision for the continuation of this alignment through the point of transfer of the road is a matter which requires further research.

Conclusions

The introduction to this chapter presented an analytical framework which could be used to consider the 'effectiveness' of any privatization or private sector participation structure. The framework was developed drawing on the logic of institutional and transaction cost economics, and utilizes agency cost of finance concepts from financial contracting research. In essence, the approach considers the notion that one of the functions of the financial system is to create complex transaction forms aimed at managing incentive conflicts between contracting parties (following Crane *et al*., 1995). While the example of a BOOT-form of PPP does not categorize simply as a financial contract, such transactions typically always include one or several contracts that have fundamental underlying financial contract characteristics, even if the visibility of the construction and operational contracts seems to dominate the public and political perception of such transactions. We sought to identify to what extent the framework could be extended to categorize the relationships created by the 'nexus' of contracts represented by a PPP, to use project finance terminology (Williamson, 1991). The framework was developed to test the logic in the complex world of BOOT transactions, and used to conduct an analysis of the Melbourne CityLink toll road project.

A subjective view of the framework itself would possibly consider the experiment a qualified success. In principle, the logic of the framework reflected a degree of internal coherence. Therefore, it seemed to represent a system which could be used to map incentive conflicts in existing transactions. However, the framework is not general, and while it uses a factor common to any privatization transaction, namely, the allocation of rights, it will not apply in the BOOT-form to other common forms of privatization activities. For example, with respect to the allocation of rights to residual income and residual value, BOOTs were analyzed in a particular way because the distribution of rights resembled complex long-term operating leases. One observation from the analysis is that every different form of privatization transaction is expected to generate conflicts between public and private sector agents particular to that transaction form, and correspondingly particular transaction governance mechanisms to manage those incentive conflicts (as suggested by Jensen and Meckling for financial contracts, as long ago as 1976). An inventory of common privatization transaction forms, mapping their economic logic, particular incentive conflicts, and governance mechanisms, seems a necessary public sector management research endeavor.

The framework was then applied in the analysis of the Melbourne CityLink, a first-generation urban toll road system conceived and developed over some 8 years, and designed to integrate and toll a number of urban motorways in the Melbourne CBD/inner city area. CityLink is a BOOT between the Victorian government as the procuring party and Transurban as the private sector BOOT contractor. It may be concluded that the Victorian government managed the precontract process extremely well and so avoided many postcontract bilateral dependency conflicts. This was possibly the consequence of their being mindful of the high profile and political importance of the project, and paying particular attention to the nature of the transaction. While CityLink was a complex project to execute, and did present some complex substructure engineering challenges, the project could not be presented overall as containing engineering or technological challenges that were completely unchartered territory—one exception being the development of an entirely new automated tolling system was called for. While the ground engineering challenges turned out to be serious, and development of the automated tolling system caused delays but eventually was completed, the BOOT venture itself could be considered a success because the transaction appeared to be internally consistent, with no glaring incentive conflicts that were unaccounted for, as is often the case in traditionally executed large and complex construction projects.

In conclusion, it is possibly useful to note that worldwide experience with PPP/BOOT-type transactions has grown markedly over the last three decades, and that this body of experience has contributed to the learning, standardization, and acceptance of many PPP transaction forms. Where only the delivery of construction projects were considered, PPP arrangements appear to have delivered far better performance in terms of time, cost, and quality than traditional contracting has, while systematic research on the performance of term-completed PPPs in Australia has yet to be attempted. Transactions of the BOOT family certainly have gained acceptance, and this can probably be ascribed to the close resemblance to project finance transactions, namely, single-function assets, well-conceived concession agreements and regulatory arrangements, but also with high debt levels that eliminated most potential discretionary activities from private sector Operators. Such single-minded transaction characteristics are not present with later privatization transaction forms such as Private Finance Initiatives, where the ‘privatization at any cost’ ideology may have contributed to overly complex and possibly ungovernable transactions.

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5

Land Management and Planning Legislation

Marcus Spiller

Introduction

To a significant degree, the cost of supplying and managing urban infrastructure is contingent upon the form, density, and timing of urban expansion and redevelopment (AURDR, 1995). In seeking to optimize investment in water supply, sewer networks, roads, rail, power, and other urban systems, it is therefore important to understand the land use regulatory systems which set out to shape settlement patterns.

This chapter identifies the elements of land use planning systems and explores the main issues involved in efficient, fair, and accountable regulation of development. The discussion is based on current practice in Australia. This focus on the generation and regulation of individual urban development projects complements the macroscale perspectives presented in Chapter 2 (which demonstrates the need for a holistic approach to managing urban change) and Chapter 3 (which outlines productivity, evaluation, and finance of infrastructure investment).

The current chapter recognizes that land use regulatory systems cannot be usefully evaluated independently of the market context which gives rise to urban development proposals and growth pressures. Statutory planning systems are, after all, reactive in character. They cannot make development happen; they must rely on guiding the investment decisions of others. Accordingly, the chapter opens with a brief discussion of the land development process—how private developers make judgments about whether and when to proceed with projects. This is followed by the principal analytical content of the chapter which comprises an assessment of the configuration of land use planning systems in Australia. The chapter concludes with some suggested best practice principles for designing and reforming these regulatory regimes.

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

The Land Development Process

A useful way of considering the dynamics of the land development process is through a simple *Net Residual Land Value (NRLV)* model. This is an investment feasibility assessment framework with almost universal applicability among developers, albeit that it will be applied with varying degrees of sophistication.

The Net Residual Land Value Model

As its name implies, the model addresses the maximum price which a developer might bid for a piece of land for a given project. The principal elements of this equation are summarized in Figure 5.1. The developer starts with the realizable value of the project upon completion—known as 'gross realization'. Usually, this will be an estimate of the immediate sale value of the housing units, offices, factories, or shops which are proposed for the site. However, some developers, especially larger institutions, may wish to retain the completed projects for some time as rent-yielding assets. In these circumstances, a present value equivalent of the anticipated future income needs to be factored into the NRLV analysis. This can be achieved either through standard discounting of the rental stream, or by a shorthand method involving the application of a capitalization rate. This reflects the observed relationship between annual rental and capital value (or yield).

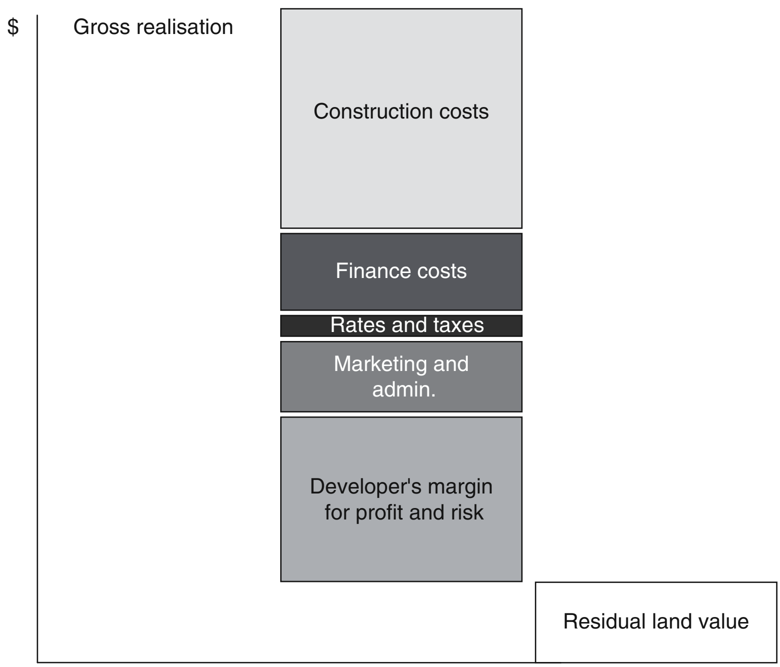

Figure 5.1 Simplified net residual land value model.

From the sale value (or equivalent value) of the project upon completion must be deducted all of the developer's costs in bringing the project to the market. Construction costs will include

- all fees paid in designing the project and preparing documentation for official approval;
- demolition and site preparation costs;
- contract payments for external works and services, building construction, road construction, and landscaping;
- headworks charges levied by water supply, sewerage, electricity, and other infrastructure providers; and
- other development contributions sought by approval authorities (e.g., for local recreational facilities, parkland, and neighborhood social infrastructure).

Interest costs incurred during the project must also be factored into the equation. Rigorous application of the NRLV model would see the developer allowing for costs in this area even if the project is wholly funded from internal sources. That is, the developer must allow for the income foregone in not using this capital in other investments during the course of the project.

Any rates and project-specific taxes paid during the course of the project will need to be recovered from the gross realization. Marketing and administration costs, including real estate agents fees, costs incurred in setting up showrooms, and other sales promotion programs and general project management salaries or consultant fees, must also be recovered.

A further, and critical, cost component is the developer's profit margin. This can vary from 10% of project costs to 40% or 50% and, as such, can have a major bearing on the feasibility of the project. The margin will generally include a significant premium over the rate of return available on government bonds, bank deposits, or blue chip stocks, as the developer will be carrying a far greater risk of financial loss from the project. Without this compensation for risk taking, private capital would not flow into the project.

The Boom-Bust Cycle

The gross realization which is pivotal to feasibility assessments undertaken on a residual land value basis should reflect conditions in the economy. Therefore, judgments regarding sale values and rental streams should be informed by investigation of current and projected demand from end users for the dwellings, offices, factories, and so on.

In Australia, the development sector features large numbers of small operators with limited resources for, or belief in, market research. Moreover, most developers have a relatively small share of the market and, in any case, tend to operate in particular niches. While there may be warning signs in the economy, many developers may at first ignore these, choosing to believe that their particular 'patch' is likely to be sheltered from the wider supply and demand trends.

These factors partially explain the boom and bust cycle which often affects land development markets. Developers continue to supply stock until well after major declines in absorption rates. This exacerbates price falls with softening demand. By the same token, there are often significant lags before developers can be attracted back into the market after real demand has recovered, accentuating the rate of property value increases during the early stages of market recovery.

A boom-bust pattern in the property market complicates several aspects of urban systems management. Investment timing risk for the extension of economic infrastructure like water supply, roads, and electricity is increased. Volatile cycles also introduce further uncertainties into medium-term forecasts of employment and population by small area, which are vital inputs to the infrastructure planning process.

Government programs to monitor demand and supply in the economy and to ensure that developers are well briefed on these trends therefore make a great deal of sense.

'Betterment' and Development Licensing

The NRLV model highlights the importance of the concept of betterment. If the infrastructure required to support the project are paid for by the wider community, rather than by the service users, a windfall profit will be sustained by the owners of the land in question. Thus, if users are not required to pay for water on a volumetric basis but rather through some form of generalized tax (as used to be the case in many Australian cities), they may be encouraged to bid up the end price of the project. This will elevate the realizable value of the developer's project while leaving the developer's costs largely unchanged. The outcome is an increase in the residual land value.

Similarly, if developers are not charged for the extension of infrastructure to their project (and this cost is not otherwise recovered in a transparent way from the end users of the project), their costs will shrink while the realizable value of the project remains unchanged. This also leads to an increase in the residual land value.

Even with full user-pays pricing applied in a transparent way so that end buyers and users can accurately assess the value of the properties on offer, a betterment margin is likely to remain. This is so because in Australian cities a significant proportion of urban infrastructure—perhaps as much as 20% or 30% by value—is supplied by governments as social infrastructure, either without any user charges whatsoever (e.g., primary and secondary schools, public health facilities) or on a heavily subsidized basis (e.g., public transport). The absence or mitigation of user pricing for such services is not a failure of pricing policy but part of a deliberate policy of redistribution and community building.

Betterment also arises from the regulated supply of permits to take land from one category of use or development to another higher order category. As in other regulated markets, for example, licenses granted for fishing, broadcasting, taxis, liquor retail, or gaming machines, the supply of land development permits is restricted for social efficiency reasons. Without basic town planning regulation placing limits on where different types of land use might take place, dysfunctional patterns of development are likely to arise bringing with them a range of environment, social, and financial costs. These limits on the supply of development permits create a scarcity premium which, in the absence of countervailing measures, will be capitalized into the value of sites designated or approved for higher order development.

From time to time, there are calls to tax the betterment margin in the land development process, both to pay for compensation in those cases where public intervention reduces land value, and to help fund social infrastructure. The design of a fair and robust betterment tax has proven difficult in Australia, notwithstanding the powerful theoretical arguments for such an initiative (Fensham and Gleeson, 2002).

The case for betterment or land value capture may be better advanced if such measures are portrayed more accurately as development license fees, rather than taxes on unearned profits. Such a system applies in the Australian Capital Territory (ACT) where a statutory mechanism for charges for changes in land use operates alongside the development approval system. While the Territory's leasehold land tenure system facilitates the application of Change of Use Charges, or development license fees, the same principles could be applied in any tenure system.

Outward Urban Expansion

As noted, the underlying logic of the NRLV model applies equally in urban fringe expansion as it does in urban redevelopment. However, there are some significant differences in emphasis in the context of urban expansion.

The way in which infrastructure charging is applied in urban expansion may have greater impacts on the pattern and form of development. If part of the infrastructure costs is recovered from users 'up-front', by way of applying headworks charges on developers and requiring them to construct some facilities (e.g., local roads, local water, and power reticulation, etc.) at the time of subdivision, developers will be encouraged to pursue sites which can be more readily serviced through the extension of existing infrastructure. Moreover, they will have an incentive to develop at densities which reduce the infrastructure cost per lot. The resultant pattern of development is likely to be more orderly, less prone to fragmentation and leap frogging, and more compact compared to a situation where land is able to be subdivided in advance with infrastructure retrofitted and paid for through recurrent user charges.

More consolidated development facilitates efficient roll out of infrastructure, saving costs for the community as a whole (AURDR, 1995). Greater efficiency applies to social infrastructure as well as the extension of roads and piped services. Through containment of the number of development fronts, education, health, and public transport agencies are better able to provide essential support services to new communities in a timely fashion. Consolidation of development consequential upon up-front charging for infrastructure also mitigates speculative trading in raw land for urban subdivision. Prior to the introduction of developer responsibility for on-site services and district trunk charges in Australian cities during the 1960s and

1970s, suburbs sprang up in ad hoc fashion. Much good quality farmland close to the urban fringe was lost to full production as speculators took up holdings in expectation of the windfall gains to be made through sales to bona fide developers.

However, as a method of user charging, development contributions suffer from several shortcomings (Kinhill, 1995), namely:

- they deny consumers effective choice regarding the timing and quality of infrastructure provision; and
- they offer less flexibility in the management of infrastructure demands, that is, changes in the consumer's consumption behavior do not directly impact on the charge.

There is also an often repeated critique that development contributions may reduce housing affordability, because of the front loading of infrastructure costs into land prices. On this score, it is interesting to note the comments of the Industry Commission (1993), now Productivity Commission, that, in an efficient market, there should be no difference in principle between a buyer paying for infrastructure through higher mortgage repayments (derived from the imposition of development contributions) and the same buyer paying for this infrastructure through higher recurrent user charges. Nevertheless, development contributions continue to attract adverse public commentary on affordability grounds (Minister for Housing, 2009).

Because of these problems, a good case can be made for confining infrastructure charges to items where consumer choice would be limited in any case because of health and safety reasons, or because long-running provision costs would be higher under alternative arrangements. Such items might include economic infrastructure (i.e., water supply, sewerage, drainage, roads, and public transport corridors) and those elements of new residential areas which need to be reserved in advance of full development, for example, recreational areas (but not embellishments) and sites for local community facilities (but not the facilities themselves).

Furthermore, decisions about which items might be covered by development contributions should consider the degree to which infrastructure supply costs vary from one development location to another. If there is little or no spatial variation in delivery costs at the local level, for example, in the case of higher order headworks (dams, generation plants, etc.), the locational signaling role of development contributions becomes irrelevant and with it one of the key efficiency arguments in favor of this form of infrastructure funding. In these circumstances, alternative user charging arrangements, for example, access and recurrent charges levied directly on users by utility companies, are likely to be preferable.

In practice, there can be wide variation on the scale and range of infrastructure charges to developers. In 2009–2010, the Australian Productivity Commission undertook a study benchmarking performance of State and local governments in planning, zoning, and development assessment across Australian cities. This study found infrastructure charges varying from \$37000 on average per greenfield plot in NSW covering a broad range of

Box 5.1 Principles underlying the application of development contributions.

1. **Need and nexus**
   The need for the infrastructure included in the development contribution plan must be clearly demonstrated, and the connection between the development and the demand created should be clearly established.
2. **Transparency**
   Both the method for calculating the development contribution and the manner in which it is applied should be clear, transparent, and simple to understand and administer.
3. **Equity**
   Development contributions should be levied from all developments within a development contribution area based on their relative contribution to need.
4. **Certainty**
   All development contributions should be clearly identified and methods of accounting for escalation agreed upon at the commencement of a development.
5. **Efficiency**
   Development contributions should be justified on a whole of life capital cost basis consistent with maintaining financial discipline on service providers by precluding over recovery of costs.
6. **Consistency**
   Development contributions should be applied uniformly across a development contribution area and the methodology for applying contributions should be consistent.
7. **Right of consultation and arbitration**
   Land owners/developers have a right to be consulted on the manner in which development contributions are determined and the opportunity to seek a review by an independent third party if they believe the calculation of contributions is not reasonable in accordance with set procedures.
8. **Accountability**
   There must be accountability in the manner in which development contributions are determined and expended.

Source: Adapted from the Western Australian Government (2009) by the Productivity Commission (2011), p. 202.

economic and social infrastructure charges to $3 693 per greenfield plot in South Australia. In line with the findings it had made in earlier inquiries (Industry Commission, 1993), the Productivity Commission noted in its 2011 report that recovery of the cost of infrastructure by way of up-front user charges through the development assessment system is most appropriate where the facilities in question are used to service a particular development rather than the broader community. From this the Commission sets out a number of principles underlying the application of development contributions (see Box 5.1). These, and related best practice principles, are discussed in more detail later in the chapter.

Planning Systems and Land Use Regulation

Turning now to the question of land use planning systems, the scope of the following discussion is largely limited to regulatory matters—how development control rules are made and administered. Planning governance or the distribution of decision-making authority across the various spheres of government—local, regional, State, and national—is also of vital importance in any analysis of effective urban management and is discussed more fully in Chapters 2 and 9.

Elements of Planning Systems

The legislative and administrative frameworks for planning in the Australian States and Territories vary significantly, reflecting differences in the roles of State and local government, settlement patterns, and the evolution of case law (Centre for Developing Cities, 2003). Nevertheless, all of these systems can be analyzed in terms of three elements:

1. those parts of the system to do with the *making of plans*;
2. the *substantive content* of those plans; and
3. the processes and procedures by which development proposals are assessed.

Plans and Plan Making

The institutional processes by which plans are made are important. Relevant issues include the level of autonomy enjoyed by local government in plan making and the mechanisms for coordinating the activities of government departments impacting on land use outcomes.

Local government planning schemes are common place in Australian planning systems but they certainly do not represent the limit of the plans that can affect the use and development of land. Depending on the State in question, regional planning schemes, State planning policies, and metropolitan overlay plans may be enforced.

Furthermore, plans are not confined to instruments made under planning legislation. Laws dealing with emission control, protection of habitat and waterways, heritage conservation, access to and impacts on State highways, environmental health, liquor licensing, and so on can be used to make effective land use plans albeit that these may be sectorally focused.

The Substantive Content of Plans

What actually goes into plans can be usefully considered separately from the processes for making them. From the perspective of urban growth and infrastructure systems, key areas of policy content include

- the scope of development impact assessment;
- land release and infrastructure coordination strategies;
- development standards; and
- infrastructure funding mechanisms.

Development Assessment Processes

Decision-making discretion within the development approval process is, in large part, informed by the policy content of the planning instruments noted above. Many systems also allow for extensive unguided discretion. The development assessment component of the planning system generally comprises seven stages:

1. Consultation with Council (and other approval authorities);
2. Formal lodgment of a development application;
3. Review of the application, including advertising or 'public exhibition' of the proposal;
4. Requirements to refer the proposal to other agencies for comment;
5. Evaluation and determination of the application;
6. Advice on decisions; and
7. Appeals.

Each of these planning system elements is discussed in more detail in the following pages, with a view to identifying some general principles for the design of efficient and equitable regulatory arrangements.

Plan Formulation

As noted, the legislative and administrative instruments by which land use and development outcomes may be influenced are many and varied. Each of these instruments may be regarded as a plan. Terminology tends to vary across Australian jurisdictions, but most systems feature at least the instruments listed in Table 5.1. In identifying a best practice model for plan making, several issues arise, including

- integration and coordination between plans covering the same geographic and/or topic area;
- the reconciliation of State, regional, and local interests in plan making;
- the involvement of the public in the plan-making process;
- the capacity to amend plans quickly in response to changing circumstances;
- the extent to which plans should confer compensable development rights on property owners; and
- the development control philosophy underlying the structure and format of plans.

Horizontal Integration in Plan Making

It is evident from Table 5.1 that there is potential for overlap and duplication between the various instruments which may be deployed to address a particular land use or development issue. Also of concern is that instruments designed for a particular purpose may have unforeseen development control implications elsewhere in ways which are inconsistent with already adopted

Table 5.1 Indicative range of planning instruments.

Council town planning schemes	Generally recognized as the principal tool for regulating local development outcomes in Australia. Can be based on prescriptive zoning regimes or more performance-based approaches (or various combinations of the two). The 'local' aspects of planning schemes often feature layers of control, e.g., broad land use zoning supplemented by structure plans and more detailed precinct development plans. It is also common for Councils to operate a set of policies to guide the exercise of discretion under these various plans
Regional planning strategies	Most metropolitan areas in Australia are covered by regional plans which set broad growth directions, development constraints, and population/ employment distribution targets. Regional plans may also be found outside major cities particularly in areas faced with sensitive environments and/or strong growth pressures. Regional plans set the framework within which local planning schemes are developed (but may or may not be directly referred to in local planning schemes). Regional plans are usually expressed through a combination of outline development plans and sectoral or thematic policy statements
State planning policies	These are formal declarations of policy dealing with development constraints and outcomes deemed to be of State-wide significance. No particular geographic or scale limits need apply to such statements. They can range from, say, State-wide tree clearing controls to the adoption of national building or development standards
Statements of Environment Protection Policy	These are often made under separate legislation dealing with emission control (i.e., protection of air quality, water quality, and noise). By establishing emission performance standards for particular activities within particular environmental settings, these policies are powerful determinants of land use outcomes in their own right
Requirements under specific pieces of infrastructure legislation	Legislation dealing with the provision and maintenance of State and national highways commonly empowers the State road authority to set and enforce policies regarding the type and intensity of development in relevant 'feeder corridors'. Similar provisions may be found in other infrastructure corporation legislation, for example, ports and railways as well as companies involved in the provision of power, telecommunications, gas, water, and sewerage services
Habitat preservation legislation	Most States have introduced legislation requiring a moratorium on development if endangered species are encountered
Cultural heritage legislation	This provides for interim or permanent protection of buildings and places found to have historic, aesthetic, educational, or other cultural significance. Again, such legislation is commonly separate from mainstream planning legislation
Coastal protection legislation	This 'single issue' legislation can establish littoral buffer zones, height limits, and other major constraints on development potentials in coastal areas judged to be sensitive
Health regulations	Health regulations can enforce *de facto* zoning by stipulating mandatory separations between various classes of land use. They can also influence land use mix by dictating specific design requirements for particular types of public access buildings

government policy. For example, surface runoff controls enforced under environment protection legislation may reduce development potentials in designated urban growth areas upstream.

Most States now operate some form of regulation review process to limit the potential for legislative duplication and conflict. However, those agencies responsible for regulatory review tend to rely on sectorally focused cost-benefit analyses. They generally do not have the expertise or analytical perspective to detect overlap and contradiction with respect to the *spatial* outcomes of proposed legislation.

The Cabinet review process is supposed to provide the ultimate forum for resolving the potential tensions between the various plans dealing with the same topic or area, but this step occurs very late in the policy development process. Furthermore, the central agencies which have responsibility for coordinated policy development across departments (e.g., Premier's Departments and Cabinet Offices) may also lack the expertise to see and deal with policy tensions of a spatial nature.

Those State departments that have custody of land use planning legislation are probably in the best position to coordinate legislative initiatives with the potential to impact significantly on land use and development outcomes. In this sense, such departments can be thought of as central policy agencies fulfilling similar roles to those of Premier Offices and Treasuries. However, they are rarely accorded this function in the machinery of governments in Australia and this frequently leads to generally unproductive debate among bureaucracies about the role and scope of spatial planning within the wider canvas of public policy. The parties which have tended to prevail in this debate argue that planning is simply about development control and should be confined to this space. Others see a wider 'spatial coordination' role for the planning department.

Vertical Integration in Plan Making

Policy discretion in local plan making will necessarily be constrained by the interests of the wider community whether this is regional, State, or national in character. For example, it would not be appropriate for local planning objectives to prevail over national conventions on ecological sustainability or for key State resources like high-quality agricultural land or mineral reserves to be compromised by local development preferences. This reflects the subsidiarity principle (Spiller, 2004).

However, the manner in which the custodians of these wider community interests intervene in local planning can have important implications for the efficiency of the planning system as a whole. If State interests are not reasonably well articulated in advance (in principle if not in detail), and if State Governments are seen to intervene on a whim, either in the introduction of overriding policies or by calling in particular development applications, local governments and the community generally can lose confidence in the integrity of the planning system.

The negative effects of unstructured pursuit of State interests, seemingly running counter to local community interests, often reduces the quality and quantity of community input to planning schemes (given that a community feeling marginalized by the process will be unlikely to put in effort to the planning process when those plans can be easily overridden) and reduces consistency in decision making by local governments. These breakdowns in the decision-making processes increase uncertainty in the urban development process and therefore the risk premium built into required infrastructure investment returns.

Regional and metropolitan planning requires both horizontal and vertical integration. This is further discussed in Chapter 9.

Community Involvement in the Making of Plans

Genuine public involvement in the plan-making process is critical to an efficient and effective planning system. Where there is substantial public involvement, better outcomes for both local communities and the planning system can be secured through a mutual understanding of needs, interests, and priorities. Community involvement is often particularly important to reinforce local communities' sense of ownership of, and identification with, their local area. Moreover, thorough community consultation processes clearly elaborate to the community the nature, requirements, and timeframe of plan implementation, minimizing the likelihood of future public objection and reducing the need to continually advertise development proposals during the implementation process. On the question of meaningful and genuine public involvement in plan making, the following general principles suggest themselves:

- No arbitrary distinctions are made between planning instruments with respect to when public involvement is mandated (although the scope of advertising may well vary depending upon the issue at hand). Thus, the making of State Planning Policies could be subject to the same advertising and public input requirements as, say, the making of local planning schemes.
- Interested parties have an opportunity to shape the terms of reference for major reviews and amendments of plans rather than being presented with faits accomplis.
- Persons making submissions to State and local government agencies regarding proposed plans or plan amendments have access to an independent review process.

Flexibility in Amending Plans

Local planning schemes are seen as the key building block in the planning system. They integrate local and wider community aspirations for land use and development outcomes based on local knowledge and accountability to local communities.

A corollary of this role is that planning schemes ought to be relatively stable policy documents, offering a degree of certainty to community members and development proponents alike. All interested parties should have the

Box 5.2 The structure and format of plans—Prescriptive versus performance-based planning.

Plans may be *prescriptive*, that is, spelling out both *what* and *how* certain development outcomes are to be achieved, or *performance based*, that is, stating the outcome required but allowing the development proponent to nominate the method by which such objectives may be achieved. The efficacy of performance-oriented development control systems requires the incorporation of 'deemed to comply' provisions whereby proponents who are unwilling or unable to devise their own solutions to the required outcomes are required to adopt a conservative 'default' prescription set out in the planning document.

Moving land use and development controls onto a performance-oriented basis has been promoted in Australian planning circles for over 30 years with only partial success. Implementation difficulties have arisen because of lack of clarity in the definition of performance requirements (i.e., lapsing into prescription), poor specification of deemed to comply provisions, and lack of training on the part of both design and development assessment professionals. Some commentators argue that a return to more prescriptive development controls would cut risk premiums in the development process and generally reduce transaction costs in the approval process (Adams, 2008).

Notwithstanding these difficulties, performance-oriented planning systems still offer considerable potential in terms of innovation in design practices across the gamut of professionals involved in the urban development process and foster a greater focus by planners on their core business, that is, defining environmental constraints and opportunities and setting desired outcomes.

security of knowing that any major changes in direction in the local planning framework will be subject to thorough going public consultation as outlined in the foregoing section.

The notion of third-party initiated and judicially reviewable amendments to planning schemes (as opposed to individual permit decisions) does not sit comfortably with the need for stability and community control in the planning system. By introducing the courts to the plan-making process, there is also a confusion of judicial (*policy interpretation*) and governance (*policy making*) roles in the planning system. Nevertheless, it is important to have reasonable flexibility in the plan-making process, so that the local development controls may be readily adjusted, without major policy shifts, as unforeseen circumstances arise.

A great deal of flexibility can be built into planning schemes by adopting a performance based rather than prescriptive regime for land use and development regulation (see Box 5.2). If properly drafted and administered, this approach would avoid the need for formal scheme amendments to accommodate minor rule changes.

Further flexibility can be introduced into the system by differentiating (by regulation or within the planning legislation itself) those minor matters which can be dealt with through a streamlined scheme amendment process. Such streamlining could involve no public consultation period or a limited consultation period and/or a reduced need for review by State Government agencies.

Development Rights and Compensation in the Plan-Making Process

Between major reviews which are conducted in an open and accountable way, local planning schemes have the potential to provide reliable and stable guides to development potentials and preferred development directions. This is critical to the efficient roll out of infrastructure, among other things.

An oft debated issue in this context is whether adopted planning schemes should be seen as conferring development *rights* on property owners. There are some serious practical difficulties with the idea that planning schemes can provide such security to land holders. Any curtailment of a development right would need to be measured in terms of lost development potential, but the development potential of a specific site is difficult to define prior to the determination of a development proposal by the relevant Council or approval authority. This is particularly true of performance-based development controls. Another important consideration relates to the need for the community to periodically review planning schemes without the threat of compensation claims from land holders who might be subject to varied development controls. Based on an 'urban efficiency' conceptualization of the role of planning (see discussion below), the object of any scheme review must be to maximize net community benefit regardless of the distributive effects. On this basis, distributive questions would ordinarily be left to the tax/transfer system. This view of planning generally prevails across Australian jurisdictions, but it is not taken to extremes. For example, compensation might be payable where land is required for some public purpose or where *all* development potential is removed. It might also be payable to persons holding legitimate development approvals but who are denied the opportunity to act on these by subsequent changes to planning laws.

These issues might be managed differently were a 'development licensing' system introduced. As discussed above, the conference of a development right under such a system would attract a fee reflecting the attendant scarcity premium and the capitalized value of socially funded infrastructure. If such licenses were to be canceled as a result of 'back zoning', the case for compensation would be much clearer. Moreover, there would be a pool of funds from which compensation might be paid.

The Policy Content of Plans

The substantive policy content of planning systems relates to desired development and settlement pattern *outcomes* as opposed to policy on the *processes* for making and enforcing plans.

Substantive policy content can reside in any of the instruments cited in Table 5.1, or it may be enunciated in State planning legislation itself.

Value-Driven Models of Planning

Any critique of substantive planning policy will be heavily influenced by the value stance of the analyst (though this is not often acknowledged). Operational philosophies of planning vary greatly, and their categorization carries the risk of oversimplification. Nevertheless, it is useful to distinguish between three broad models based on two parameters: firstly, the types of externalities considered as legitimate planning matters, and secondly, the extent to which land use planning should be used as a general tool of income redistribution.

The '*public health model*' derives its name from early land use regulation systems where the focus was on the separation of incompatible land uses and the preplanning of essential infrastructure, most particularly water supply, sewerage, and drainage. The distinguishing feature of this view of planning is its concern with the containment of negative externalities. While the public health school has ancient origins, there have been considerable advances in recent times regarding the most effective ways of dealing with pollution and other negative spillover effects of development. For example, current versions of the model see a greater role for pricing signals and the assignment of property rights in these matters.

The '*urban efficiency model*' argues that planning should be concerned with the creation and reinforcement of positive externalities as well as the mitigation of the negative environmental impacts of development. Positive externalities in urban development may arise from mutually supportive clusters of industrial activity, major agglomerations of commercial activity, and areas with heritage values or a distinct urban character.

This view of planning also emphasizes the need for efficiency in the provision of both private benefit and social infrastructure. This includes management of settlement patterns to reduce the need for travel, and staging growth to create inventory cost savings in water supply, sewerage, roads, schools, health-care facilities, and other urban infrastructure.

The *urban efficiency* model can be divided into two submodels. The first would draw no distinctions between types of external impacts when considering compensation flows from the beneficiaries of development to parties adversely affected by the development in question. Thus, if a development were to have an adverse social impact, for example, the displacement of low income housing in an inner city location, the development proponent would be seen to be equally responsible for mitigating this externality as they would for any adverse impacts on the 'physical' environment (e.g., overshadowing neighboring properties, interfering with smooth traffic flows, overloading existing infrastructure capacity, etc.).

The second urban efficiency submodel would claim that while all external impacts of development should be considered in the plan-making process, only particular types of impacts would be compensable by the proponents of development. In this context, the distinction between a planning matter and noncompensable impacts depends on the existence of other redistributive programs of government designed to address given impacts. Thus, under this submodel, developers of new residential estates on the urban fringe would not be expected to mitigate the adverse social impacts of deficient community infrastructure (schools, hospitals, community centers, etc.) as State Governments have accepted responsibility for delivering these services. These impacts of development would only draw an obligation for compensation if governments declare specific limitations to their social infrastructure responsibilities.

The issue of displaced low income housing poses a conundrum in this context. Australian State and national governments have not explicitly limited their role in social housing provision, but until recently the quantum of publicly provided resources flowing into social housing has been stagnant, if not declining, and has certainly not been sufficient by itself to maintain a healthy social mix in inner areas of Australian cities. In these circumstances, a strong case can be made for the adoption of Inclusionary Zoning (see below) and other planning mechanisms to part fund the provision of social housing in areas which would otherwise drift toward social polarization, with attendant social and environmental impacts.

A third operational philosophy of planning, described here as the *social resource model*, is concerned with positive and negative externalities of urban development but, in addition, would see a role for planning as an instrument of income redistribution. Such income redistribution would run beyond the compensation of adversely impacted parties from the betterment pool created by the planning and urban development process.[1] Planning controls and conditions would be seen, in part, as a means of generating supplementary resources for the provision of community benefits ordinarily funded out of general tax revenues.

Although implicitly adopted by many activist Councils, the social resource model can be seen to run counter to the broad thrust of social policy reform undertaken in Australia over the past three decades. This period has seen a concerted program to disentangle redistributive processes from industry and labor market policy. Until the early 1980s, considerable assistance to farmers, small business and home buyers, and other groups in the community was delivered through complex cross-subsidization mechanisms embedded in a regulated financial system. This part of the Australian 'social contract' has been abandoned because of distortions in financial resource allocation and the nontargeted nature of the subsidies delivered through the system (Kelly, 1994). Similarly, the various redistributive mechanisms woven into a highly regulated labor market have been wound back in favor of more explicit and targeted assistance to particular groups of workers. Targeted industry assistance has been substituted for a once impenetrably complex regime of tariff and other trade barriers. Further examples of such reforms may be found in the corporatization and commercialization of public infrastructure agencies where various classes of users deemed to be in need of assistance are now protected by explicit community service obligation payments rather than cross-subsidies among customer groups.

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[1] Confinement of redistribution to these compensatory payments would make the model a variant on those in the urban efficiency school.

The social resource model of planning is clearly out of step with these shifts in Australian society. The need to build on the nation's competitive strengths including the livability and broader efficiency of its major cities tends to rule out the public health model as being too narrowly focused. This is why the urban efficiency model of planning has been widely adopted. Accordingly, against the backdrop of the urban efficiency model and the values it carries, the chapter will now discuss four substantive policy areas of particular interest to the housing and land development industries because of their ability to drive infrastructure demands. These policy areas are

- the scope of impact assessment considerations;
- settlement pattern and land release policies;
- development contributions for infrastructure; and
- residential development standards.

The Scope of Impact Assessment

Environmental impact assessment lies at the heart of both plan making and development approval processes. Transparency in the scope of these considerations is essential if consistency in successive generations of policy making is to be maintained and litigation minimized. The pursuit of efficiency in urban development rules out the arbitrary exclusion of particular types or classes of environmental impact in the planning process. It is appropriate, therefore, that planning legislation includes an all encompassing definition of environment. Most planning legislation in Australia now include a holistic definition of the scope of environmental values, to include social factors (cultural qualities, sense of community, and aesthetic values) as well as natural and physical resources.

While all impacts on a broadly defined environment are taken into account in framing plans and assessing development applications, there is a compelling case, as noted, that development potential ought not be constrained, or development proponents called upon to provide compensation, where the (social) environmental impacts in question fall within the already declared redistributive responsibilities of government. This will mean that planning matters will generally, though certainly not always, be confined to impacts on the physical environment.

Settlement Patterns and Land Release

Considerable policy regarding when and where land is to be released for urban development has been directed at creating efficiencies for government infrastructure programs. This approach runs the risk of compromising overall urban efficiency. What is a cost-effective pattern of settlement from a public sector perspective may impose relatively high costs as far as privately funded infrastructure is concerned (Industry Commission, 1993). While public sector outlays on social infrastructure are substantial, and taxpayers demand cost-effective delivery of urban services, the lion's share of urban infrastructure costs are privately funded. Moreover, the least cost pattern of development may not be the most efficient in a resource allocation sense. If achievement of the least cost pattern means that consumers are denied housing and lifestyle choices which they prefer, overall welfare may be diminished by planning policy.

Urban efficiency may be assisted by a market-driven approach to land release arrangements. This would require that, in the first instance, plans would be based on clearly defined environmental constraints and soundly argued potentials for positive externalities (e.g., the need for a hierarchy of major centers to contain aggregate travel demands). The costs of supplying both private benefit and social infrastructure would also enter into the analysis, but these should not be regarded as the only drivers of policy.

Such plans may nominate a release scheme which is deemed to be cost effective from a total infrastructure cost perspective. This may be adopted for service planning purposes by social and private benefit infrastructure providers alike, but developers would have the opportunity to take on projects which are 'out of sequence' provided these projects continue to observe the environmental and strategic considerations underpinning the plan, *and* provided the developers are prepared to meet the additional infrastructure costs involved. The latter could include the cost of having to provide social infrastructure to an area sooner than what had been allowed for under the adopted release scheme.

Development Contributions

While they all require financial or in-kind commitments from project proponents, development contributions come in various types. Distinguishing between these various forms is of more than academic significance as the principles governing the fairness and applicability of any given type of contribution can vary considerably, with major implications for how such levies are implemented via planning and institutional frameworks such as those operating in Australian jurisdictions (Gurran *et al*., 2010; Productivity Commission, 2011).

There are essentially three 'core' types of development contribution: user-pays charges, impact mitigation levies, and betterment levies (Figure 5.2). The rationale for these and the principles governing good practice in their application are discussed below.

In addition to these three contribution types, development proponents may sometimes be required to make cash in lieu payments for 'Inclusionary Zoning' (IZ) provisions. IZ may apply to any development standard necessary for the preservation or creation of particular environmental values in an area. For example, proponents may be required to incorporate a certain amount of car parking in their project or pay the Council the cash equivalent for this parking to be provided elsewhere in the neighborhood, otherwise accessibility within the precinct may be unduly compromised. Similarly, developers may be required to incorporate a given number of affordable housing units in their projects or pay cash for these units to be provided elsewhere. This may be justified on the basis that maintenance of social mix is an environmental value recognized in most contemporary planning statutes in Australia.

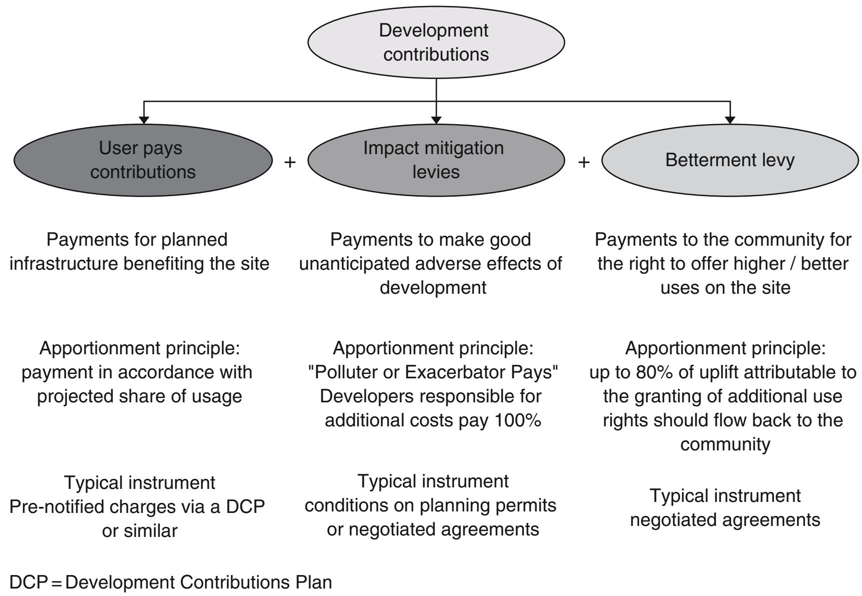

Figure 5.2 Overview of development contribution types.

When applied as *User Charges*, development contributions are payments required of developers to help fund planned infrastructure which will be directly used by the development in question. The cost apportionment principle applied here is 'user pays', that is, developers contribute according to their projected share of beneficial usage of the items in question.

In most Australian jurisdictions, approval authorities wishing to levy such infrastructure charges are required to prepare a development contribution plan (DCP) ahead of any exaction. The DCP identifies the area subject to the charges, the works that will be charged for, and the amount that will be charged per dwelling or equivalent demand unit. As these contributions are calculated according to the user-pays principle, that proportion of the usage of the planned infrastructure works which will be generated by preexisting development is netted off the aggregate cost to be recovered from future new development. This is known as the 'discount for existing development'. Discounts may also be made for 'external usage', that is, usage of the infrastructure generated by development which has or will occur outside the Contributions Plan area, or outside the catchments of the infrastructure items in question.

Once infrastructure charges are conceptualized as a form of user charge rather than a tax, certain principles of fairness and accountability about their collection and deployment follow:

- The development contributions should be linked to a clear services provision plan.
- This provision plan should embody infrastructure performance requirements in line with reasonable community expectations and engineering

requirements which minimize the community-wide life-cycle costs of meeting these requirements.

- Infrastructure charges should be used exclusively for the provision of the facilities and services for which they were levied. Where an originally planned for infrastructure item is no longer required, funds collected for this purpose should be returned to users who paid the charge. This return of funds could occur in cash (e.g., local rate rebates) or the supply of substitute infrastructure with comparable benefits for the community in question.
- Infrastructure charges should be equitably apportioned based on estimated shares of facility usage. This will generally require a disaggregated, catchment-based approach to the calculation of charges, utilizing a transparent process.
- Charges should also be struck at levels which avoid cross-subsidies between early and later development projects in a catchment.

Because of self-imposed and official borrowing constraints in public sector infrastructure agencies, and the desire of such agencies to avoid risk regarding the direction and timing of future urban growth, development proponents are often called upon to supply facilities or services which exceed the demands of their particular project. That is, they are required to contribute infrastructure over and above a reasonable charge based on the principles outlined above. Provided such projects are generally in accordance with a preferred sequence of development and provided the proponent is prepared to accept development timing risk, it would be reasonable to mandate reimbursement schemes bearing interest.

Many Councils apply a user-pays-based approach but without a formal Contributions Plan. These Councils may have a schedule of works (published or unpublished) which is used to guide negotiations with development proponents on case by case contributions. Should negotiations break down and wind up in court, similar cost apportionment principles to those applied in a formal DCP will generally be invoked to resolve the dispute.

Whereas user charges for infrastructure apply to planned infrastructure, development contributions enforced as *Impact Fees* may apply when a development creates unanticipated or unplanned demands on local infrastructure by virtue of its particular design or timing. For example, a large multi-unit development in an infill location may be required to make a routine 'user-pays' contribution under the DCP of, say, \$1500 per dwelling for the planned upgrading of drainage in the area. However, because of the particular approach to landscaping or site coverage, the project may generate significantly more runoff than a typical development of this size in the area in question, necessitating the installation of an additional retarding facility off-site. The cost of incorporating this facility into the drainage network could reasonably be fully recovered from the development proponent on top of their regular drainage contribution. Another example, more relevant in greenfield areas, relates to out of sequence development, where the proponent may be called upon to compensate public transport, roads, health, education, and other infrastructure agencies for the cost of accelerating services to the site in question, while maintaining services in 'in-sequence' development areas.

The ruling principle for cost apportionment with impact fees is not 'pay according to share of use' (the drainage retarding facility and the accelerated infrastructure items in the above examples may be 'used' by developments across wider catchments). Rather, it is the 'polluter or exacerbator pays' principle, ensuring that those who cause the cost impact are 100% responsible for mitigating that cost. This would apply even if the unplanned additional investments in local infrastructure subsequently provide opportunities/benefits for other developments. Unlike user charges, impact fees for infill, brownfield, and other sites cannot, by definition, be prenotified. They must be worked out on a case by case basis.

Compensating for the adverse impacts of development, either by modifying project design, or by making cash payments to accelerate infrastructure or fund off-site mitigating works, is integral to the development approval process in Australia. It is well accepted by all parties in principle, though the detailed resolution of cost liabilities will always remain the subject of intense negotiation and occasional litigation.

The rationale for applying development contributions as 'Betterment Levies', 'value capture' payments, or development 'license fees' has nothing to do with charges for beneficial infrastructure, or with compensating for the unanticipated adverse effects of development. It relates to the fact that the site in question may be the subject of an uplift in value conferred by the wider community by virtue of its regulation of development approvals and investment in social infrastructure which will benefit the site in question (see earlier discussion). Conceptually, the three types of development contributions are additive, that is, they could apply simultaneously to the same development.

Development Standards

Residential development standards relate to design including density, local street layout, privacy, sunlighting and daylighting, private open space, setbacks and streetscape, landscaping, parking, and building appearance. The setting and administration of such standards in line with the urban efficiency model of planning would avoid preempting market choices. A performance-based regulatory regime would be preferred where desired outcomes are clearly specified and the method for achievement of these outcomes is left to development proponents (Centre for Developing Cities, 2003).

Development Assessment Processes

Legislated and administrative processes for the assessment of development proposals can relate to

- planning permit applications;
- building permit applications; and
- license applications (e.g., to sell liquor, to make certain discharges into the environment, to run particular types of health-care facilities, etc.).

Particular types of development, or development proposals affecting particular areas, may also be subject to enhanced evaluation and assessment procedures under Australian or State law (i.e., environmental impact assessments).

Rezoning applications are not included on this list because they constitute planning scheme amendments. They are subject to the comments and assessment criteria discussed earlier in relation to 'plan making'.

In reviewing the efficiency of development assessment processes, certain issues recur across Australian jurisdictions. These are

- the multilayering of approval processes;
- the treatment of large-scale projects, or projects undertaken over a long time frame;
- certification of compliance with technical codes for development;
- advertising of development proposals and the extent of third-party objection and appeal rights;
- the role of referral agencies; and
- the circumstances warranting Ministerial intervention.

Multilayering of Approval Processes

Applications for a planning permit, lodged with the local Council, are often the first formal step in a long list of approval hurdles faced by development proponents. In some planning systems, it is not uncommon for proponents to be required to re-present information in successive rounds of decision making. Different emphases may be required in the way this information is marshaled, leading to considerable additional expense in proposal documentation as well as lengthy delays in decisions.

Efficiency would be optimized if the approval processes of State and local government agencies were undertaken concurrently. Moreover it would be useful if development proponents had a single point of contact for advice regarding concurrent and sequential approval processes and the type of information which will be required by various decision makers. Local governments may be best placed to provide this 'one stop shop'.

Treatment of Large-Scale Projects

It is often difficult to resolve in advance all details of large-scale development proposals or projects undertaken over several years (e.g., major new residential communities). For larger projects, the cost of detailed documentation may be prohibitive given the possibility of refusals or significant amendments emanating from the development assessment process. For longer term projects, it is important to maintain flexibility in project design because of possible shifts in market demand.

Planning systems should be capable of providing binding 'in principle' approvals. A formal 'in principle' approval may be subject to the finalization of project details (by stage or for the whole project), but would protect the proponent from any reevaluation of the issues already considered by the approval authorities. In the case of major housing development, the 'in principle' matters might relate to overall density, the land budget for the project, and other key factors impacting on project viability. Such matters would not be revisited when the proponent came forward with an application for a development permit. Rather, development assessments in this subsequent stage would focus on issues like site planning, streetscape integration, on-site integration of project elements, architectural treatment, and so on.

Such a facility is important for efficient project financing. The providers of debt and equity finance will have some certainty that a project will proceed even if its final shape is yet to be determined. Such efficiencies translate to smoother supply side responses to market shifts, because the planning/financing pipeline is shortened. This, in turn, would assist decision making in infrastructure planning and investment.

Private Certification and Technical Panels

Detailed assessments of environmental capacity are central to the process of making a planning scheme or similar instrument. Such assessments of opportunities and constraints need to be related to other planning objectives including those relating to accessibility, urban form, and the public domain.

Given such analyses and full public input as discussed above, it should be possible to clearly identify within schemes those land uses and types of development which are judged to have satisfactory environmental/planning impacts in various parts of the jurisdiction in question. These parts may be defined by way of 'zones' or some other spatial description. These 'preferred uses' may be simply defined (e.g., farming in a rural zone) or by reference to various technical codes (e.g., a dwelling built in accordance with the Building Code of Australia).

Assessment of development proposals fitting within this 'preferred' category under the planning scheme could be a matter of technical review only, providing confirmation that the development complies with relevant building, engineering, and other design codes. Prima facie, it would assist the efficiency of the development assessment process if the 'front end' effort to identify preferred uses and the technical conditions attaching to them were maximized.

As in any other market for services, efficiency may also be assisted by making the assessment of compliance with technical codes and conditions contestable if not open to full competition. Arguably, private certification of compliance is appropriate because it would involve no policy interpretation on behalf of the wider community. These policy matters will have been dealt with during the plan formulation process.

For true efficiency gains, a genuinely 'level playing field' would need to be created. Among other things, this would require private certifiers to bear the same financial risks as their public sector counterparts in terms of any errors committed in the application of relevant codes or in the checking of relevant project documentation.

While independent private certification may provide a spur for more time-efficient assessment practices within local government, *self*-certification raises a number of difficult issues. The balance of incentives faced by the self-certifier cannot be assumed to be consistent with the public interest.

Liability for the costs of structural failure (linked to inadequacies in the certification process) may not be a sufficient deterrent to malpractice, particularly where long-lived buildings and urban infrastructure are involved.

There has been strong advocacy from the development sector in recent years for the extension of 'technical assessment' to the great majority of development applications made under planning legislation. The PCA (2009), for example, argues that elected councilors should set policy and then leave the implementation of these rules to arm's length technicians or 'Development Assessment Panels'. The PCA likens this approach to the establishment of road laws by the State Parliament and the enforcement of these laws by the police. The difficulty with the PCA argument is that if the planning rules in question require significant interpretation of policy intent, the technicians charged with making approval decisions would be drawn into a 'political' role for which they have no mandate. The rejoinder is that a 'separation of roles' approach would provide councilors with an incentive to get their policy frameworks and rules 'right' in the first instance. This, however, has proven difficult in practice, particularly in a performance-based development control framework.

To some extent these tensions in development assessment, between the imperative to reduce holding costs by streamlining decision processes and the need for proper community scrutiny of potentially controversial proposals, have been reconciled in the work of the Development Assessment Forum (DAF) in Australia. The Forum includes representatives from all levels of government, the development industry, and related professions. It has developed a leading practice development assessment model involving six tracks linked to the complexity of the project in question and the extent to which it might be amenable to technical certification. The tracks include exempt, prohibited, self-assess, code assess, merit assess, and impact assess. More information on track-based assessment can be found in DAF (2005).

Advertising and Third-Party Appeal Rights

If there is extensive public consultation in the plan-making process, third-party appeal rights could be restricted to those parts of development proposals which have not been anticipated in a planning scheme. For discretionary uses, where the conditions of approval have been clearly foreshadowed in a planning scheme, it may be appropriate for the assessment authority to require advertising of the proposal and to accept submissions, but third-party appeal rights may not apply. For all other proposals, full notification and appeal rights may be warranted.

Referral Procedures

As discussed, there are good reasons to operate the development assessment process on the basis of a single application (to local government) with referrals to other interested parties. In this way, several assessments can be undertaken concurrently rather than sequentially. Under such a system, referrals could be made by the local government, operating in accordance with regulations and guidelines issued by the State Government. Alternatively, the applicant could have the responsibility for making referrals after advice from local government.

From an efficiency perspective, it is important that the number of referrals is minimized. Only agencies with a genuine interest should be entitled to review a proposal. As far as possible, referral agencies should include their permission criteria in planning schemes or in other published plans so that the maximum delegation of these decision-making processes to local government can occur.

Referrals must be handled expeditiously and fairly, with appropriate disciplines being applied by all players. For example,

- agencies might be required to adhere to reasonable deadlines in providing their approval conditions or requests for additional information; agencies failing to comply with these timelines might even be deemed to support the proposal as submitted; and
- development proponents should have access to independent and authoritative arbitration should they feel the information requests made of them are unreasonable.

Ministerial Interventions in the Development Assessment Process

By definition, Ministerial intervention in development assessment processes cuts across the established role of local government. It sends a signal to stakeholders that the local planning scheme may not be the preeminent guide to future development, notwithstanding the extensive public input to the construction of such schemes. Accordingly, Ministerial intervention can undermine wider community confidence in the planning system and should be used sparingly.

Efficient planning legislation would limit such interventions to matters of State significance and would provide some guidance as to how such significance might be judged. Ideally, these tests would be fleshed out in a State–local government protocol. Where Ministerial interventions do occur, fairness would suggest that they should be subject to the same notification and submission rights as would have applied had the proposal been dealt with via the standard procedure under the planning scheme in question. However, appeal rights would not apply (except for matters of judicial review) because, in general, it would be inappropriate for an appointed court to overrule the policy decision of an elected government.

Overview of Good Practice Principles

A generalized checklist of good practice principles in the design of land use regulation systems can be drawn from the foregoing discussion and are set out in Table 5.2. This provides a starting point and, perhaps, a conceptual

Table 5.2 Good practice principles.

Plan making	▪ Identify the State planning department as the principal agency for coordinating government initiatives with potential to impact significantly on development and land use outcomes ▪ Incorporate an intergovernmental protocol or a statutory provision which outlines the roles and responsibilities of the various spheres of government in planning and which describes the matters which might constitute 'national, State, and regional interests' ▪ Require State agencies to declare their interests and requirements at an early stage in the plan-making process ▪ Require the same public consultations for proposed regulatory initiatives affecting land use and development outcomes, regardless of the statutory origins of these initiatives ▪ Wherever possible, provide for a two-stage consultation process, so that interested parties may comment on the terms of reference for major planning initiatives as well as draft plans ▪ Provide for independent review of public submissions regarding significant planning initiatives ▪ Avoid court appealable amendments to planning schemes (other than for judicial process review) ▪ Make provision for a 'fast track' scheme amendment process to deal with a predetermined range of minor planning matters including marginal changes to development standards ▪ Provide for compensation rights only with respect to reservation of land for public purposes, the 'sterilization' of land which previously had development potential and the cancellation of existing development permits ▪ Make maximum use of performance-based formulations in the structuring of land use and development controls
Substantive content of plans	▪ Adopt a broad definition of environment including social as well as physical resources and conditions ▪ Make a clear distinction between environmental impacts which are compensable by development proposals and those impacts which are the province of other government redistributive and compensatory programs ▪ Adopt a market-driven approach to land release, including the opportunity for developers to pursue out of sequence projects provided they are prepared to meet the additional infrastructure costs involved ▪ Formally distinguish between three types of development contribution—user charges, impact mitigation payments, and betterment levies or development license fees ▪ Restrict the application of infrastructure charges to facilities and services where consumer choice would have been limited anyway for reasons of health and safety or compelling savings in long-term provision costs

Table 5.2 (*Cont'd*)

Development assessment	▪ Require a single application and referral approach to development assessment as opposed to the operation of several separate approval systems ▪ Utilize track-based assessment to stream development applications according to their complexity and potential for technical (nonpolitical) determination ▪ Except in unusual circumstances, require local government to perform the application registration and coordination role in this single application approach. That is, local government would have responsibility for direct referral of applications or advising development proponents of those agencies which have a referable interest in the proposal and, after due consideration by all interested parties, would issue a single comprehensive decision ▪ Make provision for formal in principle approvals which are binding on relevant development assessment authorities. In this context, 'binding' means that the parameters agreed upon in the in principle approval may not be revisited when a development permit is sought (unless otherwise agreed by all parties including the development proponent) ▪ Encourage the identification of preferred uses and development as part of the making of planning schemes. Preferred uses would be precertified as being acceptable from an environmental impact point of view and their approval would only be subject to compliance with technical codes ▪ Provide for independent private certification of compliance with technical codes ▪ Link third-party notification and appeal rights to the extent to which the developments in question have been anticipated in the planning scheme (or similar instrument) ▪ Provide for universal standing with respect to third-party submission and appeal rights ▪ Encourage referral agencies to include their permission criteria in planning schemes or other published plans (so that proposals meeting the criteria can be approved by local government under delegation) ▪ Establish strict timelines within which State agencies must respond to referred applications ▪ Provide for independent arbitration where the development proponents feel the information requests of referral agencies are unreasonable ▪ Explicitly limit Ministerial interventions in development assessment processes to matters of State significance. Tests for such significance should be included in legislation and/or formal protocols between State and local government ▪ Make applications dealt with under these 'Ministerial call-ins' subject to the same notification and submission rights as would have otherwise applied, except that they would not be court appealable

framework for addressing these issues in any particular jurisdiction. Clearly, local circumstances and, indeed, differing planning values and priorities might warrant a significantly different approach.

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6

Financing and Managing Urban Water

Kath Wellman

Introduction

Water is complex and ubiquitous. It is a major component of all living systems, not only inextricably bound within living cells, but also providing a medium for bacteria, viruses, and other living organisms. As humans it is part of us, we drink it, we wash in it, we enjoy it in recreation, we grow our gardens with it, we are cooled by it, and we transport our human waste in it. The Water Initiative of Australia (COAG, 2004) recognizes the broad and important role that water plays and designates water as part of the nation's natural capital, serving productive, environmental, and social objectives.

The fact that water is necessary for us to live does not mean that water is accessible to all. Water is a finite substance with irregular distribution. Even countries which have sufficient water for their needs may not have water in the right place at the right time or in the right form. This necessitates the careful consideration of how we acquire and subsequently manage water, particularly for our urban areas.

The varied nature of water and the different values attached to it ensures there is no uniform perception of water. As an essential good for both man and natural ecosystems, there is a strong case for water as a public good. However water's scarcity, the diversity in its use, and the different values attached to water in its different forms and functions makes it extremely complex to make policy decisions on how water is valued and used. This has led to increasing calls for water to be considered an economic good (ICWE, 1992; Seabright, 2004; COAG, 2004 and Productivity Commission, 2008a), letting price mediate between the different values that communities, firms, and individuals attach to it.

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

However, a purely economic approach to water does not value the social and environmental dimensions of water. Dovers (2008, pp. 90–91) noted that property right instruments (water as a tradable commodity) shift the policy logic from distributional equity with ecological consideration, to economic efficiency with sustainability concerns based on the market being founded on robust, ecologically sustainable limits. In this he does not discount the potential of the market to allocate scarce resources but notes the need for allied and supporting policy instruments. This is particularly pertinent where water impacts on development in other sectors, such as health, biodiversity conservation, land development, energy, etc., and is in turn impacted by them. Here broad intersectoral and/or cross-government approaches may be needed to develop policy and regulatory frameworks within which markets for water can be facilitated to drive efficiencies in cost, allocation, and innovation. Discussions on cross-sectoral approaches to urban policy, including tensions and benefits inherent in these, are discussed in Chapters 1, 2, and 9 and will not be covered in this chapter. This chapter deals specifically with those factors which drive or have the potential to drive efficiencies and security within the urban water sector itself.

Urban metropolitan areas in Australia support over two thirds of the population (ABS, 2009). As noted in Chapter 1, these urban populations are projected to grow faster than the population of Australia as a whole at over 1% per annum. Prolonged drought in most metropolitan areas in the early years of this century left most metropolitan water utilities ill prepared to meet demand utilizing traditional water sources such as mass storage dams. This has necessitated a review of how we balance supply and demand for water in our cities and the structure and finance of the urban water industry. These form the central themes for this chapter.

The chapter first provides a spatial and environmental context for understanding the interconnections in how water flows through environments and in particular cities, in a description of the urban hydrological cycle. The predicted impacts of climate change on the hydrological cycle and water management are then described. Having set the context, this chapter then tackles the major issues currently facing Australian urban water management: firstly exploring issues of demand and supply and secondly financial and structural arrangements in the urban water industry.

In investigating the nature of demand and supply, the following four themes are addressed.

1. Water security: Balancing water supply and demand within defined risk tolerances.
2. Demand management: Examining the potential for demand management and the techniques currently used in Australia.
3. Access and water pricing: Analyzing the existing base of pricing and the potential for water scarcity pricing to balance demand and supply.
4. Water supply: Broadening the search for water sources beyond metropolitan storage dams and examining their cost structure.

The final sections of the chapter describe the structure and finance of water utilities. These sections address how decisions are made for water infrastructure investment, whether and where competition can be utilized to increase efficiency, and how the investment and economic performance of government-owned water utilities can be improved. This discussion is placed within the context of the microeconomic reforms discussed in Chapter 1 and issues of productivity and finance discussed in Chapter 3. It is structured under three broad headings.

1. Ownership and governance: Analyzing issues which arise from water utilities present structure of vertically integrated government monopolies.
2. Value chain of water management: Identifying potential functions that could be unbundled to become contestable and differentiated.
3. Financial structures: Examining the financial structures of current water utilities to define levers to improve investment and economic performance.

Finally conclusions are drawn on potential areas for reform.

The Urban Hydrological Cycle

The natural hydrological system is driven by energy from the sun, gravity, and forces of cohesion in water. Rain (or snow) falls under the force of gravity. Some rain (or snow) falls over land. This is either absorbed by the earth or remains on the surface. Water that is absorbed by the earth is utilized by plants or soil organisms or gathers in underground aquifers, which vary in size from small streams to large underground lakes. Plants translocate water from their roots to their leaves where water is utilized in photosynthesis to form carbohydrates and is also transpired from the leaves to cool the plant. Trees act in a similar way to a pump transferring water from underground into the atmosphere, utilizing the cohesive force of water.

Water that remains on the surface of land either pools or evaporates or runs across the land in connected, dendritic drainage systems, ending up in lakes or the ocean. Water in these drainage systems is subject to evaporation. Subsurface water in underground aquifers can breach the surface of the land in streams or springs.

Of course the hydrological system is more complex than this. As to what water is absorbed by the earth is highly dependent on surface attributes. Heavily vegetated cover on light soils such as a coastal heath or a forest on sand will generate very little runoff. Hard urban surfaces such as rooftops and asphalt will generate almost 100% runoff. Thus, shifting a landscape from a natural or rural landscape to an urban landscape can have a profound effect on the regional hydrological cycle, generating substantially more runoff and reducing infiltration. In an urban environment this water needs to be managed, otherwise the compound effect of large areas of increased surface runoff will create flooding of both man-made and natural systems, and water quality lowered by urban pollutants.

How much water flows through a drainage system depends on a number of factors. These include the size of the catchment contributing to the drainage system, the surface characteristics of the catchment, and the rainfall frequency, intensity, and duration. Often intense storms are short-lived and cover small areas. Here runoff, initially falling as rain high in a catchment, reaches a point in the lower part of a catchment long after the rain has stopped and the lower part of the catchment is no longer contributing to the drainage flows. Longer duration storms usually cover larger areas and fall at lower intensities. Engineers have monitored the intensity and duration of rainfall in cities to develop tables which allow them to design drainage systems to deal with peak flows (Carpenter, 1976). Facilities such as car parks and ovals are positioned along drainage lines to act as supplementary floodplains and often form part of connected open space systems utilized for recreation, transport (pedestrian and cycle ways), bioconservation, city structure, and flood control (see Whiston Spirn, 1984). Where there is sufficient area within the drainage network, water may be impounded in small dams, ponds, and wetlands. The function of these may be aesthetic or utilitarian, with ponds often having a dual function supplying irrigation water to golf courses or ovals and wetlands increasing the quality of water and enhancing biodiversity. Housing and institutional buildings are placed high in the landscape where there is less risk of flooding. The risk associated with any designed solution can be calculated based on the probability of a storm flooding it, ranging from a predicted storm frequency of once every year or 2 years to once in a 100 years. Since rainfall is not entirely predictable, it is possible to have a storm with a probability of once in 100 years on 2 consecutive years. This unpredictability of runoff impacts on the financial feasibility of developing treatment facilities on parts of the stormwater network where flows are irregular. However, Victoria now sources over 40% of their urban recycled water from surface drainage systems (ABS, 2006) and there is a potential to extend that to other cities in Australia.

Added to the hydrological cycle of the city is water sourced for urban water needs from large catchments outside city boundaries, or the sea or underground sources. This water is transported to water treatment facilities where it is treated to defined health standards. Water is then transported (pumped) to reservoirs usually located on hills above the urban area. Water from reservoirs is distributed across the cities in piped networks and used for drinking, carrying waste, cooling industrial processes, watering gardens, and other uses. Much of the wastewater from these processes is piped back through a sewerage network to treatment plants where it can be treated and released into the environment or reused. This water does not follow the patterns of rainfall but the diurnal and weekly patterns of households and industry in cities.

The sewerage network concentrates wastewater for treatment, usually to a restricted number of endpoints, low in the catchment. Because gravity is the preferred energy used to move the wastewater along the sewerage network, the trunk mains are often located in the surface drainage open space systems, utilizing the natural fall of the land to minimize the depth of the sewers and to minimize the need for pumps, with treatment facilities positioned low in the catchments. The concentrating nature of the sewerage system, the predictability of its flows, and its relationship to open space systems provides opportunities to mine water from sewer-mains, treat and utilize the treated water for facilities such as golf courses and ovals that may lie within the open space systems, or for other purposes. Proximity is important in water supply as water can be more costly relative to its value to transport than other services such as electricity.

Climate Change and Its Impact on Urban Water Management

A broad overview of climate change and its impact on infrastructure is given in Chapter 1. This chapter focuses in particular on how climate change impacts on water management. This is more complex than it first appears. Measurement has shown that Australian temperatures have risen significantly over the past century, and rainfall has decreased in southwestern Western Australia since the mid-1970s (CSIRO and Bureau of Meteorology, 2007). Other predictions are based on models. Here, it is important to understand that there is a degree of uncertainty in the prediction of models, particularly when they are predicting complex systems such as climate, and that these models have higher predictive capability at global rather than metropolitan scales. Given this, it is likely that temperatures will continue to rise, with the CSIRO and Bureau of Meteorology (2007) estimate of an increase of 1.0°C in the average annual temperature in Australia by 2030. This rise is likely to be a little lower on the coast at 0.7–0.9°C than inland at 1–1.2°C.

The predictive power of the climate models on rainfall is less direct, as the system interactions that control rain in a particular region are complex and include ocean currents, topography, land cover, and water available for evaporation. Regional variation in rainfall is not closely correlated with temperature change. Broad trends expected are an increase in rainfall in the tropics and at high latitudes with a decrease in rainfall in the subtropical and temperate regions of Australia, as the weather circulation patterns over southern Australia are pushed further south. The predicted range of change for rainfall in southern Australia by 2050 is from a decrease of 20% to little change with a best estimate around a decrease of 7.5% (CSIRO and Bureau of Meteorology, 2007).

However, small decreases in rainfall can have a large impact on runoff, as rain will first infiltrate the earth until it reaches a saturation point before contributing significantly to runoff. Lower rainfalls and drier soils reduce runoff. Chiew (2006, in Garnaut 2008) has found that a decrease in rainfall can result in a two- to threefold decrease in stream-flow. Due to the recent drought conditions in much of Australia (2001–2009) in 2008, stream-flows supplying Sydney were 40% of the long-term average, Brisbane 42%, Canberra 43%, Adelaide 62%, and Melbourne 65%. Given rainfall decline in the southwest of Western Australia since the 1970s, annual stream-flows in 2008 were only 25% of the pre-1970 long-term average (Garnaut, 2008).

Climate change may affect storm intensity and duration, with climate models showing an increase in daily precipitation intensity and in the number of dry days. There is a predicted increase in tropical cyclones in the more intense categories but a decrease in the total number of cyclones

(CSIRO and Bureau of Meteorology, 2007). Both will impact on data that engineers use to design stormwater management systems, and on the existing built systems.

Sea level rise is projected by the IPCC (2007) to be 18–59 cm by 2100, although there is substantial uncertainty about ice sheets on Greenland and the west Antarctic which could add substantially to this figure (in Garnaut, 2008). Storm surges along coastlines are expected to increase with higher wind speeds and sea level rise, increasing flooding and erosion. Increasing sea levels may increase saline water tables in low-lying coastal regions. This is particularly problematic where freshwater tables are being drawn down close to coastlines, with the possibility of saline water forming a lens on the top of freshwater. This occurs on many of the coastlines in Southeast Asia and has the potential to occur in Australia.

Water Security: Balancing Demand and Supply

Urban expansion and low rainfall and runoff within urban water catchments over the period 1997–2009 have heightened awareness of the risks associated with a reliance on water from traditional urban water sources, particularly metropolitan dams. Most major metropolitan dams are designed to store enough water to meet demand over a number of years. For cities that are primarily dependent on dam water, dam storage capacities range from sufficient to meet 4 years of demand (Canberra and Melbourne) to nearly 8 years (Darwin) based on 2005–2006 consumption statistics (see Table 6.1).

Efficiency gains are possible by managing catchments and storage facilities more effectively. Silvicultural treatment of forested water catchments can increase water yields to storage facilities including underground reservoirs. Linking water reservoirs through a water grid can allow transfers from high-yield catchments to low-yield catchments, thereby increasing the utility of dam storage capacity across the region. However, due to the relatively high costs of water transfers this requires rigorous cost-benefit analysis.

Sustained periods of low rainfall can reduce inflows into dams and underground reservoirs to such an extent that strong measures (either regulatory or price) need to be taken to reduce demand. Given that even in periods of low rainfall urban water supply can be augmented by increasing spending on infrastructure such as desalination plants, increasing the holding capacity of urban dams and/or by rural-urban water trading, policy makers are becoming increasingly interested in trying to quantify the risks associated with any given level of infrastructure provision. Water security is a measure of this risk and is defined as the probability of urban water not meeting demand over a given period, such that restrictions will need to be applied. This is similar to the measure of risk that engineers and developers already take into account in relation to flood control.

Communities and policy makers need to decide on the level of risk the water supply infrastructure is developed for. Should it be designed for a one in 50 year, one in 100 year, or one in 200 year dry period? If it is designed

Table 6.1 Capital city water storage capacity.

City	Dam Storage Capacity mL	Annual Consumption 2005–2006 mL	Supply When Full (Based on 2005–2006 Rate of Consumption) Years
Sydney	2 584 300	528 260	4.9
Melbourne	1 173 000	444 365	4.0
Brisbane and SEQ	1 930 350	298 132	6.5
Perth	688 000	244 158	2.8
Adelaide	168 979	163 577	1.0
Hobart	11 000	38 150	0.3
Canberra	207 400	56 823	3.7
Darwin	265 000	34 521	7.7

Note: Brisbane and SEQ includes Little Nerang and Hinze Dams as these, in addition to Wivenhoe, Somerset, and North Pine, supply water to the Gold Coast. The latter three dams also supply Ipswich and Logan City and a number of other local government areas.
Source: Reproduced with permission from Productivity Commission (2008), Towards urban water reform: A discussion paper, Productivity Commission, Melbourne, Victoria, Australia, p. 3.

for a one in 50 year dry period, there is a 2% probability that it will not meet urban demand and regulations or pricing will need to be utilized to reduce demand. Here the community and policy makers are balancing the cost of the infrastructure (and therefore the cost of water) with the risk of not having enough water to meet demand. The lower the risk tolerance, the higher the cost and the more unused capacity there is in periods of normal rainfall. Much of the decision making on water security rests with governments who control the metropolitan water utilities. However, individuals within urban communities can influence their own water security through harvesting and storing rainwater in water tanks or community dams.

A major factor now effecting the prediction of risk is the prediction of rainfall and stream-flows. This is made more difficult by the long-term trends of reduced stream-flow in parts of Australia and in particular in Western Australia. Added to the complexity is the difficulties in predicting changes in rainfall due to climate change (see previous section on climate change). Weather patterns are fractal in behavior as opposed to being based on the normal Gaussian curve (Taleb, 2007). This means that methods to calculate risk based on the normal curve are not appropriate.

Water Demand

In Australia, approximately 18% of water is used in urban areas. Although domestic consumption is a high proportion of urban consumption (62%), it is still a low user of total water consumption, utilizing 11% of total Australian water use in 2004. In 2000–2001, outdoor use amounted to 44% of domestic consumption, approximately 4.84% of total water consumed in

Table 6.2 Water consumption 2000–2001 and 2004–2005.

	Australia		2004–2005							
	2000–2001	2004–2005	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
	GL	GL	GL	GL	GL	GL	GL	GL	GL	GL
Agriculture	14 989	12 191	4 133	3 281	2 916	1 020	535	258	47	1
Forestry and fishing (a)	44	51	11	8	3	1	25	4	1	-----
Mining	321	413	63	32	83	19	183	16	17	-----
Manufacturing	549	589	126	114	158	55	81	49	6	1
Electricity and gas	255	271	75	99	81	3	13	-----	1	-----
Water supply (b) (c)	2 165	2 083	631	793	426	71	128	20	8	5
Other industries	1 102	1 059	310	262	201	52	168	18	30	17
Household	2 278	2 108	572	405	493	144	362	69	31	31
Total	21 703	18 767	5 922	4 993	4 361	1 365	1 495	434	141	56

-----, nil or rounded to zero (including null cells); (a) includes services to agriculture, hunting, and trapping; (b) includes sewage and drainage services; (c) includes water losses.
Source: Reproduced with permission from Australian Bureau of Statistics (2006). *Water Account Australia 2004–2005*, Commonwealth of Australia, Canberra, Australian Capital Territory, Australia, p. 8.

wz Australia (ABS, 2004). Table 6.2 shows the breakup of water use in Australia in 2004–2005 (ABS, 2006). Note that water supply includes sewerage, drainage services, and supplies to agriculture, with much of the consumption due to losses in distribution. Fifty-nine percent of water supplied by water suppliers goes to agriculture. Only 4% of water is recycled by water providers for reuse (ABS, 2006), of which approximately half is sourced from wastewater and half from drainage water.

Studies have been carried out to determine how domestic consumption has changed over time. Davison (2008) documents a trebling in water demand in Sydney and Melbourne from the mid-nineteenth century to the present, changing from approximately 100 to 300 L per capita. In the late nineteenth century, piped water and underground sewerage pushed consumption to 200 L per day. Water use peaked at 400 L a day from 1950 to 1970, correlated with postwar housing construction. From 1990, scarcity of water available for urban use became apparent and led to an interest in managing households' demand for water. Per capita consumption reduced by up to 300 L a day through increased awareness, water saving technologies, and water restrictions. A more detailed description of the drivers effecting household consumption of water is given later in this chapter under demand management.

Despite the continued growth in urban populations, there has been an overall reduction of 11.8% in water supplied to urban areas from 2001 to 2007 (Productivity Commission, 2008b). This reduction occurred for most metropolitan government water trading enterprises, with the exception of the Water Corporation in Western Australia which increased urban water supply by 9.9% over the same period. Figure 6.1 shows the urban water consumption for a selection of government trading enterprises over this period.

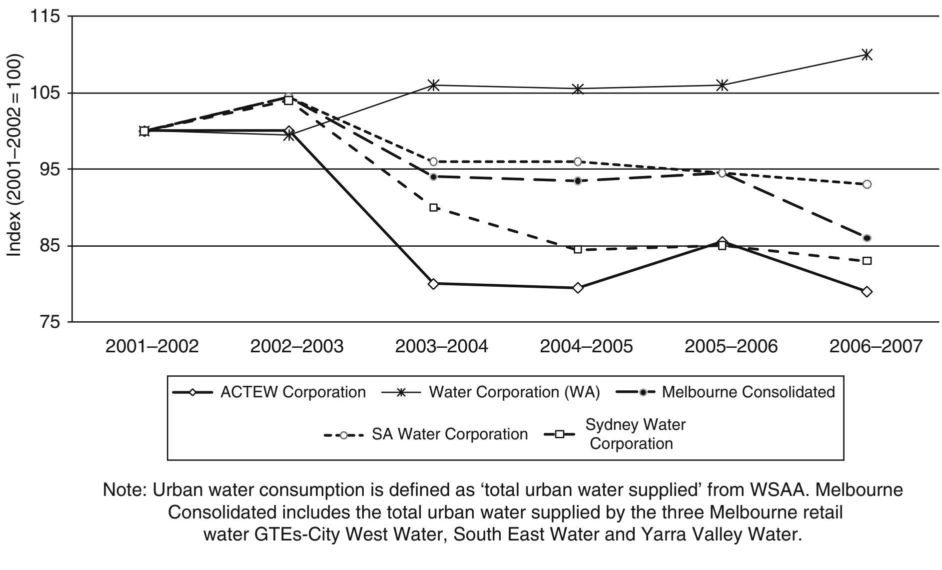

Figure 6.1 Urban water consumption—selected GTEs.

Source: Reproduced with permission from Productivity Commission (2008) Financial Performance of Government Trading Enterprises, 2004–05 to 2006–07, Productivity Commission: Canberra, p. 134.

Managing Demand

Reducing demand for water and wastewater services can have a marked effect on capital requirements for infrastructure investment, water management, and maintenance costs and reduce environmental impacts of water consumption. Demand management seeks to increase the productivity of water through focusing on the end user. Here the emphasis is on meeting long-term objectives. This may not be a simple linear process but might require the integration of economic, social, and environmental objectives, and the development of innovative and efficient strategies to achieve these. Greater efficiency and increased conservation of water may be achieved through technological advancement, better management of water resources, more effective distribution systems, pricing systems, changing people's perceptions and behavior, and/or changing the physical environment. Given the interchange between urban and rural water, this drive to reduce demand through conservation and efficiency should span both sectors.

Substantive reductions in demand and increased efficiency can be gained through improving the performance of water distribution systems. The losses due to distribution in Australia are comparable to the water demand for domestic use (see Table 6.2). Although much of this loss is in the rural sector, urban water distribution systems are also subject to loss due to leakage, particularly in periods of drought where dry soils can put pressure on pipes and joints. An efficient and effective monitoring and maintenance system is important to try and minimize these losses.

Many of the gains from demand management will be consolidated by changing behaviors. Many countries, including Singapore, the United States, Canada, and Australia, have been involved in programs to reduce water-user demand, particularly in urban areas (see OECD, 2007). In Australia, the interest by public utilities in identifying the characteristics of demand and trying to respond to these can be traced to 1993, when ACTEW undertook a community-wide education and consultation program to decide whether Canberra's future water demand could be satisfied by demand management or by the construction of a new dam. At that time in Canberra, there was strong community support for demand management strategies including increased pricing rather than a continuous search for new mass storage dams (ACTEW, 1994). The interest in demand management has increased across urban water authorities in the early part of the twenty-first century. Water authorities have utilized a range of policy instruments including advocacy, education, price, subsidies, and water restrictions. Behaviors are difficult to change and how effective these policy instruments are in changing behaviors depends on their strength and on the environment in which they are played out. Water frugality that requires financial and/or time input may not be at the top of the list for a family that is both financially and time constrained, even with the knowledge of the need to conserve water.

A sustained period of low rainfall from 2001 to 2009 found many water authorities with infrastructure ill prepared to sustain a period of prolonged drought, and the policy instrument of water restrictions was heavily relied on. In October 2003, South Australia introduced permanent water restrictions, Victoria followed in 2005, and the ACT in 2006. By June 2007, all capital cities except Hobart and Darwin had water restrictions in place (Productivity Commission, 2008b). Most of these water restrictions were on outdoor use. In 2010/2011, heavy rainfall in eastern Australia led to lifting water restrictions in the east.

Although demand management on urban water use in Australia (2001–2007) has had an effect (see Figure 6.1), there has been discussion about the reliance upon such a blunt instrument as water restrictions, particularly given water restrictions have been targeted almost exclusively to outdoor use, and have reduced the utility of both personal and community assets (Productivity Commission, 2008a, 2011). Community assets lost include the loss of irrigated ovals, irrigated parklands, reduction in urban trees, and the general rundown of neighborhoods. Detriment to personal assets includes the deterioration of lawns and gardens, the need for labor- and time-intensive methods of watering, the ability of children to use the garden sprinkler as a way to cool down (often used in low-income households as an alternative to a pool), and changes to the microclimate in cities. Individual households, attempting to capture and recycle their own water through an assortment of containers, run the risk of physical injury and the community risk of supporting disease transmitted through vectors such as mosquitoes (malaria, Dengue Fever, Ross River Fever). The Productivity Commission (2008a, 2011) proposes that pricing should be utilized more effectively, thereby not discriminating against those who prefer to use their water outdoors to indoors and allowing those who value their gardens highly to buy water (for more on this see the section on pricing).

To manage demand, it is important to understand what generates demand. This is a relatively new area of research. Davison (2008), Head (2008), and Troy and Randolph (2006) have investigated drivers of household demand. Davison (2008) traced the history of water use from Victorian England to the present use in Australia (see earlier under water consumption). In this he investigated both the technological drivers, such as the development of sanitation systems in the mid-nineteenth century and the perception to hygiene, recreation, and home care that drove attitudes and behavior of Australian households. Head (2008) investigated water use in backyards in Alice Springs, Sydney, and Wollongong in 2002–2003, a period within a drought cycle. She found that if plants were valued by householders, they were willing to inject their own labor into the water network (hand watering or recycling water from indoor use) and that aspirations toward conservation conflicted with householders' desire for water in their gardens.

Troy and Randolph (2006) investigated water use in over 2000 households in Sydney over the 2004–2005 summer in four dwelling types: separate houses, semi-attached housing, flats up to three stories, and flats four stories and above. Generally across all households there was an endorsement of conservation as important, although in action the results were variable. Only 37% of those with a garden had reduced the watering of their garden, 90% of people with a pool did not use a pool cover, and 13% said they had taken no action to reduce water usage in the previous year. Attitudes to future water savings suggested that any further substantive water savings would be generated by changing water use within the home, especially in the use of kitchen, bathroom, and washing appliances. However subsidies to promote more efficient dishwashers may not be the way. Troy and Randolph (2006) found that although half of their households had dishwashers, 10% never use them (about 25% of high rise flat dwellers), and around 75% say they hand rinse dishes before putting them in the dishwasher, adding substantially to water use. Crase and Dollery (2005) found that water saved by the Melbourne Water Authorities through subsidizing AAA dishwashers was at a cost of \$33 395 per mega-liter.

Access and Water Pricing

The need to protect public health by providing access to water supply and sanitation have ensured that the equitable supply of urban water services has remained an important part of public policy. Additionally there are strong and valid arguments that the price of water is too low, that it does not allow for the planning, development, management, and maintenance of water infrastructure, nor indicate the scarcity value of water and/or the need to conserve it and utilize it efficiently. Both these arguments have validity and need to be taken into account in any pricing system.

Given that water is an environmental good in scarce supply in many metropolitan areas, how are water prices determined? In Australia, the Council of Australian Governments in the National Water Initiative (COAG, 2004) have required full cost recovery for water services in metropolitan areas to ensure business viability and avoid monopoly rents, with upper bound pricing to include, but not exceed, all operational, maintenance, and administrative costs, externalities, taxes, depreciation, and cost of capital. By 2008, all urban water utilities operated pricing systems that aimed to ensure full cost recovery utilizing a range of different fixed and volumetric charging structures with multiple tiers (block tariff structures) for volumetric charging (Productivity Commission, 2008b). The tiers are a way to ensure those who consume a basic volume of water per annum pay a relatively low price per unit consumed. As consumption increases above this base level, the cost per unit of additional water increases. The pricing of tiers are not directly related to cost recovery, although the overall pricing scheme is (Neutze, 1993). These tiered structures vary from a two-tiered structure in Adelaide to a five-tiered structure in Perth.

In 2011, prices charged in NSW, Victoria, and the ACT metropolitan areas are regulated by independent bodies. In Queensland, Western Australia, South Australia, and Tasmania, water and sewerage charges are set by government after consultation with water authorities and other stakeholders (Productivity Commission, 2008a, 2011), with South Australia and Tasmania committed to shifting toward independent economic regulation in the near future. The tiered structures and present price regulation do not indicate scarcity, where price rises are correlated with increasing scarcity of water.

If a pricing system was developed to reflect the scarcity value of water, it would be important to ensure that low-income households received an essential allocation of water to meet basic needs at an affordable price (Productivity Commission, 2008a; Troy, 2008). In doing this there is need to determine an amount of water which fulfills basic water requirements. An amount of 30 kL per person per year has been suggested by Troy (2008). Community Service Obligations paid by government to the water utilities from the budget or direct payments to households could pay for costs associated with subsidizing those unable to pay full costs for their basic water requirements.

The assumption underlying pricing as a means to regulate demand during periods of scarcity is that households will respond to price signals. Research findings on price elasticity for water internationally show wide variation, ranging from –0.07 to –0.21 (highly unresponsive) to –0.34 to –0.96 (highly responsive). Estimates of price elasticity for water in Australia are –0.35 for Sydney and –0.51 for Brisbane, indicating a relatively high sensitivity to increase in prices (Productivity Commission, 2008a). At the present level of water pricing, Troy and Randolph (2006) found that in Sydney few householders were aware of their water bills or used them in their decision making. However, if prices were to escalate quickly from a base level during periods of scarcity, sensitivity to price would likely increase and the willingness of consumers to pay would also send signals to water utilities on the level of water security required and the required investment in new infrastructure needed to meet this level of water security. A limit to the supply of water would need to be determined by government based on the levels of existing supplies, to ensure a secure, sustainable base level of supply to the city. If water pricing could be used to manage demand during times of scarcity, in place of the present water restrictions, it would provide greater flexibility of choice to householders and ensure that high consumers of water paid both financial and environmental costs of their water consumption.

Efficiency gains attained through competitive markets could lead to lower water prices than prices determined under a cost recovery basis, due to a reduced risk of poor investment decisions imposing a cost on users and tax payers. More effective market signals should also improve timely investment decisions.

Water Supply

Recognition of the need for water security has focused attention on existing water supply arrangements for metropolitan areas in Australia. This has generated a demand to utilize water supply more effectively and to diversify water sources for urban use. The ineffectiveness of a fragmented approach to water management has encouraged National, State, and Territory Governments to take a regional approach in sourcing water and for connecting metropolitan regions into supply networks. Water grids linking supply sources have been, or are to be, developed in South East Queensland, Victoria, and Western Australia.

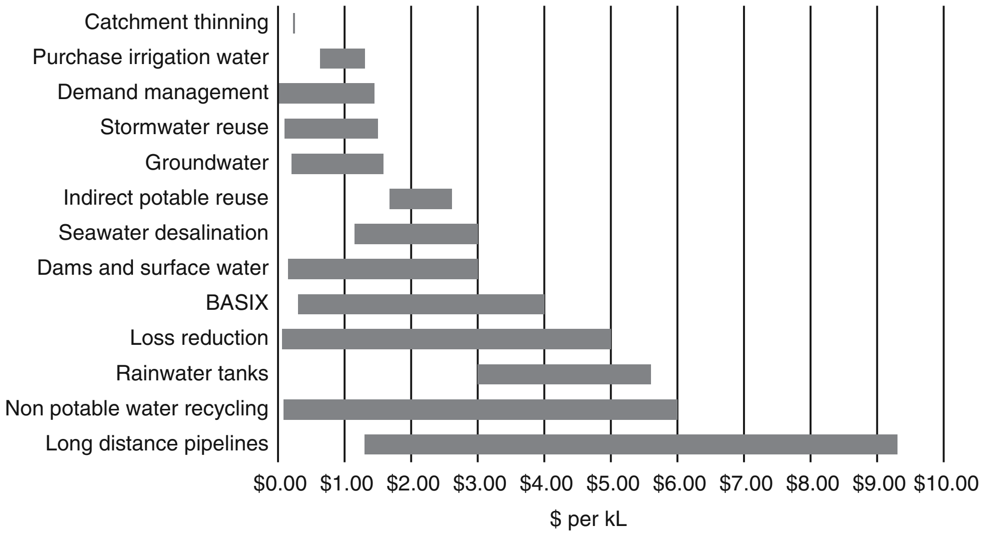

Figure 6.2 Direct costs of water supply/demand options—Sydney, Adelaide, Perth, Newcastle.
Source: Reproduced with permission from Marsden Jacob Associates (2006) *Securing Australia's Urban Water Supplies: Opportunities and Impediments*, a discussion paper prepared for the Department of Prime Minister and Cabinet, Nov. 2008, p. iv.

The traditional source of water has been mass storage systems based on protected catchments for urban water supply. There is potential to increase the runoff from forested catchments, including catchments supplying underground aquifers through thinning of tree cover. Other water sources for metropolitan water utilities include underground aquifers: water traded from the agricultural sector, recycled water from stormwater, and sewage and manufactured water from desalination plants. Small-scale water sources accessed by communities and individuals can include rainwater tanks and recycled water.

The relative costs of different supply options can vary depending on location and situation. The figure above (Figure 6.2) by Marsden Jacob Associates (2006) indicates the range of costs of water supply and demand options from data for Sydney, Adelaide, Perth, and Newcastle.

It is evident from this figure that catchment management through thinning and the purchase of irrigation water are relatively low-cost options and the purchase of rainwater tanks is a relatively high-cost option, based on the volume of water supplied. The high cost of rainwater tanks as a solution may be particularly true for government where subsidies are paid. Subsidies paid in Melbourne on water tanks found the cost per mega-liter of water saved was $9069 (Crase and Dollery, 2005).

Cost-benefit analyses of water sourced from different supply options need to be made on a location and timely basis, cognizant of the risk associated with climate change, before policy decisions are made. There should be enough flexibility to allow for innovation in water sourcing and to consider rural-urban water trading. Rural-urban water trading has been carried out in Western Australia and through the southern Murray Darling Basin rural water market and is supported by the Australian Intergovernmental Agreement, the National Water Initiative, and the Productivity Commission (2008a, 2010). However rural-urban water trading is only effective where there is an ability to physically transfer the water between the seller and the buyer at a reasonable cost. The bulky characteristics of water increase the per unit transfer cost making accessibility and proximity important in any water trade. Due to relatively high costs, buy in to long-term, energy demanding infrastructure such as desalination plants, and rebates for microsystems such as water-efficient dishwashers and rainwater tanks need rigorous appraisal.

There are situations, such as during a long-term drought, where it becomes evident that a major augmentation in water supply is required. If this demand cannot be satisfied by a portfolio of other choices such as catchment management or rural-urban water trades, a decision may be required for long-term investment in high-cost infrastructure such as a new dam or a desalination plant. This decision necessarily occurs in an uncertain environment, as the breaking of the drought through heavy rains may fill existing storage dams and obviate the need for an increase in infrastructure capacity and only time will reveal if this will happen. Here there is an obvious benefit in delaying investment until critical risk thresholds are reached that necessitate the investment based on water security requirements. These trigger points need to be identified by water authorities and made transparent so that investment decisions are evidence based and accountable. The cost of not doing this and allowing decisions to be politicized can be high. The Productivity Commission (2011) calculated premature investment in desalination plants in Sydney and Melbourne cost the community between \$1.5 and \$2.2 billion over a 20 year period. These investment decisions went ahead well before identified trigger points had been reached or other viable alternatives had been properly canvassed.

The Urban Water Industry

There is no standard industry structure for urban water provision and management. Business models range from private sector models of England and Wales (now with government oversight, after a rather rocky shift from public monopoly to private monopoly), to hybrid models of Holland (where more than 50% ownership must remain public), to the public ownership model found in Canada, Australia, and some parts of the United States (OECD, 2007). Whatever the business model of urban water utilities, there will always be a strong government and community interest in urban water because of the broad economic, social, and environmental benefits that safe urban water management provide. This will ensure that water supply and management will continue to remain important to politicians and the public.

Ownership and Governance

In Australia metropolitan water infrastructure is owned by the States and Territories. In Victoria this ownership is written within the State's constitution and would require a three fifths majority in parliament to enable the transfer of water services to a private body (VCEC, 2007). In most States, metropolitan water services are carried out by government-owned enterprises, with the exception of South Australia where water services for the metropolitan region of Adelaide are franchised to United Water, and in the ACT where a public–private partnership, ActewAGL, is contracted to operate and maintain the water and sewerage networks which are owned by government. Most of these metropolitan water utilities operate under a Corporations Act.

There are tensions inherent in government-owned, corporatized water utilities. Their structure and the responsibilities of their Governing Boards mirror that of the private sector based on commercial imperatives with similar incentives and sanctions. However important differences apply to private and government-owned enterprises. Ownership by government brings political and policy intervention, whole of government objectives and processes, stewardship of public funds and assets, and protection from bankruptcy (Productivity Commission, 2005). Voting shareholder Minister(s) can impose public interest requirements through ownership controls. The Minister, as an elected representative, has the responsibility to reconcile competing interests in water, particularly reconciling commercial and other public benefit objectives. The Minister's understanding of what is in the public interest is informed by the values and policy platform of his or her political party. Water Utility Boards will be responsible for financial risk but ultimately the Minister will be responsible for political risk. The challenge is to reconcile tension in the governance of water utilities in a way which clarifies accountabilities and separates noncommercial (public interest) objectives from commercial imperatives. This requires clear articulation of goals and objectives by the Minister and the funding of noncommercial (public interest) objectives through the budget. This plus independence of the Board from the Minister will support maintenance of capital market discipline on the water corporation and separate external governance, that is, governance by the Minister and external agencies from internal governance exercised by the Board.

Internationally (through the OECD, 2005) and in Australia (Productivity Commission, 2005), there have been calls to clarify the distinction between external governance and internal governance of government trading enterprises. Governance principles have been developed to support these reforms (OECD, 2005). These include the clarity of objectives the government sets for trading enterprise and how conflicting objectives would be resolved, the separation of the trading enterprise from the regulatory body and the entity which exercises the governments ownership responsibilities, the transparent selection of board members based on competence and experience, arms length external governance through publicly disclosed directions, and public statements of entity objectives, performance, and conduct of community service obligations.

These reforms have not been realized in entirety for Australian government-owned metropolitan water utilities. Although there have been moves to separate ownership and regulation, this has not always occurred. In Queensland, Western Australia, South Australia, and Tasmania, water and sewerage charges are set by government after consultation with water authorities and other stakeholders rather than by an independent authority (Productivity Commission, 2008a). Government objectives, commercial and public interest, are general in nature and are not prioritized. Public interest objectives are, in some cases, not costed and even where identified may not be funded (see section under community service obligations). Members of the water boards continue to be nominated by Ministers, without transparent processes. The lack of clarity between external and internal governance provides an opportunity for Ministers to become involved in the day-to-day management of the corporation, running the risk of politically expedient solutions on decisions such as water sourcing rather than objective decisions based on cost-benefit analysis. The move toward an independent water grid manager in South East Queensland and Western Australia (see section on differentiating water sources) is an important step forward in external governance reform.

Reviewing Government-Owned Metropolitan Water Utilities

Although there has been some commercialization and corporatization of the Australian water sector based on the Competition Principles Agreement 1995 (COAG, 2007), this has not changed the vertically integrated, monopolistic character of these government-owned utilities. This monopolistic characteristic, the high capital costs of water infrastructure, and the relatively high dividends these utilities have paid to government (Productivity Commission, 2008a) have led to inadequate investment in infrastructure. State water utilities were ill prepared for the extended period of low rainfall 2002–2009, resulting in strong regulation (water restrictions) in Canberra, Sydney, Melbourne, and South East Queensland. This, in addition to growing community concerns about the impact of climate change and a growing interest in manufactured water involving large, long-term infrastructure investment, has led to a number of government reviews on urban water management, including the reviews for South East Queensland (2007), Victoria (VCEC, 2007), Western Australia (ERA, 2007), Tasmania (MWST, 2006), and a national review undertaken by the Productivity Commission (2008a, 2011). Major concerns have been as follows:

- Inefficiencies and heightened risk associated with fragmented water systems and institutional responsibility (see case study on South East Queensland).
- The monopolistic, strongly vertically integrated nature of water utilities inhibit private investment in water and reduce innovation and competition.
- High government dividends reduce water utilities ability to invest in infrastructure and maintenance.
- The full potential of rural-urban water trading has not been utilized.
- There is a need for a developed third-party access to distribution networks in line with competition policy and the Trade Practises Act.

Below an analysis is made of the value chain of urban water management to analyze how vertically integrated monopolies can be reformed through greater differentiation in products, increased competition, greater private sector investment, and support for innovation.

The Urban Water Value Chain

In the structural readjustment of urban water management, it is important to understand the different functions required to manage urban water, how these are linked along the urban water value chain, and what efficiencies are associated with each of these functions. The Productivity Commission (2008a) has broken up the value chain into the following: water sources (mass storage, desalination sources, water retention on site, recycling, and rural-urban trades), trunk transport and storage, treatment, distribution, and retail (see Figure 6.3).

In restructuring the industry water utilities face a choice of whether to

1. retain but unbundle government-owned integrated supply chains into vertically integrated systems of government corporations, each corporation responsible for its own profit and loss or
2. unbundle the urban water value chain and identify contestable and noncontestable functions; allow competition in the contestable functions of the value chain.

If the first option is taken, accounting ring-fencing for each function along the water management value chain will enable mapping of costs and profitability, which could later be utilized to encourage private investment in water infrastructure for some functions. In addition to vertically unbundling its functions, Victoria has undertaken horizontal unbundling across the distribution/retail functions of water supply and wastewater management, on an area basis, setting up three government-owned businesses and benchmarked performance across each of these businesses. From this, lessons have been learned of economies of scale operating in the water distribution/retail function (VCEC, 2007) which is discussed below. More could yet be learned about the relative costs of distribution versus retail by ring-fencing each of these functions within each of these three businesses, which has been recommended by VCEC (2007) in their draft report.

Determining which of these functions are subject to economies of scale and therefore natural monopolies, and which functions are contestable, would be the next step to determining whether competition will improve the efficiency and flexibility of urban water management. Wholesale and retail water distributions are subject to economies of scale and have the characteristics of a natural monopoly. Functions in the value chain that are likely to be contestable are sources of water, treatment, and retail functions. An analysis of the noncontestable functions and an investigation of the potential for differentiation and competition in contestable functions are given below.

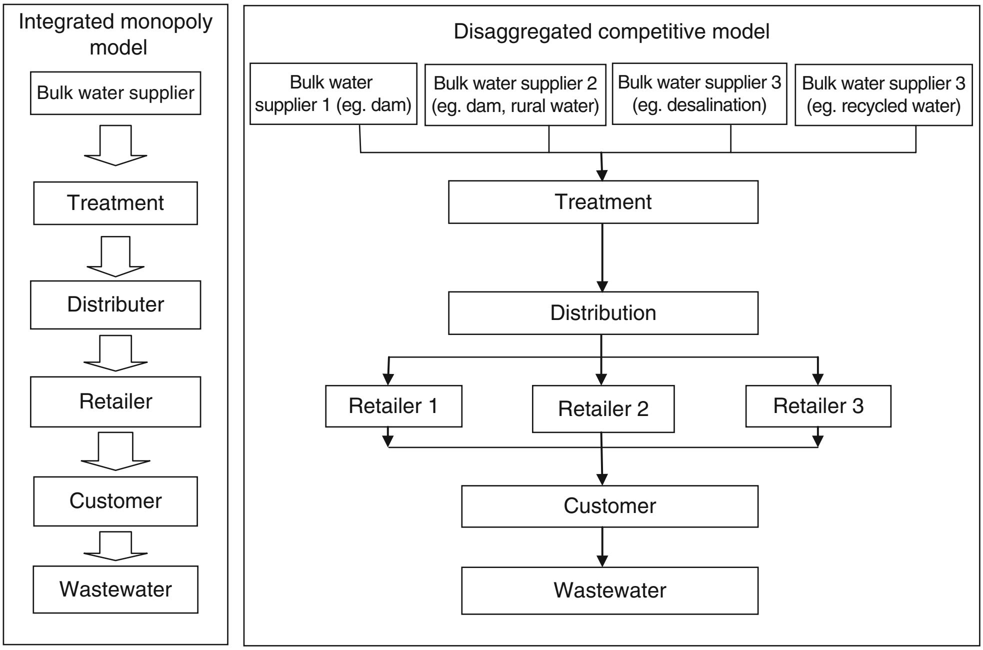

Figure 6.3 Alternative structures for the urban water sector.
Note: Disaggregated competitive model is a stylized representation. Desalinated water can be treated at source and injected into the network and recycled water, rather than going to a water treatment plant, would typically be diluted in a dam.
Source: *Reproduced with permission from the* Productivity Commission (2008) *Towards Urban Water Reform: A Discussion Paper*. Productivity Commission, p. 114.

Water Distribution: A Natural Monopoly

Water distribution, whether via trunks, mains, and reservoirs of the wholesale sector or distribution and wastewater collection networks (to and from individual households and businesses), incur high initial capital costs. As a result of the high initial costs in establishing these networks, they are likely to be designed with excess capacity to cater for future growth. The capital-intensive nature of these networks, together with their ability to cater for increased capacity, is the reason why these distribution networks are likely to remain monopolies.

How large distribution systems should be is still a matter of debate (Acil Tasman (3) in VCEC (2007)). It is interesting to note the findings of VCEC (2007) that although the unbundling of distribution and retail horizontally for the Melbourne metropolitan area had initial gains through improvements in efficiency and customer management, after the initial improvements there was little gained in terms of efficiency. The Commission also noted that there was a potential for savings of around \$15–\$16 million and capital cost saving of around \$22 million over 5 years if these businesses were consolidated, this was about 5%–7% of the controllable operating costs of the businesses. These savings would come from reduced costs for administration, IT systems, procurement, wholesale sewerage, and water billing. Additional benefits would be uniform pricing of water across metropolitan areas and uniform technical standards for plumbing. However if distribution/retail became too large or lacked competition, diseconomies could also occur including less flexibility in decision making for regional managers, reducing responsiveness to demand, and lowering innovation. Continued reliance on trunk mains for a wider and wider distribution network would mean the potential to over reach the capacity of trunk mains requiring high capital costs to duplicate these. An overall understanding of the capacities of distribution networks and forward forecasts on growth would be important in any decision related to scale.

Differentiating Water Sources and Introducing Competition

Water availability is highly dependent on weather patterns. Being able to source water from a number of different sources, both in times of high and low rainfall, can increase flexibility and cost efficiency. Differentiation of water sources with the potential to shift demand across water sources improves overall system capacity, increases water security, and reduces the need for costly augmentation of water supplies. This would be particularly advantageous if these water sources differentiated their products and prices, depending on the availability of water and its quality. Thus in periods of high rainfall, water from mass storage dams would be abundant at a lower cost (including environmental and social costs) than manufactured or recycled water, water from underground aquifers, or rural-urban water transfers and would be a preferred water source. During periods of prolonged low rainfall, the latter sources may become preferred dependent on the location and water available in the location. Sourcing water in such a manner could allow for innovation in recycling, including water mining of sewage and stormwater (see below under water treatment). The South East Queensland structural reform included the role of a water manager to coordinate the sourcing of water across a number of water sources, and this is also being considered in Western Australia in the form of an Independent Procurement Entity (ERA, 2008). The perceived benefits of such a role would be independence and objectivity in water sourcing, determining the least cost combination of water sources for the required level of water security. This would include the ability to identify innovative low-cost options and support competition.

Water Treatment: Differentiating on Use, Scale, and Access

Treatment has been traditionally carried out in large-scale facilities, benefiting from economies of scale. Most of the large water treatment plants are owned by government, but some treatment facilities are owned and/or operated by the private sector. In Australia, water is treated to a potable water standard, based on the Australian Drinking Water Guidelines 1996 developed by the National Health and Medical Research Council and the Agriculture Resource Management Council of Australia and New Zealand. The main contaminants likely to impact on health are bacteria, blue green algae, protozoa, and viruses, with the bacteria usually coming from water contaminated by human and animal feces. Although there have been no recent large-scale outbreaks of water-borne disease in urban Australia, the 1998 Sydney Water Crisis based on high readings of the bacteria Cryptosporidium and Giardia in the water supply required a Sydney-wide boil-water alert between July 30 and September 5, 1998, at an estimated cost of $33 million AUD. The social and economic impact of this crisis and the following Sydney Water Inquiry indicate a need not only for efficient monitoring of water quality but also a need for an effective response if high levels of contaminants are recorded (Stein, 2000).

Most of the water used in our urban environments is treated to a potable standard even if its use is for washing, industrial use, or irrigation. Increasing the efficiency of water treatment has focused attention on being able to differentiate water quality, targeting water quality objectives to the use that water is put, and, where possible, reducing the transport costs of water. Recent technologies including the use of biological systems and microfilters have enabled small-scale treatment facilities to be more effective, enabling the differentiation of the quality of treated water to meet user needs, close to the user. This increases the potential to recycle water in new housing or industrial developments or at different locations along the stormwater and wastewater distribution networks. This is particularly attractive in new development where developers are faced with major costs of connecting water systems to trunk infrastructure (see Chapter 5).

Mining water from wastewater and stormwater collection systems has the potential to increase supply and relieve potential bottlenecks, increasing the capacity of trunk sewerage and drainage infrastructure. The location of drainage systems and some trunk sewerage mains along open space networks (see previous section on the hydrological cycle) lends itself to small treatment facilities to service irrigated open space systems or industrial uses. This has been utilized by ACTEW in Canberra to increase the capacity of sewerage trunk mains and to supply irrigation water to ovals and open space. There has also been interest by the private sector to invest in such infrastructure. Private sector companies interested in developing such treatment facilities would require third-party access to urban sewerage or drainage systems, which are natural monopolies. A 2005 application in the Australian Competition Tribunal under the *Trade Practices Act 1974* (Cth) (*Application by Services Sydney Pty Limited* [2005] ACompT 7 cited in Gray and Gardner, 2008) upheld the right for third-party access, and other states are now developing policies to facilitate third-party access (Victoria, Western Australia). Third-party access to wastewater streams raises issues related to ownership of wastewater (see Godden [2008] for a detailed discussion of these issues). Once third-party access has been legally resolved, a major factor in the financial viability of private small-scale treatment plants will be access charges to the sewerage system. Third-party access and contestability in treatment systems have the potential to increase innovation and efficiency. Mining water from wastewater or drainage systems also has the potential to capture economies of scope from the integrated management of these two water systems (water supply and wastewater collection).

Treatment of trade waste is separated from treatment of biological waste where there is a risk of pollution from nonbiodegradable chemicals. Active chemical reagents are often functionally designed to be long-acting. This creates long-term issues if these chemicals are part of the biological wastewater stream, with the potential of impeding the biological processes in wastewater treatment and the risk of these chemicals entering the urban water system. The need to isolate the treatment of trade waste provides an opportunity to unbundle these treatment facilities from other urban water treatment facilities. Treatment systems are contestable, but require careful government oversight to ensure that environmental safeguards are maintained.

The Retail Function

The retail function of urban water management includes customer relations, billing, and possibly demand management. There is no inherent reason why this should not be contestable and opened to private enterprise. Economies may be gained from linking retail of water with retail of other services such as energy including customer relations and billing under a multiproduct retailer (see Chapter 7 on Energy Retailing).

Financing Urban Water Utilities

Australian urban water utilities are primarily government trading enterprises, which utilize off budget financing, sourced through either retained earnings, budget appropriations (set aside by legislature and allocated to the water utility), or borrowing through a central government borrowing agency, often at a lower interest rate than in the private market (Productivity Commission, 2009). Additionally there has been private sector investment in parts of the water chain which has primarily been financed through equity and debt. These structures are more fully described under The Financial Structure of Water Utilities below. In Australia the National Water Initiative requires metropolitan water utilities to recover all costs, including financing and management costs through user charges. These come from three main sources, each of which is covered in more detail below:

1. User charges
2. Developer contributions
3. Community service obligations

Revenue Streams

User Charges

There has been a shift from fixed charges to a mix of fixed (or access) charges and volumetric charges in water supply. These volumetric charges for water supply can be based on a tiered system where the price per liter increases as the volume of water used increases. The rationale for the tiered system is that it provides essential water at an affordable price, while encouraging conservation through the more expensive blocks (see section on demand management). More recently there have been calls for more flexible pricing based on water scarcity (see section on pricing).

Approximately a third of the costs in the water sector value chain accrue to sewage treatment and disposal (Productivity Commission, 2010). However, the shift from fixed charges to volumetric charges has been slow, due to the difficulty of measurement and because sewage composition affects costs. In some cases, sewage charges have been correlated with water charges on the basis that increases in water use increase wastewater in sewage. Trade waste charges are made on industrial and commercial properties that produce waste materials difficult to treat. Stormwater management has low variable costs and is appropriately charged as a fixed cost in the rates.

Because Australian metropolitan water utilities are effectively government-owned monopolies, there needs to be government oversight on water charges (see section on ownership and governance).

Developer Contributions

Developers of new housing subdivisions are required to cover the cost of water infrastructure provision within the housing development and where necessary a connection of that infrastructure to trunk mains of existing water supply, stormwater, and wastewater infrastructure (see Chapter 5). These are often in the form of upfront payments made by developers to water utilities. Development contributions create an economic incentive for developers to develop close to existing infrastructure and/or to reduce their reliance on the existing networked services, through stormwater harvesting or recycling on site. On the other hand, water authorities that specify infrastructure have an incentive to overspecify, if they are not paying the cost, as it reduces their risk and maintenance costs. The costs borne by the developer to the water utilities is capitalized on the house price and is borne by those who buy the houses.

Community Service Obligations

Community service obligations are noncommercial activities undertaken by government trading enterprises at the direction of government to achieve environmental or social policy objectives (see Chapter 3). All community service obligations should be identified and costed to support accountability and transparency in government (a clear accounting of costs of policy) and to ensure that government trading enterprises are treated in a similar fashion to private enterprise. Government water utilities receive a substantial portion of their revenues (10.2% of sector income in 2004–2005, 2006–2007 [Productivity Commission, 2008b]) from community service payments. These payments are for a range of services including subsidized water services to low-income households and the supply of water to public facilities and to environmental protection services. However not all community service obligations are identified and even when identified some community service obligations are not funded. This may affect the financial performance of a government utility and impair commercial viability.

The preferred method of funding community service obligations is direct funding from the budget. This has the advantage of transparency, accountability, and equity where the community pays for community service obligations through taxation. It also supports efficient management of infrastructure based on commercial principles. However, water utilities continue to fund the cost of some community service obligations, either through a surcharge on customers or through an acceptance of the lower rate of return on assets to government.

The Financial Structure of Water Utilities

Although in Australia most water utilities are government owned, there is increasing interest in private sector involvement in infrastructure financing and management, under government regulation to ensure that monopoly rents are minimized. There are two main reasons for this, the first is to support innovation and competition, the second is that the public sector is often budget constrained and is reluctant to debt finance high capital-intensive infrastructure. Below we look at the financial structure of both private and public sector water utilities. In this we have restricted the discussion to those services that require substantive capital investment, rather than the more contestable functions of retail, billing, etc., which would follow typical business models.

Private Sector Water Companies

Private sector companies that are involved in the development of capital-intensive water infrastructure, such as desalinization plants, would be modeled on the characteristics of typical project companies, in this case operating under public–private partnership arrangements (as in other infrastructure sectors, such as electricity generation). A typical arrangement would be to structure a single-purpose project company under a Build Own Operate Transfer (BOOT) mechanism and part finance with a project finance loan. The project company would be set up to undertake highly specific tasks with single-purpose assets in some discrete part of the value chain. Project companies are arranged typically with equity concentrated in a small number of shareholders, with high leverage (typically 70%–80% debt), and where possible with nonrecourse debt (Pretorius *et al.*, 2008). In the water sector, such a project company could be the owner of a desalination plant, for example, that produces water for delivery to the urban trunk system for further distribution. The only function of the plant is to produce water for purchase by the relevant local authority, similar in concept to an independent power producer in the electricity generation sector (see Chapter 7).

Central to these companies is a water purchase agreement, which forms the financial and economic raison d'être for the project company. The single-purpose plant is clearly hostage to a single purchaser of the output, and access to the water grid. The high debt capacity such companies reflect are mostly the result of long-term purchase agreements to ensure there is demand for the output. In the case of a desalination plant, government interest in the plant is to increase water security for a metropolitan area. To induce a private project company to invest in such a plant, the government would agree to purchase through a formal concession agreement an agreed volume of water, at an agreed schedule of rates, with agreed inflation adjustment mechanisms, and for a certain period (typically long-term, say 20–30 years). The project company promoters (equity investors) then borrow the bulk of the capital required to construct the facility against the present value of the future revenue stream that is created by the conditions of the concession agreement. The concession agreement is expected to provide sufficient incentive to private sector interest to construct and operate the facility over the term, and earn a rate of return that is sufficiently attractive to commit the equity. The plant (project company) is run as a private sector company, produces water subject to the normal regulatory controls, and at the end of the concession period the ownership of the plant is transferred to the government. The concession agreement specifies the state of repair the plant is expected to be in upon transfer, but maintenance and reinvestment is typically specified in the concession and loan agreements and monitored.

Smaller private project companies may also be developed to service niche markets such as treatment facilities. Again their financial structure may be similar, dependent on long-term contracts for demand.

Government-Owned Water Utilities

Although most water utilities are government owned, the structure of water utilities' finance arrangements shares much in common with private project companies. Whether in wholesale water or retail distribution, these utilities have a substantial investment in highly specific assets. Water infrastructure demonstrates both site specificity and physical asset specificity. The asset is located in particular locations for specific reasons and once located is essentially immobile. Its asset specificity comes from the specialized nature of the infrastructure. It is designed for its purpose, either storing water, transporting it, or treating it. There are few alternative uses for the infrastructure.

The highly specific nature of these assets and the large capital cost involved make these government-owned utilities natural monopolies.

These water utilities are financed by a mix of equity and debt with the equity owned by one shareholder, the government and the debt often sourced through a central government borrowing agency. See Chapter 3 for more information on central borrowing agencies. The equity can be sourced through retained earnings (earnings not paid out as dividends or taxes) or through government budget appropriations (public finances set aside by a legislature). The utilization of these assets produces steady cash flows, where prices have been set at a level to meet financing and management costs and to avoid monopoly rents. Performance indicators for the Water Corporation (2004–2007) are summarized in Table 6.3. The performance indicators show the scale of finance involved in operating this government-owned water enterprise, its profitability through the ratios of return on assets and return on equity, how deeply the corporation is leveraged (here not deeply) in ratios of debt to assets and debt to equity, interest cover and current ratio, and the dividends and taxes paid to government. Note that the Water Corporation's return on assets is above the average return on 10 year Australian Government Bonds in 2006–2007 of 5.8%, which shows a good financial performance for this water utility over this period.

It is in governments' interest to maximize the efficiency of these water utilities, at the same time ensuring that water services are accessible and sustainable. Managers of these water utilities have no equity stake but may have an interest in controlling large cash flows, for both their own benefit and that of the utility (Productivity Commission, 2006). Governments as the sole equity holder have three points of leverage:

1. They could set the level of debt high so that a high proportion of the cash flow would go into debt repayment, allowing little discretionary free cash flow to management for investment to create unnecessary or inefficient capacity or increases in operating expenses. This is the structure of most private project companies (see Pretorius *et al*., 2008). This is a legitimate financial structure where those that benefit from the infrastructure pay the cost of capital.

   However governments since the late 1980s have been reluctant to take on debt and this financial structure, involving public sector debt, lost political support. It is possible that this will be reevaluated as a result of the global financial crisis of 2008–2009 which is likely to increase the cost of private capital, making government debt a more attractive option. By 2006–2007, most Australian water utilities that were trading as public sector enterprises were not highly leveraged with a debt to asset ratio for the sector of 21.9% (Productivity Commission, 2008b). If well-managed, there is no reason at all why public sector utility companies that generate strong regulated monopoly cash flows cannot support high but responsible levels of debt.
2. Government funding of the assets provides government with sole equity in the water utility. A high dividend payment relative to the return on equity would provide a much needed revenue stream to government

Table 6.3 Performance Indicators for the Water Corporation (Western Australia) 2004–2007.

		Pre AIFRS[a]		AIRFS	
Indicators	Units	2004–2005	2004–2005	2005–2006	2006–2007
Size					
Total assets	$m	10 094	10 054	10 579	11 102
Total income	$m	1 315	1 314	1 416	1 566
Profitability					
Profit before tax	$'000	605 034	602 996	681 000	732 000
Operating profit margin	%	49.7	49.7	51.2	51.3
Cost recovery	%	198.9	199.0	205.1	205.3
Return on assets	%	6.6	6.6	7.2	7.5
Return on total equity	%	5.5	5.5	6.1	6.7
Return on operating equity[b]	%	5.3	5.3	5.9	6.5
Financial management					
Debt to equity	%	12.3	12.3	16.8	20.2
Debt to assets	%	10.7	10.7	14.4	16.8
Total liabilities to equity	%	19.4	19.6	24.2	28.0
Operating liabilities to equity[c]	%	15.4	14.9	19.9	23.4
Interest cover	Times	11.8	11.1	12.9	10.2
Current ratio	%	34.9	39.8	58.5	66.0
Leverage ratio	%	115.4	114.9	119.9	123.4
Payments to and from government					
Dividends	$'000	311 477	306 627	362 000	356 000
Dividend to equity ratio	%	3.6	3.5	4.1	4.0
Dividend payout ratio	%	67.2	65.8	70.2	61.7
Income tax expense	$'000	183 531	179 879	202 000	218 000
Grants revenue ratio	%	—	0.5	0.8	0.6
CSO funding	$'000	288 253	288 253	340 000	360 000

[a] Water Corporation commenced reporting under the Australian Equivalent International Financial Reporting Standards (AIFRS) on June 30, 2006.
[b] Refers to return on equity based on operating assets and liabilities.
[c] Refers to operating liabilities to equity based on operating assets and liabilities.
Source: Reproduced with permission from Productivity Commission (2008). *Financial Performance of Government Trading Enterprises, 2004–05 to 2006–07*, Productivity Commission, Canberra, Australian Capital Territory, Australia, p. 185.

with which to fund other objectives. However, this might leave little for the water utility to reinvest in maintenance or new growth, and it may be best to observe a prioritized payout structure where planned maintenance and reinvestment rank senior to both debt and dividend payments (such waterfall-type structures are common in project finance loans, as mentioned above). The Productivity Commission (2008b) has noted that the dividend payments for water utilities in Australia have been high in the past. Dividend payout ratios for urban water utilities in 2005–2006 were around 70%–100%, with Sydney Water 73%, the Water Corporation (Perth, Metropolitan) 76%, and South Australia Water 95%. This reduced in 2006–2007 with the continued drought.

In 2006–2007, payout ratios were Sydney Water 35%, The Water Corporation 62%, and South Australia Water 68% (Productivity Commission 2008b) and were generally down throughout the sector. Difficulties could arise if government became reliant on these revenue streams as return on equity is not always totally predictable, particularly in periods of low rainfall and reduced demand. High dividend payments to government may also disadvantage government-owned enterprises relative to private enterprise.

3. Governments presently set user charges except for NSW, Victoria, and the ACT where prices are set by independent regulators. Prices are set to recover costs rather than provide a profit to government. At present these prices do not signal the scarcity value of water. If prices were to reflect the scarcity value of water, water prices would be set by the market and would be more fluid and less subject to government control. Water scarcity pricing would provide an indication of the level of water security demanded by users which would provide more effective signaling to both the public and private sector for future capital investment in capacity.

The impact of these three levers creates the financial space for water utilities to operate in. This financial space defines where discretion lies in relation to future planning and investment in water infrastructure, whether it rests with the water utilities or with the government as sole shareholder. High leverage leading to high debt repayments, and a tight control on prices, might leave water utilities with little ability to pay maintenance costs, or plan and build for the future, with this underinvestment reducing water security and sustainability. Thus sound management would prefer senior prioritized maintenance and reinvestment programs (with the residual paid as dividends). Too loose a hold on these levers, thus generating substantial free cash flows, might support unnecessary and risky investment and decreased efficiency. Political involvement in investment decisions may also lead to uneconomic investment requiring long-term commitment for short-term results. A possible example of this may be the decision to develop desalinization plants in Victoria and New South Wales, rather than undertake rural-urban water transfers. Whether it is the Boards of water utilities or government through the Minister that takes investment decisions in relation to these water utilities, there are strong benefits in public disclosure of water planning and management with investment decisions subject to public review and management subject to performance appraisal. To be able to do this effectively will require reform of external governance.

Conclusions

It is evident in Australia and in many other nations that there is a strong imperative to increase efficiency and manage risk within the urban water sector due to increasing population growth and impacts of climate change on a scarce resource base (energy, water, and finance). This chapter has focused on water security (balancing demand and supply) and the financial and structural arrangements in the urban water industry. Major areas for reform are as follows:

1. Water security: A need to define water security standards for metropolitan regions to establish targets for investment and management.
2. Demand management: The development of a more responsive and effective instrument for demand management as an alternative to past heavy reliance on water restrictions. Water security pricing responsive to environmental conditions and the market would send clear signals to water managers on the required level of investment in water security and would increase flexibility of choice for consumers.
3. Water supply: The development of a diversified and resilient water supply, broadening the base beyond urban storage dams to catchment management, underground aquifers, recycled water, rural-urban transfers, and manufactured water with the sourcing of water contestable and coordinated on a least cost basis. This is feasible given the proximity of Australian cities to coastal areas and/or irrigation areas.

   Major investment in water supply should be based on a real options approach, programming investment decisions to take into account increasing certainty with time. Here there is value in delaying investment decisions until critical thresholds are reached based on water security objectives. These trigger points should be made public so decision making is transparent and accountable.
4. Governance: The separation of external and internal governance of water utilities and the clear articulation of goals and accountabilities.
5. Water industry: The identification of contestable and noncontestable functions in the urban water value chain and the support of private sector investment in contestable functions to increase competition, improve differentiation, and support innovation.
6. Finance: The review of government financing policy including ratios of debt to equity and debt to assets and dividend policy to bring government utilities more in line with the private sector and to leverage the lower cost of government capital, particularly since the 2008–2009 Global Financial Crisis.

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7

Financing and Managing Urban Energy Systems

John Daley

Introduction

This chapter presents information on the finance and management of urban energy systems within an Australian context—though more general applications of energy realities and principles are covered.

Energy is integral to the way a modern city operates. Most cities rely on energy as a critical element in their functioning, and energy is the reason for the development or renaissance of others. Energy systems are part of the underlying fabric of a city and their characteristics and design influence urban form and development.

At a national and State level, energy attracts the interest of policy makers and planners because energy is an essential service and elements of energy systems are considered natural monopolies requiring economic regulation. A separate concern is that necessary energy infrastructure might not be funded by the private sector. Because of the long-term nature of energy infrastructure, the magnitude of the investment, the pace of innovation, and the volatility of energy markets, major energy infrastructure has associated with it very high risks. Accordingly, government policies relating to energy infrastructure need to be clear and transparent to support competitive markets. Risks and costs should be borne by those who are responsible for them or accept them, rather than by those who, usually unknowingly, have costs and risks foisted upon them by a government authority or monopolistic utility. This is an underlying theme of this chapter.

While energy issues have increasingly been appropriated as matters of national jurisdiction, vital urban interests remain. Similar to other network infrastructure, energy systems make demands on city administrations, requiring access to public land, public arteries, and public airspace. The involvement of city managers in fostering improvements to energy

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

systems—on both the supply and demand side—is important if key energy and climate change objectives are to be delivered.

Energy technologies influence urban form and city design. Cities continuously develop and reinvigorate themselves. New fuels and energy sources have evolved over time; their relative costs have changed; and new technologies of production and delivery are constantly emerging, if relatively slowly.

There is more scope to curb energy usage and to deliver energy more efficiently when planning new cities and satellites than exists within the constraints of existing city structures. Rapidly emerging cities of Asia and the developing world offer the greatest opportunity for improvement at least cost. Retrofitting established cities is challenging but will be important in realizing national and global energy security and greenhouse objectives.

Outline of the Chapter

The chapter looks at the relationships between energy and how cities are shaped and function. It first discusses energy systems (introducing concepts of energy services and value chains), energy policy and energy regulation, and the financing and governance of energy investment, focusing on the management of risk. The central sections of the paper describe energy markets, resources, and supply systems, highlighting interactions with the urban environment, with an illustrative survey of primary and secondary energy supply and demand in Australia. This is rounded out by a discussion of the potential for future energy systems, including the prospect of more decentralized energy supply systems. The chapter concludes with summary observations of relevance to policy makers, planners, administrators, and regulators interested in the good functioning of energy systems in our cities.

Energy Systems, Energy Policy, and Governance

This section introduces the concepts of energy services and value chains, outlines three central motives of contemporary energy policy—efficiency, environment protection, and energy security—and discusses the assignment and management of risk, both policy risk and business risk.

Energy Services

Energy is ubiquitous in the economy and the community. Very little gets done without expenditure of energy. It is important to the functioning of the macro economy and critical to the performance of most social and business activities. Energy analysis is undertaken from different perspectives: from the top-down to the bottom-up, plus any number of cross-cutting dissections. A top-down perspective is provided in a later section. However, to understand energy it is necessary to conceive energy systems from the bottom-up: how it is used in specific applications and circumstances, and what alternatives might exist.

Energy consumption is seldom a purpose of itself, but rather a means to another end. Energy is used to propel vehicles, drive equipment, pump fluids, heat furnaces, warm spaces, heat water, fuel stoves, light buildings, and process materials, among other things. Indeed, some of these applications are not ends of themselves, in many instances energy is a third-order issue in a consumption or production decision. So energy demand is derived—a consequence of demand for downstream goods and services from which people gain utility—and this prompts the concept of energy services. Commercially packaged energy services, like the provision of lighting and fully fuelled car leasing, are now common; as are much larger scale undertakings such as independent on-site power and steam generation. The latter arrangements allow industrialists to concentrate on their core business, leaving the provision of these services—and importantly their capital cost—to specialists. But the concept has more promise and it can be expected to develop further as valid business models are devised.

Value Chains

It is appropriate also to introduce the concept of the value chain. Almost all production processes can be depicted as linear value chains—tracing the origin of the raw material(s) to their destination as consumer or final products and tracking the progressive increase in value along the chain. Transporting a raw material to a processing center needs to add worth at least equal to the full cost of providing the transportation, otherwise the link is not financially viable; and that criterion applies to each link in the chain.

The value chain provides opportunity for structural separation—that is, for dividing a vertically integrated production and supply system into sensible elements, either as an accounting construct (which can be valuable) or for independent control or ownership. Since the early 1990s, a very substantial effort has been made in Australia and other countries to separate the contestable elements of supply chains from those which exhibit natural monopoly characteristics. This has been a deliberate focus in the energy business, as it has in telecommunications and other network industries.

Competition—as a driver of innovation and efficiency—can be facilitated in separated, contestable segments using economy-wide antitrust legislation to prohibit collusion and limit barriers to entry (though there may be a need for industry-specific rules to preclude reintegration). In energy, the experience has been that the production segments of the value chain (mining, electricity generation, etc.) and the retail segments (selling end products to businesses and households, monitoring consumption and billing) are highly contestable and can be unbundled from the network segments.

This requires intervention by government, since there is seldom any incentive for integrated enterprises either to divest or to allow full transparency. Unbundling, and related pro-competition reform, affords lower final prices, greater consumer choice, and generally improved service quality—though, in special circumstances, critical mass considerations might outweigh these benefits.

Genuine natural monopoly (typically network) elements of energy systems need to be regulated on an ongoing basis by industry or sector-specific regulatory authorities. This is economic regulation approving network businesses' pricing (cost recovery), service standards, and investment proposals, in the interest of energy consumers.

Energy Policy

Until the early 1990s, energy security was the cornerstone of energy policy. It was a preoccupation—with supply reliability and cost—that was overshadowed only relatively recently by the new imperatives of efficiency and climate change (though following the oil price shocks of 2007 and 2008 and interruptions to European winter gas supplies transiting Ukraine, energy security reemerged as a key issue).

Notwithstanding these oscillations in priorities, the focus of energy policy in recent times has been divided between economic regulation (fostering competitive energy markets), environmental regulation (with a dominant emphasis on climate change), and energy security (fostering reliable energy supplies at stable and affordable cost). All three have important local ramifications, though policy responsibility is generally at national level.

Economic Regulation

As intimated above, from the early 1990s reforming governments in Britain, Scandinavia, Australia, the United States and elsewhere challenged established monopoly utilities with a competitive alternative, the thesis that efficiency can be induced and fostered by unbundling the contestable elements of otherwise integrated value chains. In essence, this is a matter of making sure that markets are allowed to work in the contestable segments and that the noncontestable elements, which remain in the hands of monopoly owners, are properly regulated.[1] Governments around the world have established new bodies to provide this governance[2] and most proclaim commitment to best practice. Only time (and interjurisdictional comparisons of outcomes) will reveal which approaches have worked best.

In urban areas, energy networks typically comprise facilities and transport for the distribution of liquid fuels, electricity transmission and distribution lines and natural gas transmission and distribution pipelines. Power lines

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[1] Relevant literature see: Baumol *et al.* (1982); Giulietti and Waddams Price (2005); Green and Newbury (1998); Littlechild (2009).

[2] In Australia, the key bodies at national level are the Australian Energy Regulator (AER) and the Australian Energy Market Commission (AEMC). These are bodies established jointly by the Federal Government and the States and Territories.

and gas pipelines usually have strong characteristics of natural monopoly (duplication by a third party is seldom economic) and it follows that profit maximizing owners have no incentive to set capacity and prices for access and transmission at optimal levels. This is where there is a case for economic regulation. Road distribution of petroleum products, by contrast, is normally highly competitive or at least contestable and there is little reason for regulation other than public safety and consumer standards.

Economic regulation of electricity and gas networks focuses on both price and capacity issues. Where prices are regulated by a method which averages costs across all users, there is a public interest in ensuring that excess capacity is not built, and that capital investments are made on a timely basis and without 'gold plating'. This key regulatory function—ensuring the network provided is efficient, given all the circumstances—is problematic, given that network owners have far better access to pertinent information, making it seldom possible to prove the counterfactual (what would happen if a proposed capacity expansion, for example, is not proceeded with). Regulating network prices is equally problematic, though cross-sectional comparisons between broadly similar networks are instructive.

Access regulation is particularly important in circumstances where a wholesale energy supplier or an energy retailer has retained ownership of a network or network link. A clear conflict arises if a third party needing access is a competitor of the network owner in a related contestable market (either upstream or downstream). Modern access regimes enable third parties to move electricity or gas through energy networks that they do not own (when spare capacity is available) and prescribe the rate the network owner can charge.[3]

While the regulatory function of an energy policy regime relates principally to network infrastructure and access to it, it is also important to ensure that unbundled contestable segments of the value chain remain competitive. Power generators and fuel marketers, for example, are routinely criticized for anticompetitive behavior—and political realities demand some order of oversight.

Economic regulation is inescapably ongoing: market and technology developments dictate changes, extensive consultation needs to be conducted, and reforms, which tend to amplify the complexity of regulation, require enactment and implementation. The nature of the process means that economic regulation is bound to be slow, clumsy, and inferior to competitive alternatives (where they can be devised). Unnecessary and poorly conceived regulation needs to be eliminated, while being careful not to infringe valid property rights, and regulations need to be continuously tested to demonstrate they improve market outcomes and, indeed, achieve better outcomes than other conceivable interventions (Coase, 1960).

[3] This outline grossly oversimplifies the matters at issue, since network services are generally priced using two-part or multi-part tariffs (comprising access or demand charges and throughput charges) and services are offered in various degrees of quality, typified by the distinction between 'firm' and 'interruptible' service.

Climate Change: Constraints on Carbon Emissions

Governments around the world assert a determination to take stronger action to curtail emissions in order to avoid dangerous anthropogenic climate change. All developed countries and many developing countries have mitigation and adaptation policies in place and all acknowledge that, unless much stronger and more universal action is taken, atmospheric concentrations will pass 450 ppm CO_2e, almost double preindustrial levels, implying that the increase in global average temperatures could exceed the 2°C target they set themselves in Copenhagen and Cancun.

The commitments of the developed countries for the first Kyoto commitment period (ending in 2012) will deliver only a tiny reduction in emissions compared with 'business-as-usual' reference scenarios, and have imperceptible impact on climate. Several prominent countries will fail to meet their commitments and others will only do so by virtue of the recession following the 2008 Global Financial Crisis (GFC) and incipient recovery. Rich countries are reluctant to take on substantially stronger commitments when growth in emissions from the poorer countries will offset any abatement achieved. Developing country emissions in aggregate outstripped developed country emissions in 2010.[4] On the other hand, developing nations understandably accord priority to improving the living standards of their people—an improvement that will only come about via economic growth. They are cognizant also of their own relatively low contribution to global emissions on a per capita level and from an historical perspective. Accordingly, they have refused to take on onerous emission reduction obligations before they see much more significant sacrifice by developed countries. This is a dilemma that seized Professor Ross Garnaut in his report on climate change to the Australian Government in 2008 (Garnaut, 2008).

While progress might be slow, stronger greenhouse mitigation measures can be expected to be enacted, particularly in the industrial countries, and the energy sector will be front and center of these endeavors. Pricing or taxing emissions (market instruments) are preferred over more prescriptive interventions, though most governments are disposed politically to implement costly suites of 'complementary' approaches. Consciousness of the need to curtail emissions has also permeated business and the community and many companies and individuals are taking deliberate decisions to minimize their greenhouse footprint.

Adaptation policies (i.e., measures by governments and by companies to anticipate and react to impending climate change) are being developed in most countries and at all levels of jurisdiction—though adaptation policy development is still in its infancy. There are adaptation policy responses relevant to the energy sector (for example, inland power stations' water supply is an issue) and many will be addressed appropriately when the

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[4] Developed countries are concerned about 'carbon leakage' which will occur if competitive industries in developing countries are not subject to the same order of penalty on emissions. This is the problem of 'footloose' trade exposed, emissions intensive industries—usually energy intensive industries.

relevant risk is more clearly evident and imminent (for example, storm protection for offshore oil production facilities).

The prevailing thinking, reflected by the International Energy Agency (IEA), is that if dangerous climate change is to be averted:

> … hundreds of millions of households and businesses around the world would need to be encouraged to change the way they use energy. This will require innovative policies, an appropriate regulatory framework, the rapid development of a global carbon market and increased investment in energy research, development and demonstration.
>
> (IEA, 2008, Executive Summary p. 37)

Imposing a price on emissions is the main policy direction, either through a carbon tax or emissions permit trading, notably cap-and-trade.

Pricing Emissions via ETS or Carbon Taxes

Emissions trading demands special attention in the Australian context because emissions trading has again been proposed for implementation within 3–5 years of the planned initiation of a 'price on carbon' imposed with a tax from mid-2012.[5]

Under an emissions trading scheme, emitters are obliged to acquit their emissions by surrendering permits issued by government. The quantity of permits on issue, for a given period of time, is determined at a level deliberately below the level of expected unconstrained emissions, and hence the permits command a price. The quantity can also accord with a policy target for national emissions or a national emissions commitment. This is probably why trading schemes rather than taxes are the preferred market instrument of many environmentalists: the environmental outcome (a specific target) is guaranteed by compliance whereas, with taxes, which economists tend to prefer (Nordhaus, 2007), only the direction of the outcome (emission reduction) can be guaranteed in the short term.

Most trading schemes, including the Australian legislation, the European Union's latest scheme, and the Kyoto Protocol scheme, allow 'banking' of permits—that is, for permits to be held for use in acquitting emissions in a subsequent period. Being government paper, these permits should be risk free with a forward price curve that would progress in nominal terms at exactly the government bond rate (Hotelling, 1931). The corollary is that long-term abatement cost—the cost of significant abatement in the foreseeable future—is translated forward to the current price of permits. To some, this character of a trading scheme is unfortunate

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[5] Legislation to enact a 'carbon pollution reduction scheme' was introduced into the Australian Parliament in 2009. However, under political pressure, plans for its passage were suspended. In 2010, the Government declared its intent to impose a price on carbon (a carbon tax) with a later transition to a trading scheme, and legislation to this effect was introduced in 2011 (www.climatechange.gov.au).

because it advances high future abatement costs to the present, missing the opportunity to harvest 'low hanging fruit' first.

Probably the Achilles heel of emissions trading (or tax) systems is their adverse impact on trade-exposed industries—assuming, realistically, that the whole world does not take comparable mitigation action at the same time. These impacts will oblige most countries—initially or in time—to carve out the liability of trade-exposed industries, thereby seriously undermining the efficacy of the whole scheme. The only way around the problem, short of a truly comprehensive global commitment, is to change the accounting of emissions liability from *production* of emissions—which is the Kyoto approach—to a *consumption* approach. This would also have the advantage of encouraging participation rather than deterring it, as the production approach does (Carmody, 2009). Emissions measurement by consumption, in countries which employ value added taxes (like Australia), is relatively straightforward, completely compatible with WTO obligations, and requires no information not required of the entrenched production approach.

Australia's move to price carbon will have powerful ramifications for the Australian energy sector. It will impact directly on cost structures: higher emissions intensive energy sources, like coal, oil, and electricity, will be disadvantaged (as intended) in competition with lower emissions energy sources, like natural gas, wind, and solar; the economics of electricity generation will change, possibly radically; and the structure of the Australian economy is bound to change as well, particularly if trade-exposed emissions intensive industries are not adequately shielded from competition from countries that do not impose comparable emissions penalties.

All of these impacts, as elaborated in later sections, will be manifest in Australian cities, affecting both the patterns and pace of growth.

Security Issues

Reliable and affordable energy supplies are critical to the functioning of economies and cities. When the lights can't be switched on, when natural gas supplies are disrupted, and when the petrol bowsers are dry, economic activity comes to a near halt. Reasons for supply disruption might include natural disasters, system failures, industrial activity, acts of terrorism, war, and economic brinksmanship. Understandably, authorities are inclined to make contingency plans and implement policies that forestall or ameliorate such events.

Petroleum Product Supply Security

Petroleum product supply systems are reasonably diverse, so a disruption at a service station, a terminal, a refinery or an oilfield tends to be of little consequence because supplies can be redirected and sourced from stocks. Instead, the greater policy concern has been geopolitical: the increasing concentration of global economic sourcing of crude oil supplies from the

Arabian Gulf, with the concomitant influence on crude oil pricing and the risks of short-term interruptions to supply given political instability in the Middle East and the intensity of use by crude oil tankers of the Straits of Hormuz seaway. Members of the IEA have agreed to maintain 90 days' supply, including in strategic stocks, to forestall a major oil supply crisis, and to share available supplies in the event of such an emergency.

The Australian Government has undertaken responsibility to prepare contingency plans against foreseeable national emergencies, including by preparing a national response to a major fuel shortage. The objective is to minimize the impact on the community in terms of maintaining essential services, minimizing economic disruption, and ensuring that available supplies are distributed as equitably as possible. The Liquid Fuels Emergency Act gives government a range of powers to prepare for and manage a national fuels emergency to these ends. Importantly, fuel prices are allowed to rise and act as the major instrument of rationing.

Natural Gas Security

Australia's supplies of natural gas were severely disrupted by two major explosions, one at the Longford gas processing plant at Sale, Victoria, in 1998 and another at the Varanus Island plant in Western Australia 10 years later. The latter blast slashed the State's gas supply by a third and seriously impacted industrial production for many months. The earlier Victorian disruption cut gas supplies to homes and businesses for almost 2 weeks. Deficient operating and maintenance procedures and training were held responsible. In response, governments have developed improved contingency plans for managing such emergencies and have moved to strengthen supervision of relevant operating standards.

Further afield, natural gas supplies to western Europe were interrupted for several weeks in 2007 and 2008 as a consequence of a commercial dispute between Russia, where the gas is sourced, and Ukraine, through which the major pipelines pass. Russia supplies about 35% of Europe's gas needs and the figure is set to rise. The disruption caused hardship in Ukraine and EU countries and raised serious questions about plans to further increase gas-fired power generation in Europe. The key solution being pursued to mitigate this problem is the promotion of alternative pipeline projects from more diverse sources further east and further south, and the incidents were thought to afford impetus to investment in nuclear power.

One observation is that disruptions to gas supplies are probably inevitable and, while trying to ensure that supply systems are as robust as possible, the principal way to best manage a disruption is to allow prices to rise to ensure that available gas gets to the highest value applications. Save for supplies earmarked for essential services, this was allowed to happen in Australia and in Europe, and the adverse impacts of those disruptions were greatly reduced.

A related observation is that natural gas prices can be differentiated in terms of security of supply. Gas can be contracted, for instance, on an interruptible basis rather than firm supply, with the supplier able to interrupt for whatever reason up to a specified number of days a year. Differentiation allows the market to devise supply priority in advance of an emergency and should reward the supplier for making contingency provisions.

Electricity Security

Electricity security in a power pool like Australia's National Electricity Market (NEM) can be said to be achieved if dispatch does not need to be undertaken by regulatory intervention and if average pool prices do not exceed new entrant levels for any sustained period. In the NEM that would mean that prices do not spike to the trigger for directed rationing (a maximum price designated as the value of lost load) and that dispatch weighted prices, say on a 24 month moving average, do not exceed the average total cost of a gas-fired combined cycle turbine (CCGT). Without intervention, the market can be expected to match available supply with demand reasonably efficiently.

Suspending the pool market and rationing electricity by regulation should be necessary only in extreme circumstances where there is an unfortunate coincidence of plant outages or catastrophic system failure.[6] Provisions are made to mitigate these possibilities by routine reviews of system reserve margin and by contracting ancillary services like black start capability.

Experience with the Australian NEM suggests that the pool market, especially with its integrated interconnection of otherwise separate State markets, has served to enhance security of supply. A great deal of peaking capacity has been added to the system (by private entrepreneurs risking their capital) and direct intervention has been minimal—both outcomes possible only by allowing pool prices to rise sharply when they need to.

At the same time it is evident that some elements of the Australian electricity supply system have become less reliable, particularly in urban distribution networks. In Sydney, a series of blackouts in parts of the CBD in 2008 and 2009 was found to be due to neglect and underfunding by State-owned utilities.

Managing Risk

For public policy makers and city administrators all three of the motivations outlined above address risk minimization: minimizing the risk that energy investments will be insufficient or unduly costly; minimizing the risk of climate change and the risk of devoting unwarranted resources to the task, especially if their effectiveness is in question; and minimizing the risk of energy supply disruption and of over-provision of such insurance.

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[6] That is, if several major units of capacity are forced off-line at the same time. This can happen, among other things, if the outage is on account of the failure of a transmission line serving multiple stations.

It is hard to overstate the inherent risk of contestable energy businesses. For investors, exploration and construction risks are singularly high, operation risks can be very high (notably for peaking generators in failing to switch on and for baseload stations with unscheduled outages), and product price risks are substantial, particularly when trading positions cannot be covered. Risk management is crucial. This is not a function that government agencies have a history of doing well, particularly in the event of failure, and this deficiency is compounded by conflict of interest when regulatory risk is superimposed.

Business risks are much more moderate in monopoly network industries. But assets in these businesses do get stranded—and the proper course in such circumstances (write-offs) is sometimes unpalatable if the assets are owned by government. Australian economics consultant, Dr Henry Ergas (2009), put the issue succinctly:

> The assumption underpinning the market-based approach is straightforward: given a regulatory framework that provides the confidence required for long-term investments, commercial investors are best placed to bear and manage the risks involved in determining timing and technologies. The pragmatic outcome is that private shareholders, rather than taxpayers, shoulder the costs of any mistakes.

Ergas is a proponent of letting markets, not government agencies, 'do the heavy lifting' with properly targeted, technologically agnostic, and competitively neutral subsidies for service provision if socially justified. The proper role for government is to establish and maintain that all-important regulatory framework. Within that framework it is important that risks are made as transparent as possible and are assigned to where they belong—which is to say to those who are responsible for them (for the decision to allow exposure). This is the essence of a properly functioning market. If risks are properly assigned, those who have the ability to ameliorate them can be expected to be rewarded by those exposed.

The GFC of 2008 revealed in the starkest possible way that financial markets were not functioning properly. Some people were quick to blame 'the ideology of the unrestrained free market'—and that contained an element of truth. It was also the case, however, that careless and unconstrained lending was encouraged by misguided public policies and that regulatory and business supervision of disclosure was totally inadequate, permitting risks to be obscured beyond trace and fees to be paid without reference to longer term outcomes. Devising and maintaining that all-important high quality regulatory framework, with government playing its proper part, is no simple matter in energy, just as in finance.

Governance and Financing

In the context of urban energy systems, governance addresses arrangements to ensure energy is supplied adequately and efficiently, taking account of all the inherent and imposed risks. At a deeper level, governance goes to the assignment of risk, responsibility, and reward between the owners of a company's capital (its shareholders) and company managers—a distinction which is opaque in the case of government business entities (Rushworth and Schluter, 2008).

Analysts wonder whether capital will be available when needed to fund essential infrastructure, including energy infrastructure (EEI, 2009). This issue is always present when governments own energy businesses (as in several Australian States) but have competing expenditure priorities, and increasing concern about funding rejuvenated interest in public–private partnerships (PPPs). In normal circumstances, commercially validated investment projects would readily attract the required capital but, post-GFC, some of these norms are less reliable. The World Energy Council (WEC, 2009, p. 2) expressed concern about funding shortages in these terms:

> The illiquidity of global financial markets has meant that companies find it much more difficult to access capital, even for high return projects. Such funding shortages are raising concerns about the short-term feasibility of the capital-intensive investment required in the energy sector.

The IEA (IEA, 2009, pp. 3–5) suggested that:

> … falling energy investment has 'potentially grave effects on energy security, climate change and energy poverty' and that these concerns 'justify government action'.

Major new investments like power stations and gas pipelines have traditionally been funded by project finance, with large syndicates of banks worldwide providing nonrecourse debt capital for perhaps 70%–90% of the total commitment. The balance was provided by vendor finance, mezzanine debt, and equity. International bank syndication of project debt largely dried up immediately post the GFC, including for roll-over debt. In Australia, local banks have been understandably reluctant to increase their exposure to individual projects beyond risk-governed diversification covenants. Until the international banks stabilize their loan books and once again look for global diversification, project financing of energy infrastructure will remain difficult and new financing models may need to be found.

Following the GFC there was also a pause on bond issues secured against a network business, that is, wires and pipes in the energy sector, after investors suffered huge write-downs in the market value of these kinds of securities. On the other hand, savings still flow to fund managers and need to be productively and safely invested, and regulated utility investments should, in theory, provide the assured returns investors are now seeking.

For businesses owned by public agencies, PPPs offer a possible model, although there are issues of risk management and agency costs (see Chapters 3 and 4).

Public Ownership

In Australia, the New South Wales (NSW) and Queensland governments own power stations; in those States and others, State entities also own electricity network and retailing businesses. Most industry experts, including professionals (Owen, 2007) engaged by the NSW Government, have concluded that public ownership has been detrimental—starving government-owned businesses of needed capital for maintenance and upgrading by extracting excessive dividends, deterring or distorting private power generation investment by virtue of posing an unfair competitive risk, and exposing government assets (and hence residents' and taxpayers' wealth), and the State's credit rating, to significant commercial peril.[7] In mature economies, with diverse and interlinked energy systems, the case for direct government investment is very weak.

Energy Markets, Resources, and Supply Systems

From the top-down perspective, a key observation would be that energy demand has always been closely correlated with expenditure and output (i.e., at the national level, with Gross National Expenditure and Gross Domestic Product). It is generally true that the more we spend, the more we consume energy; and the more we produce, the more energy is needed in the process. Urban energy demand would exhibit the same correlation. But the lockstep is no longer one-for-one: after the oil shocks of the 1970s the growth in energy demand, and particularly demand for oil, proceeded more slowly than GDP: the energy intensity of the Australian economy, like most others, declined until 2000 when a closer lockstep reemerged in Australia. The oil price spike of mid 2008 was a consequence of that reemergence and an element in its subsequent suppression.

The energy intensity of economies declines for several reasons. One is an improvement in energy efficiency—the energy required to perform a particular task. A second is a restructuring of activities within an economy away from energy intensive activities—typified by the global trend toward services. And a third is a substitution of fuels with lower life-cycle energy content for fuels with higher energy content. This substitution opportunity is application specific—the most important instance being the substitution of natural gas for electricity in applications such as space and water heating.

There have been spectacular improvements in energy efficiency over recent decades. The latest household refrigerators, for example, use less than a third of the electricity of their 1980s equivalents; modern automobiles drive much farther with better comfort and safety than earlier

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[7] In electricity pools the contestable generation and retail businesses often cannot avoid exposure to very significant market risks. Accounting standard AASB139 requires that all derivative financial instruments be reported in the financial statements at their fair value which is calculated using an estimated price of the forward contract—and, reflecting current prices, the forward price is highly volatile.

models; the latest facilities in electricity intensive industries, like aluminum smelting, are much more efficient than their predecessors; and latest technology power generation plants can be 50% more energy efficient than older stations still in operation. However, energy efficiency in this engineering sense—that is, the energy required to complete a specified task—is subject to immutable laws of physics, and continuing improvements will approach limits asymptotically. The scope for ongoing improvement is progressively declining and the cost of improvement is generally rising. Energy efficiency is a critical component of efforts to secure the world's economic future and to contain greenhouse gas emissions but it is not a panacea.

Another observation cautioning undue reliance on continuing improvements in energy efficiency is the rate of innovation in new applications, particularly in the form of electrical appliances for the home, office, and modern day life. New product launches and the proliferation of additional appliances have probably outstripped the energy saving contribution of improved efficiencies in traditional appliances.

An interesting final point is that the rate of decline in energy intensity has seldom matched the growth in output (GDP). Countries with high population growth tend to exhibit significant energy demand growth despite improving energy intensity. In Australia there has been a very close relationship between population growth and growth in energy demand—and this would be typical of growing economies and growing regions and cities.

Urban Energy Demand

Urban energy demand—or energy use in cities and towns—is a construct not normally contemplated by energy analysts and planners and, as such, is not measured routinely. It can be derived, however, with acceptable accuracy by deducting from total energy demand the energy used in defined nonurban activities. These would include: agriculture, fishing, forestry, mining, and upstream oil and gas; nonurban industrial installations, including most major power stations; and international, regional, and interurban transport. Identifying major nonurban industrial installations and their energy use is a more painstaking exercise—but there are indirect data sources.[8]

In its World Energy Outlook 2008 (IEA, 2008) the IEA made a first attempt to describe and quantify energy use in cities, given high percentages of urban populations in the developed world and rapid urbanization in Asia and Africa (currently 50% of the world population lives in cities with this percentage expected to grow, as discussed in Chapter 1). The IEA estimates (given current greenhouse gas mitigation) that by 2030 city energy use could be as much as

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[8] For example, the National Greenhouse Gas Inventory, Department of Climate Change and Energy Efficiency (annual) and the National Pollutant Inventory, and the forthcoming National Greenhouse and Energy Reporting system (NGERs).

Table 7.1 World energy demand in cities, by fuel, 2006 and 2030.

	2006		2030		2006–2030
	Mtoe	% Consumed in Cities	Mtoe	% Consumed in Cities	Average Annual Growth (%)
Coal	2330	76%	3964	81%	2.2
Oil	2519	63%	3394	66%	1.2
Gas	1984	82%	3176	87%	2.0
Nuclear	551	76%	726	81%	1.2
Hydro	195	75%	330	79%	2.2
Biomass and waste	280	24%	520	31%	2.6
Other renewables	48	72%	264	75%	7.4
Total	7907	67%	12374	73%	1.9
Electricity	1019	76%	1945	79%	2.7

Note: An Mtoe (million tonnes of oil equivalent) equals 41.868 PJ.
Source: *World Energy Outlook*, © OECD/IEA, 2008, Table 8.2: World energy demand in cities by fuel in Reference Scenario, p. 183.

57% higher than in 2006[9] and account for 73% of the world's total energy use. Some 81% of that increase is expected to come from cities in non-OECD countries (even though, by 2030, 87% of US energy demand will be from cities—up from 80% in 2006—and 75%and 80% of EU and Australasian energy demand will be from cities—up from 69% and 78%, respectively).

Table 7.1 summarizes the IEA's estimates of city and world energy use by primary energy source in 2006, and the reference case projections to 2030. About two thirds of the world's energy is consumed in cities, where residents on average consume more coal, more gas, and more electricity than the global average, but somewhat less oil and much less biomass and waste. The gap between rural and city energy use per capita is expected to narrow into the future, but increasing urbanization implies continuation of the trend of urban energy use outstripping total energy use (see Figure 7.1).

Primary energy is consumed directly (or with minimal processing) as final energy. This includes black coal when used in blast furnaces for steelmaking, in cement plants, and other industrial applications. More than half of primary energy supply is converted to secondary energy. This involves converting fossil fuels (and uranium) to electricity, crude oil and natural gas liquids to refined petroleum products, and gas to LNG.

Note that coal, under this IEA scenario, would continue to be the most important urban fuel source (mostly for electricity generation) accounting for 32% of urban primary energy use in 2030 while total renewables, despite having the fastest average annual growth rate, would account for just 9% of 2030 usage. With more stringent action to curtail greenhouse gas emissions, there will be somewhat less coal and more renewables (and gas) in the energy mix.

The corresponding data for Australasian cities compared with the regional totals for Australasia are depicted in Table 7.2. These projections indicate

[9] This is the IEA 'reference scenario' which does not comprehend additional greenhouse gas mitigation action.

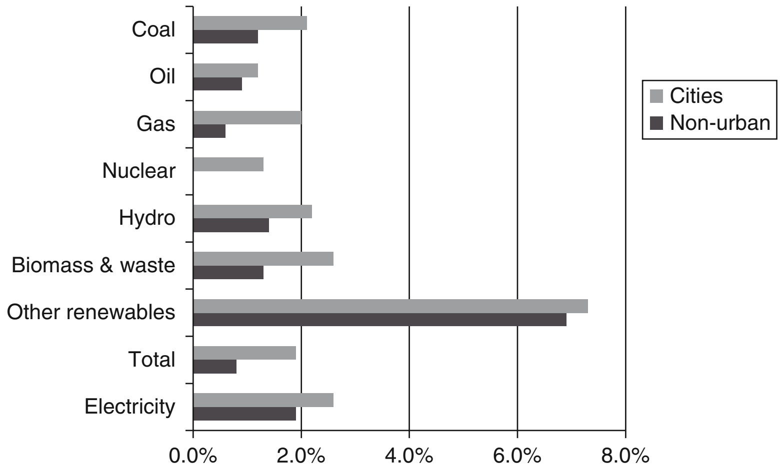

Figure 7.1 Projected growth in fuel demand, 2006–2030, cities and nonurban areas compared.
Source: *World Energy Outlook*, © OECD/IEA, 2008, Table 8.2: World energy demand in cities by fuel in Reference Scenario, p. 183.

Table 7.2 Australasian energy demand in cities, by fuel, 2006 and 2030.

	2006		2030		2006–2030
	Mtoe	% Consumed in Cities	Mtoe	% Consumed in Cities	Average Annual Growth (%)
Coal	45	76%	47	81%	0.2
Oil	30	63%	35	66%	0.7
Gas	25	82%	34	87%	1.3
Nuclear	0	76%	0	81%	0.0
Hydro	3	75%	3	79%	0.8
Biomass and waste	5	24%	10	31%	3.5
Other renewables	2	72%	7	75%	5.9
Total	110	67%	136	73%	0.9
Electricity	17	76%	24	79%	1.4

Source: *World Energy Outlook*, © OECD/IEA, 2008, Table 8.5: Australasian energy demand in cities by fuel in Reference Scenario, p. 183.

more moderate growth overall, particularly for coal use. Electricity use in cities is projected to rise to 84% of total Australasian electricity use (up from 80% in 2006) with urban use of natural gas accounting for no less than 97% of the total.

Australia: Primary Energy Resources and Supply

Australia is well endowed with primary energy resources, possessing the world's largest reserves of uranium—in the order of 40% of world resources—very large coal and lignite deposits, substantial natural gas and coal seam gas and abundant solar radiation. Crude oil reserves (and production) have been declining, though liquid fuel output has been sustained by increasing quantities of NGLs (natural gas liquids) produced from natural gas reservoirs.

Australia's low-cost uranium and black coal resources have established the country as the world's largest exporter of these commodities, and before long, Australia is expected to become one of the world's top three exporters of LNG (liquefied natural gas). Figure 7.2 locates Australia's energy resources.

Energy resource development and extraction in Australia is undertaken by private enterprise mining and oil and gas companies. Capital requirements are high, especially in the petroleum sector, where LNG developments of up to $50 billion are proposed. In that industry, joint ventures, often between several of the world's largest companies, are common—dictated by the necessity to diversify enormous risks.

While Australia is a substantial net exporter of energy it is increasingly dependent upon imports to satisfy petroleum product demand. That outlook could change if emerging technologies like gasification and liquefaction of unmineable coal prove successful. Australia is also a dry continent and hydro-electric power resources are limited. Most have already been developed, so with growing electricity demand the share of hydro will inevitably fall.

Energy resources need to be moved either to a port for export, to direct users such as steel mills, or to conversion facilities: refineries, LNG facilities, and power stations. Coal is generally moved from mines to remote power stations or ports by rail or to adjacent power stations by conveyor belt or dedicated roads. Oil and NGLs are moved to refineries in Australia and overseas by pipeline or ship (or a combination of both); and natural gas for domestic consumption is transported by pipeline.

Coal mining has direct spatial implications for urban development. The progress of open-cut strip mines has required the relocation of towns, as well as highways and rivers. More common interactions arise in respect of underground coal mining because surface subsidence and rock falls—which are frequent consequences—are incompatible with urban development. Mining and urban land uses should be separated, preferably without alienating valuable underground resources.

There are seven major refineries in Australia, all located within or on the immediate perimeter of capital and regional cities. These have a combined capacity of 46.3 GL pa (Australian Institute of Petroleum, 2011). There are also several mini refineries processing local crude oil and reprocessing waste or recycled oils. Some refineries are more embedded in the urban fabric than others. An eighth major refinery—at Port Stanvac in South Australia—was closed in 2004 and Shell's refinery at Clyde, NSW is slated to close. Adelaide now relies on petroleum product supplies imported by ship, rail, and road—and sensitivity about supply security in the State is evident. Adelaide, however, will not be the last Australian capital without an oil refinery. All are small scale and ageing in comparison with Asian competitors, a disadvantage which will be accentuated if Australian refineries bear the cost of greenhouse gas emissions before their overseas competitors face similar charges.

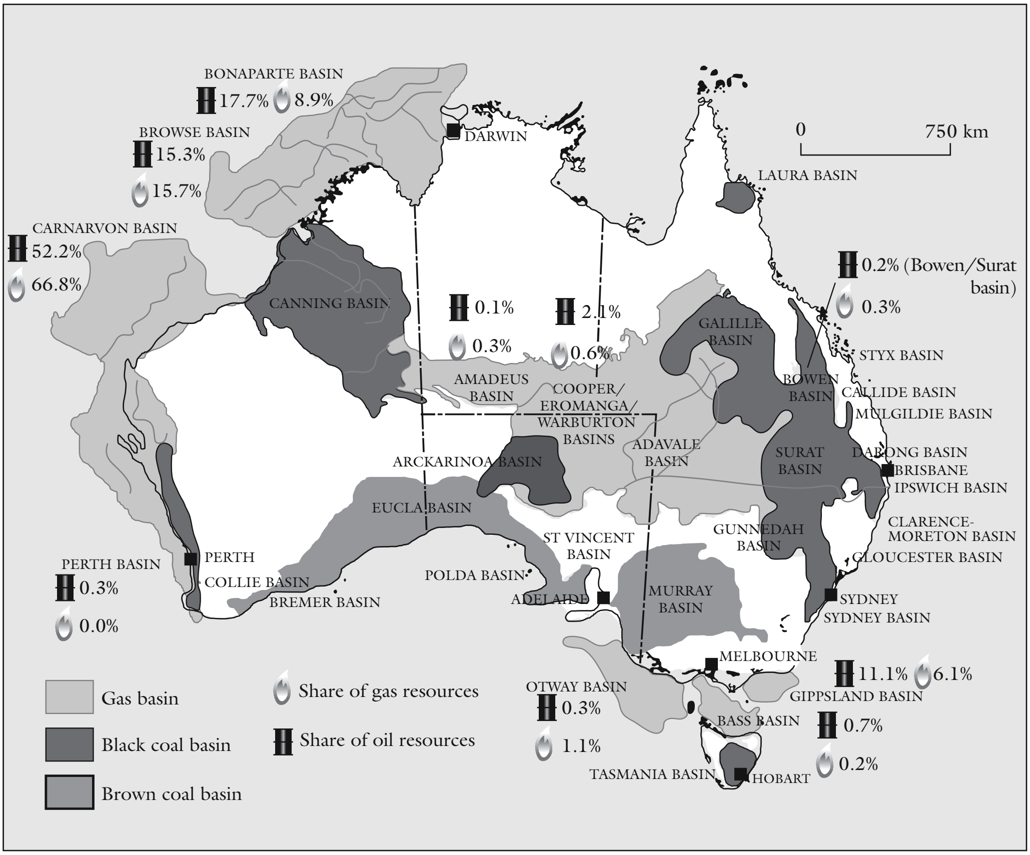

Figure 7.2 Australia's energy resources.
Source: Australian Bureau of Agricultural and Resource Economics, 2008. *Energy in Australia 2008*, Energy resources and major export ports, p. 4.

Pipelines carrying crude oil are commonly laid beneath city streets. Refinery products—gasolines (petrol and avgas), distillates (automotive and industrial diesel), kerosenes (mostly jet fuel),—are distributed through terminals and/or distributors to retail outlets and end users, by ship, rail, road, and pipeline. Shipping is used for bulk transportation to large coastal terminals at capital and regional centers and for export. Most petroleum distribution within cities is by road tanker to service stations and industrial sites; the main exception being airports which are generally supplied with jet fuel by pipeline. Rail and road transport move fuel to inland regional centers. The oil industry owns fixed infrastructure (tankage and pipelines), often in joint arrangements, and contracts out fuel transportation.

Moving fuel around cities is a significant enterprise and raises issues of traffic congestion and public safety. The number of retail sites in Australian cities is greatly diminished, but petrol retailing remains a significant employer and provides a vital service to residents.

Natural gas represents only about 17% of Australian primary energy demand, because coal is very dominant in electricity generation. The gas is brought to cities and other demand centers by high pressure underground pipeline. Major industrial users and electricity generators in urban areas need access to high pressure gas, so these pipelines are also networked within metropolitan areas. Commercial and residential demand is met using much lower pressure reticulation systems, generally laid in the street.

LPG is used in Australia to satisfy specialist industrial, commercial, and residential needs, and for automotive fuel.[10] LPG is stored at refineries and oil terminals and, in Sydney, in an underground rock chamber at Botany, and is distributed to users and retail outlets by bulk road tanker or in pressurized containers.

Australia: Secondary Energy Supply and Retailing

Electricity generation, transmission and distribution, natural gas distribution, and energy retailing contribute about 1.5% of Australia's GDP and employ about 49 000 people (ESAA and ENA websites).

Electricity

The Australian electricity sector encompasses businesses in the NEM and the isolated South West Interconnected System in Western Australia,[11] the Northern Territory system, and a number of remote networks. The NEM

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[10] LPG is preferentially taxed in Australia and is favored for use by taxis and other high mileage urban vehicles.

[11] WA's Wholesale Electricity Market, with its Electricity Industry Act 2004, regulations, and rules, is administered by the Independent Market Operator (IMO) and supervised by the Economic Regulation Authority. The WA pool, in contrast to the NEM, is a net pool.

provides interconnection between the eastern Australian States and the ACT—and is possibly the longest interconnected system in the world.

The NEM is a pool market combining five interconnected regions. Unless an interconnector is 'constrained' (i.e., operating at the limit of its capacity), wholesale prices in each market are equal, save for location-specific loss factors used to translate region center prices to each power station. The NEM is a 'gross pool' by which is meant all power generated (apart from generation from very small—<30 MW—stations embedded in the distribution networks) must be sold through the pool.[12] Electricity is dispatched from each power station at the sole direction of a central system operator (Australian Energy Market Operator, AEMO) in accord with an algorithm which dispatches power in ascending order of offered price. Each unit of each power station in the NEM (~260 U across all five regions) has the opportunity to bid (offer) as many as 10 tiers of price/quantity combinations covering their capacity for each 1/2 h of successive 24 h periods. These bids are stacked by an algorithm and matched to demand to minimize cost in real time, with a dispatch price determined every 5 min. This is a one-sided auction in the sense that the quantum of demand depends only on 'how many people turn the lights on' (i.e., there is no construct of a demand curve). However, demand-side bids are possible, including, for example, by aluminum smelters which could be paid to turn off (or turn down) for short periods—making them commercially equivalent to instant start peaking generators. Various ancillary services are also competitively bid.

The physical (pool) market as described above is complemented by a parallel (paper) market in financial hedge contracts. These contracts take the prices discovered in the pool as their reference prices in one-way and two-way hedges negotiated independently of the pool. The system operator can facilitate payments between participants for financial contracts if requested to do so by both counterparties. This dual market structure is depicted in Figure 7.3, which identifies the generators and consumers (retailers) on either side, linked together by the transmission and distribution networks in a physical market managed by the system operator, supplemented by the financial contracts market.

The Australian Energy Regulator (AER) monitors the market to ensure that participants comply with the National Electricity Law and the National Electricity Rules.

The NEM has been in operation since 1998. For the first 5 or 6 years of operation, it delivered average pool prices below new entrant price levels (in the order of $40–45/MWh for a CCGT)—so revealed prices would not justify new investment in generation—see Figure 7.4. In many respects that was a reflection of the very purpose of the NEM's creation, which was to exploit efficiencies extant in excess generation capacity and, in particular, efficiencies available through interconnection. Necessary spare capacity in

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12 The alternative model, favored in the United States (and WA), is the 'net pool' by which firm contracted power is dispatched by notification and only uncontracted power is cleared through the pool.

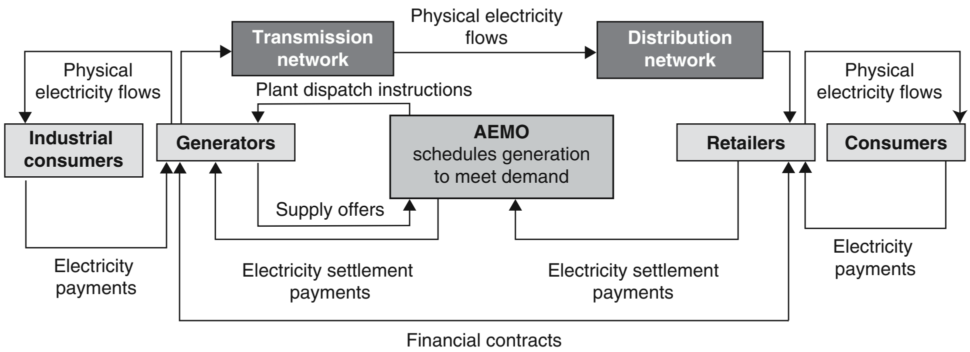

Figure 7.3 Structure of the national electricity market.
Source: Australian Bureau of Agricultural and Resource Economics and Sciences, 2011. *Energy in Australia 2011*, Market structure, p. 19.

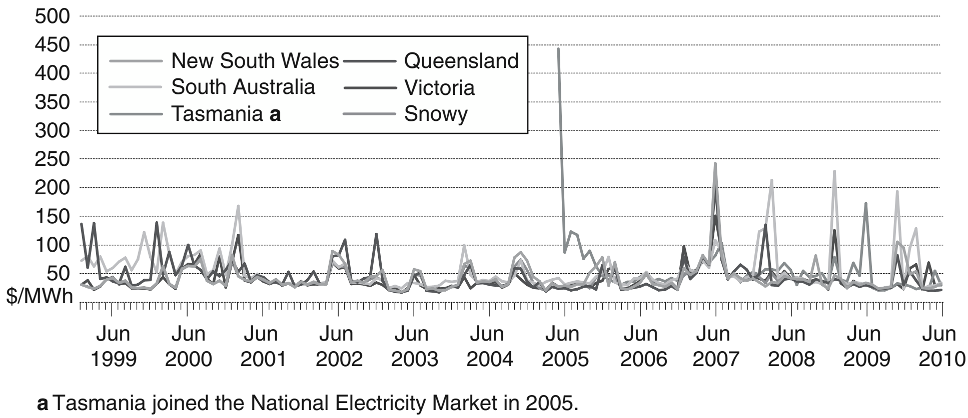

Figure 7.4 Spot market prices in the national electricity market (average monthly wholesale).
Source: Australian Bureau of Agricultural and Resource Economics, 2011. *Energy in Australia 2011*, Spot market prices in the national electricity market, p. 28.

five largely isolated systems (or systems managed independently by authorities with an interest in maximizing local generation) is much greater than shared spare capacity. While there have been sharp price spikes—to as high as $12 500/MWh, the regulated limit[13]—the NEM has worked very well, dispatching lowest cost (baseload) generators first and progressing dispatch rationally through intermediate and peak generators and efficiently utilizing available inter-regional interconnection.

[13] The NEM's regulated maximum wholesale price is known as Voll (value of lost load). If the pool price reaches Voll, the system operator is obliged to intervene, usually to implement a plan of rationing (progressive brown outs) to ensure that demand matches available power. As well as a maximum (Voll) price of $12 500/MWh, the Rules specify a minimum price of minus $1 000/MWh.

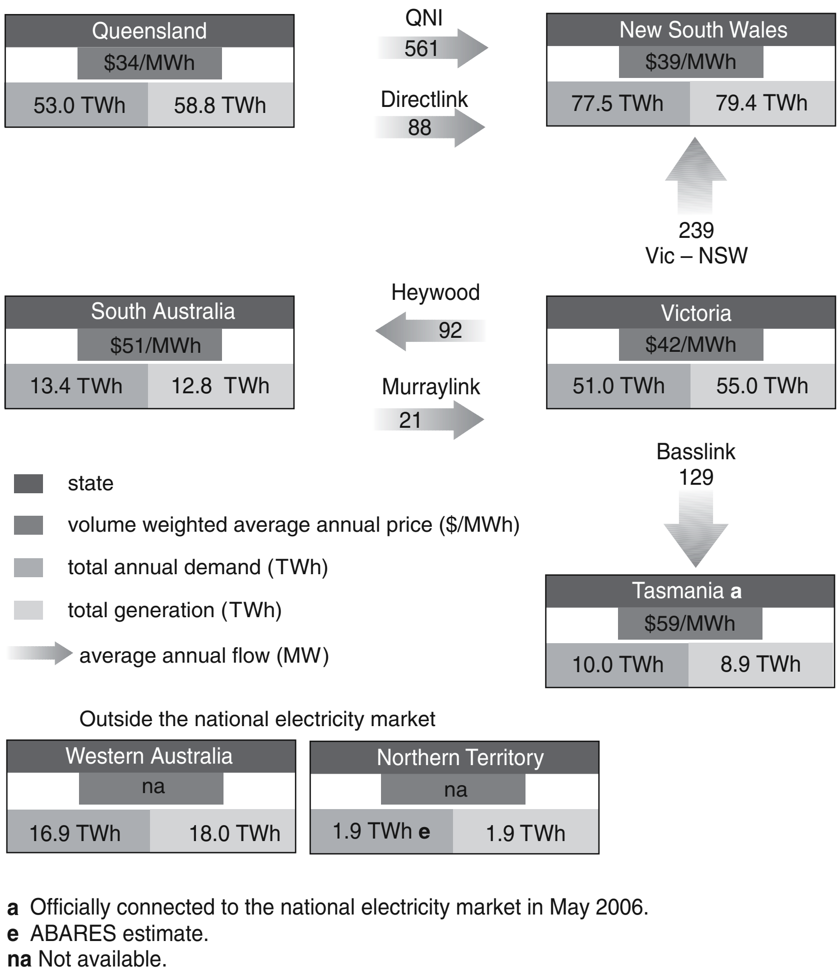

Figure 7.5 Generation and net interconnector flows in Australia in 2009–2010.
Source: Australian Bureau of Agricultural and Resource Economics and Sciences, 2011. *Energy in Australia 2011*, Summary of Australia's national electricity market, 2009–2010, p. 20.

With few exceptions, the interconnectors are regulated facilities. This means they earn a regulated return recouped from pool customers (by and large the electricity retailers) on a cost plus basis (and competition is very limited). The management of interconnectors is the most contentious and least satisfying aspect of the NEM—confirmation, if any were required, that the noncontestable elements of any network sector present an ongoing policy problem.

Figure 7.5 summarizes regional generation (output in TWh and capacity in MW) regional average prices, and average interconnector flows (in MW) across the NEM and in the two isolated systems in 2009–2010.[14] The

[14] The Snowy region—a hydroelectric scheme in NSW—has now been incorporated into the NSW and Victorian regions.

average interconnector flows disguise the fact that flows occur in the opposite direction to that depicted at certain times (e.g., BassLink flows northwards to Victoria in peak periods).

These main elements of the electricity chain are discussed in more detail in following sections.

Generation

Generation is a contestable segment of the electricity value chain since, in the wholesale market which a network or grid creates, independently owned or controlled power stations compete with each other for market share and profit. There is a question about how many independently controlled generators are required for genuine competition. The number appears to be small, perhaps only four or five, though in some circumstances—notably when demand is approaching peak levels or when major generating units are off line—oligopolistic behavior is evident, with prices maintained above the marginal cost of the required aggregate capacity.

Until the competition reforms of the 1990s, electricity generation in Australia was conducted by regional State-owned monopolies which were also vertically integrated with transmission and distribution arms. There were interconnections between regions but their purpose was largely confined to providing back-up capacity and hence competition between interstate utilities was negligible. The reforms which led to the creation of the NEM aimed first at breaking up the State utilities into component segments—generation, transmission, distribution (networks), and retail—and dividing the contestable segments, generation, and retail, into several competing companies in each region.[15] In Victoria, all the elements—which had been parts of the vast State Electricity Commission—were corporatized and then sold in competitive trade sales to different private consortia, mostly from overseas. The exercise raised a great deal of money for the State, eliminating its debt (and its obligations to devote more capital to the industry), and is credited as a key development in the creation of a competitive electricity market in Australia.

The other Australian States unbundled and corporatized their power utilities in parallel (actually with Tasmania, Western Australia, and the Northern Territory following a few years behind) but they did not immediately move to privatization and one or two may never do so.[16] After Victoria,

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[15] Distribution networks were also divided on a nonoverlapping (geographical) basis so that their performance could be compared with peers and 'competition' induced through those comparisons.

[16] For the 2006–2007 year, the Industry Commission monitored 23 government trading enterprises (GTEs) in the electricity sector. Of these, 12 were involved in only one principal activity (generation, transmission, distribution, or retailing), 8 solely generated electricity, 3 solely transmitted electricity, and 1 solely provided retail services. The remaining 11 performed more than one principal activity, with 2 (in WA and NT) being fully integrated utilities. In 2006–2007, five electricity GTEs also supplied gas and two also supplied water. *Source*: Productivity Commission, *Financial Performance of Government Trading Enterprises 2004–2005 to 2006–2007*, Productivity Commission Research Paper, July 2008.

South Australia was the first to privatize, although their model involves very long-term leases of the facilities and enterprises rather than outright sale.

In mid-2009 the Queensland Government announced plans to sell its power generation and other electricity enterprises, though these plans were dictated by the straitened circumstances of Queensland's finances rather than for any particular commitment to competition through privatization.

The NSW Labor Government which lost the 2011 election had difficulty persuading key constituents of the merits of privatization, but did pursue a compromise whereby new trading entities holding contract rights to trade generators' dispatch capability would be sold to private interests. 'Gentraders' for two of the three major generators were sold prior to the election. However, further divestments, while inevitable, await political developments.

It should be noted that NSW and Queensland have both encouraged private developers to build new power stations, a policy which is clearly pro-competition.

The Australian Capital Territory Government agreed to link its electricity and water distribution and retailing utility, ACTEW, with the private energy retailer AGL, in two partnerships—ActewAGL Distribution and ActewAGL Retail. The latter is a multiproduct business supplying electricity, natural gas, water, and wastewater services to retail customers.

The reforms of the 1990s were premised on the desirability of competition, wherever it could be fostered, and accordingly promoted competitive neutrality. This is intended to expose GTEs to the same incentives, penalties, and regulations faced by private sector businesses (such as paying dividends, paying their State government owners amounts equivalent to any tax their GTE status exempted them from, and paying similar debt premiums and guarantee fees). Competitive neutrality was a fundamental principle of corporatization but its observance does need to be independently monitored. The Productivity Commission has noted instances of increases in revenues not being reflected in tax-equivalent expenses (Productivity Commission, 2008).

Major power stations in the NEM, most of which are organized within portfolios owned by competing enterprises, represent some 38 GW of capacity, were valued at about A$100 billion in 2008 and produced around 230 TWh of electricity worth over A$12 billion at wholesale prices. Australia-wide generation capacity in 2008 comprised about 44.9 GW in grid-connected capacity and 5.2 GW embedded in distribution systems.

Total fuel shares in Australian electricity generation in 2008–2009 were black coal 54.9%, brown coal 21.8%, natural gas 15.0%, hydro 4.7%, oil 1.0%, wind 1.5%, and others (biomass, biogas, and solar) 1.2%. The shares of coal and hydro are expected to decline into the future, with the gas share rising to about 22% and others making the difference. Greenhouse gas emissions from Australian power generation totaled 194 mtCO_2e in 2005.

Powergen Economics

The economics of power generation are governed by the pattern of electricity demand which exhibits a wide diurnal range, significant differences between days of the week and, commonly, large seasonal differences.[17] This suggests the categorizations of baseload power—the overnight load, continuing throughout the day—peak power—the maximum load—and intermediate power—for the shoulder periods in between. Typically it is demand from urban areas which defines these load patterns.

The lowest cost power to supply baseload demand comes from power stations with the lowest average total unit costs and, until now, these stations have been large installations (high sunk cost) with low variable costs. Coal-fired steam turbines and nuclear power technologies have a ratio of fixed to variable costs in excess of 2:1.

Variable costs for fossil fuel stations have, to date, been completely dominated by fuel costs, with other variable operating costs being a very minor component. In the future, with emissions costs looming as a significant item, fuel costs will become relatively less dominant, though fuel plus emissions costs (and the two are closely related) will continue to account for nearly all variable costs.

In meeting peak loads it is important to minimize sunk costs because the opportunity to recoup them is severely time limited. Many classic peaking stations operate for < 1% of the time. Accordingly, it may be much cheaper in supplying peak demand to pay for expensive fuel (which is only used when the power station is operating) provided that the costs that need to be serviced all year are low. It is also cheaper—and consistent with this approach—to operate at relatively low energy efficiency if that saves on the cost of the plant.

The most important peaking stations in Australia, as in many parts of the world, are hydro stations. These have high capital (sunk) costs and almost zero operating costs. However, if their operations are viewed from an opportunity cost perspective, the commercial wisdom of using water in storage at any time today must be reckoned against the alternative (assuming the reservoir is not overflowing) of using that water tomorrow, or in several months' time when electricity prices are expected to be higher. Hydro stations' variable costs, in this context, can be very high.

Intermediate demand can be satisfied by combinations of baseload and peaking, with the baseload stations operating at relatively lower capacity utilization rates and peakers at relatively higher rates. However, specialized intermediate load power stations can perform this role more economically. Intermediate load stations in Australia, as in Britain and elsewhere, tend to be either modern CCGTs which have lower unit capital costs than coal and nuclear stations, but higher fuel costs, or older baseload stations whose values have been substantially written down. In addition, all but the lowest cost baseload stations on the grid increasingly practise load following in order to maximize net returns.

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17 In Australian cities peak loads are in summer and winter, with summer (air conditioning) loads prevailing in Melbourne, Perth, Adelaide, Brisbane, and Darwin, the winter load being dominant in Canberra, and a rough balance between the two in Sydney.

The nonhydro renewables are mostly embedded in distribution systems and reflect in reduced demand on the pool. The exception in Australia is the small number of significant stations operating on bagasse (sugar cane waste) which operate as seasonal baseloads (and price takers in the pool). All are effectively price takers in a pool market on account of their intermittent operation. They back out baseload capacity sometimes in the middle of the night but usually replace intermediate or peaking capacity which would otherwise fill the demand profile.

In a pool market, variable cost relativities determine the merit order of dispatch because it is strategically optimal for each generator to offer its contracted capacity, in any 1/2 h, at variable cost.[18] So the baseload stations which offer the lowest prices to the pool (their short run marginal cost for their swap contract quantities) are dispatched first, followed by the intermediate stations which have higher variable costs and offer higher prices, and the peakers who offer prices corresponding to the caps sold to retailers in the financial market. The system operator will dispatch as much of the offered capacity as is needed to match revealed demand.

This system has helped ensure that generation has been operated efficiently and optimized. These gains have been transferred to consumers in the form of lower electricity prices and more reliable supplies. There have been very few instances of prices reaching the regulatory limit and requiring intervention.

This observation about efficiency and optimality is a conclusion in the broad rather than in the particular since, from time to time, serious concerns are raised about exploitative generator pricing behavior when supply is suddenly tight. The reality is that pool markets need to register very high prices from time to time in order to provide the business case for investment in peaking capacity, without which more system failures would occur. The challenge is to ensure that the system provides sufficient capacity to meet expected demand plus an appropriate contingency margin, and not more. Evidence to date in the NEM is that the challenge has broadly been satisfied.

Implications of Emissions Charges and Mandatory Renewables

While this description of the pool market will not change fundamentally into the future, the composition of baseloads, intermediates, and peakers may well change—notably as emissions costs are encompassed and rise. At key thresholds, the variable cost of coal-fired generation (fuel cost plus

[18] In a gross pool like Australia's NEM, the physical pool market through which all electricity is sold is complemented by a financial market comprising transactions in 'swaps' and 'caps' (and combinations) which are contract derivatives of the pool market's price outcomes. Baseload generators normally seek to contract around 75–80% of their expected dispatch, by a swap, the price a generator is paid by a retailer for that contracted amount, providing both sides with necessary certainty.

emissions cost plus other variable cost) would exceed the comparable variable cost of gas-fired generation. This would turn the traditional Australian merit order on its head, with gas-fired CCGTs supplanting coal stations as the baseload stations (but also working to entrench nuclear power as the lowest cost alternative).

Large coal-fired stations (as with nuclear plants) are these days deliberately sited outside urban areas, commonly (for coal stations) at mine mouth, though high tension AC[19] transmission line losses mitigate against locating power stations long distances from customers, who are largely in cities. Distant locations often provide lower cost land and access to cooling water as well as proximity to fuel supplies. Coal stations tend to be anathema to populated areas on account of particulate emissions, noise, coal dust, and visual amenity; however, their workforce and their contractors tend to live in towns and prefer not to travel too far to work. Gas-fired stations by contrast tend to be more amenable to location within urban areas or on the urban fringe. Emissions are generally particulates-free and dust is not an issue though NOx emissions from gas stations can contribute to the brown haze associated with transport emissions. Hydro stations, wind farms, wave and geothermal energy all tend to be located where the resources are, and seldom in cities.

Rising emissions costs and more micro generation units embedded in distribution systems would decrease the significance of, and reliance on, large scale power plants and related transmission systems—though, given the competitiveness of pool markets (and commercial drivers to continue operations until variable costs exceed revenues), the pace of transformation may not be as fast as many predict. However, the Australian Government's mandatory Renewable Energy Target scheme[20] and other initiatives to promote solar power (notably the Federal Government's grants for major solar energy projects, solar credit subsidies for home PV systems, and State and Territory government feed-in tariffs, which have other customers cross-subsidizing small solar PV) are likely to ensure that the share of renewable in total electricity generation rises substantially (possibly to the 20% target by 2020). This will slow investment in conventional generation, but it will also tend to squeeze gas-fired generation out of intermediate loads.

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19 Alternating current. Direct current (DC) cables—which are being installed across longer and longer distances—incur much lower transmission losses, but they are much more expensive.

20 The Australian Government's *Renewable Energy (Electricity) Act 2000* required wholesale purchasers of electricity (retailers and direct off-takers) to proportionately contribute toward the generation of an additional 9500 GWh of renewable energy annually by 2010—a policy effected by the issue of renewable energy certificates (RECs) to renewable energy generators and the requirement on retailers to acquit the prescribed portion of their sales using RECs. In 2008, the scheme was substantially extended in order to facilitate the incoming Labor Government's 20% renewables by 2020 policy.

Figure 7.6 Australia's transmission lines and generators.
Source: Australian Bureau of Agricultural and Resource Economics, 2011. *Energy in Australia 2011*, Transmission lines and generators, p. 30.

Transmission and Distribution

Energy network businesses in Australia deliver electricity to over 12 million homes and businesses across the country through ~800 000 km of power lines worth something in the order of $20 billion.

Major transmission lines in Australia carry electricity at up to 500 kV to substations in suburbs and towns and at major industrial facilities. The substations transform high voltage power to lower voltages and are usually the points at which transmission is distinguished from distribution. Distribution systems transmit lower voltage power to retail customers via powerlines running along roads and streets (both above ground and underground). Figure 7.6 depicts Australia's main transmission lines, power stations, and demand centers.

Since the early 1990s many businesses which were singularly electricity 'wires' businesses, or units of integrated electricity companies, have been transformed into energy (electricity and gas) or multinetwork enterprises. Although there are now several integrated network businesses in Australia, the separation between transmission (both in electricity and gas) and distribution, which was effected in Victoria when the businesses were privatized, remains preferred by most pro-competition regulators and analysts.

Transmission and distribution network businesses normally have tariff schedules which differentiate between large and small users and between access (demand) charges and usage charges—which, in some measure, reflects the difference between capital or fixed costs and operating costs. Policy intent is usually to align charges to costs, though full alignment would involve high residential tariffs (as demand charges) and it has been customary for larger users in distribution networks to cross-subsidize smaller users. In the transmission sector, where customers are major electricity users and retailers, that kind of cross-subsidy is not possible.

Typically, electricity and gas distribution businesses operate as monopolies, thereby inviting a role for independent economic regulation similar to that applying to other utility sectors. In Australia, State and Territory regulators undertook this task in the past, but it is now the function of the AER, the new national economic regulator of energy networks. The main functions of the regulator are to determine network tariffs (at the wholesale level[21]) and to approve capital investment proposals (extensions and upgrades) or confirm which assets can be included in a network's rate base and thereby earn a regulated rate of return. This is a responsibility with a generally unsatisfactory history, being fraught with asymmetric information and other difficulties. But better models have yet to be identified. The performance of geographically separated network businesses can be compared using a variety of indicators—and this assists the regulator (and the public) to assess whether proposed investments or pricing changes are warranted.

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[21] Retail price caps will continue to be administered by State governments until an assessment has been made that effective retail competition has been established and the price caps are removed.

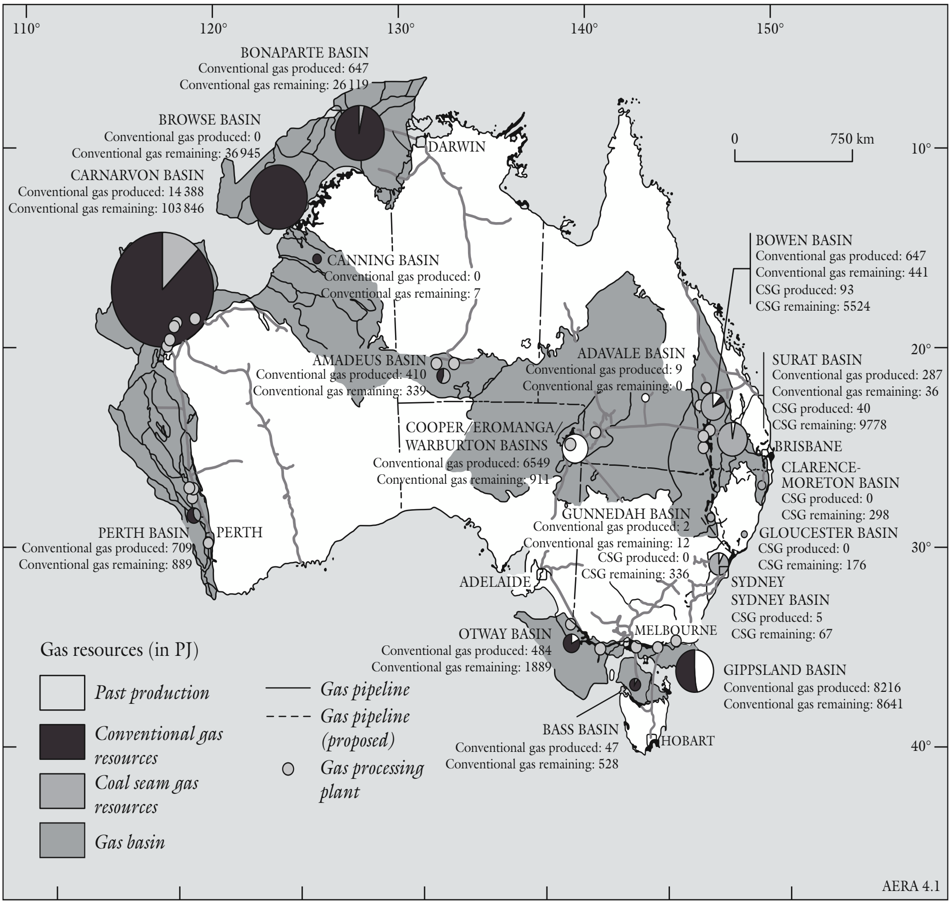

Figure 7.7 Major natural gas transmission pipelines in Australia.
Source: Australian Bureau of Agricultural and Resource Economics, 2011. *Energy in Australia 2011*, Australian gas resources and infrastructure, p. 51.

The principle of competitive neutrality applies in network (and retail) industries. However, rather than unfair government support for network GTEs, the more common difficulty arises by way of government-imposed service requirements above and beyond those commercially provided. These community service obligations (CSOs) need to be transparent and ideally recoverable from government revenue rather than from other network customers (i.e., direct rather than cross subsidies). It has also become a regulatory responsibility to identify and quantify the extent of each CSO.

Current policies emphasizing cleaner energy have heightened pressures to incorporate more renewable energy into the electricity network. The Australian Government's climate change and renewable energy commitments are manifestations of these policies. The Government's renewable energy target challenges network operators and the regulator in finding viable ways to bring significant renewable generation—typically intermittent and remote—into the grid without compromising system security and safety.

One outcome is expected to be a significant increase in embedded generation (EG). This is generation connected within the urban distribution network, in contrast to larger power plants which are generally located some distance away. EG typically involves micro to small capacity units (ranging from <1 kW to just tens of MWs), a wide variety of technologies and diverse operating characteristics and connection requirements. EG also serves a range of diverse purposes including supply of renewable energy, peak load reduction, and network stability support. EG installations include: micro and large photovoltaic systems; small to large scale wind power generators; hybrid renewable energy and diesel systems; combined heat and power generators; and micro to large gas turbines (often owned by the retailers).

A number of regulatory, contractual, and technical issues need to be resolved if network security and broader energy policy goals are to be attained. A lively and ongoing campaign is being waged by the network industries and their industry body to ensure that embedded generator connections are not subsidized by electricity networks, that technical requirements, contractual arrangements, operating protocols, and procedures for the connection of the smaller embedded generators are harmonized across different State jurisdictions and that networks are not penalized for linking EG into the grid.

Electricity transmission lines, plus their substations, require substantial space and wide corridors—usually entering a metropolis from several directions, for system security. Provision for these energy corridors is a basic requirement of a city plan.

Natural Gas Markets

The following commentary focuses on the natural gas grid in eastern Australia. Similar observations can be made of other gas networks shown in Figure 7.7.

Eastern Australia's national pipeline grid is a collection of initially bipolar pipelines which have been progressively linked into a more cohesive transmission network. Individual elements of this system are owned by independent private entities—some of which are also owners of electricity transmission and distribution assets. They are subject to regulation in respect of technical and commercial matters under the Natural Gas Law and Natural Gas Rules, both instruments developed in collaboration between National, State, and Territory jurisdictions. Most of the pipelines are regulated by the AER but others have been found to be contestable pipelines and are not subject to pricing, access, and capacity regulation.

In theory, a gas supplier connected to any point in the grid should be able to sell gas (and transportation) to a customer anywhere else on the grid, provided that real (net) transportation costs are covered and returned to the relevant pipeline owners. The market is yet to progress to this advanced stage—due to commercial impediments (and one link which to date has been capable of moving only 'wet' gas in one direction)—but in time it will do so, effectively allowing injection and offtake pricing anywhere on the eastern grid.

Like electricity transmission lines, trunk gas pipelines tend to have strong monopoly characteristics, though this characterization is weakened as cities are connected by second and third pipelines to second and third supply sources (and as competition from other energy sources, like wind and coal, intensifies). It is desirable for regulation in these circumstances to be light handed and regularly reviewed. Nonetheless—and not necessarily in conflict with this—it has become conventional for regulators to ensure that new or expanding suppliers and customers are not subject to discrimination, impairing economically efficient outcomes (third party access). The regulation of gas distribution networks in Australia is integrated with regulation of electricity networks under the auspices of the AER.

Trunk natural gas pipelines are usually connected to a city's distribution system at a city gate outside the metropolitan area and are largely invisible. The same can be said of the distribution network, which comprises both high pressure and low pressure elements. Care has to be taken to ensure that high pressure pipelines are not disturbed by surface activities, but this caveat seldom creates insurmountable problems. When it comes to adverse physical and environmental impacts for cities, Australia's gas distributors supply gas to 3.4 million households and 105 000 commercial and industrial customers, through over 75 000 km of low pressure reticulation networks. Australian residential and commercial customers account for only 15% of total natural gas usage, with power generation at 35% and industrial uses (including mining) at 47% being more significant.

Environmental policy objectives of energy conservation and the abatement of greenhouse gas emissions would favor increased use of gas. This is in applications ranging from power generation to domestic hot water. The former, when replacing coal-fired generation, saves half to two thirds of the emissions footprint and the latter, when replacing electric hot water, saves two thirds and more of the energy required (and a similar proportion of emissions). If the costs were comparable, these benefits would warrant strong measures to encourage the respective substitutions. But energy systems are more complicated. As noted earlier, gas usage for power generation tends to be displaced by wind—also favored environmentally—and removing electric water heaters from the electricity demand profile accentuates peak demand, fostering use of low efficiency peak generators (and raising average electricity prices). Getting the economic settings right—including on emissions pricing—is definitely the 'first best' approach.

Energy Retailing

Energy retailing, like electricity generation, is a contestable segment of the value chain—and conventional wisdom holds that competition between retailers will drive innovation and efficiency to benefit consumers.

The business model for energy retailing is increasingly evolving to the multiproduct retailer, whether combining petrol sales with convenience stores and groceries or the range of network provided services—electricity, gas, water, and telecoms. The advantages of this model for retailing energy services relate to the savings and synergies that can be derived from common administrative support, customer relations and sales, and meter reading and network inspection activities.

Energy retailers buy electricity and gas competitively at the wholesale level and sell to most retail customers on a basis that is inclusive of network charges. In Australia, all industrial and commercial electricity and gas users are now contestable, able to buy their energy from any retailer who is able to negotiate access on the distribution network. Many residential consumers are also contestable, in that they have voluntarily chosen to switch to a new retailer or they live in a State which has already moved to full retail contestability.[22] Residential consumers who remain noncontestable have the protection of regulated tariffs (and the regulatory system is designed to ensure that retailers are not disadvantaged by servicing these customers). Contestability is a transitional issue and, in due course, all consumers will be contestable.

Retailers have broken with the philosophical model of complete unbundling of the value chain. Some, deliberately or by dint of circumstances, have come under common ownership with, or bought, energy production and/or generation enterprises, thereby combining both contestable segments of the supply chain. This has never seriously been considered to represent an impediment to competition in either segment (Willet, 2005). However, some retailers have come together with energy distribution businesses. The concern is that the distributor could be expected to favor its related retailer in any access or priority issue, at the expense of competing retailers. So far these possibilities have not aroused great concern in Australia, though they clearly make the task of the regulator more challenging.

An important technological development in Australia and elsewhere is the roll-out of smart electricity meters. These meters display and record

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[22] The Australian States and Territories are committed under intergovernmental electricity and gas 'access agreements' to work to implement full retail contestability as soon as possible.

consumption in real time and by time of day and should heighten consumer awareness of opportunities to save money by spreading load or reducing consumption in peak times. Energy retailers, supported by government subsidies, are installing smart meters for new connections and when upgraded metering is required. Smart meters are expected to ameliorate the peaks in power demand and may yield some energy conservation dividend.

About half of Australian electricity consumption is accounted for by residential and commercial users, with metal smelting until now, about 30%.

Energy Conservation and Demand Management

Energy conservation addresses the overarching policy objectives of energy security and emissions abatement. Many government jurisdictions including city administrations promote energy conservation programs both in respect of their own activities and the areas they serve. Energy security is enhanced if consumption of liquid fuels can be reduced without impairing output or enjoyment. Greenhouse goals are also served since emissions reductions are generally proportional to fuel usage.

A first step in pursuing energy conservation is to measure and monitor fuel usage on a regular basis. For most businesses, with the notable exception of aluminum smelting, and for most cities, energy costs are a small component of total expenditures, usually below 3% of current (noncapital) costs. Thus energy efficiency has not been a high priority of senior management, much to the frustration of energy professionals, notably in government. Many governments now require energy users (or at least large ones) to routinely report their energy consumption and explain the reasons for increases. The Australian Government in 2008 passed the National Greenhouse and Energy Reporting Act requiring large energy users and greenhouse gas emitters to report annually and to have auditors sign off on those reports.

Energy audits are now widely undertaken and often reveal scope for savings with astonishingly short payback periods. Sometimes the scope of such audits does not take into account other objectives or investment capital constraints—and this is at the heart of reasons why recommendations are not always adopted. This is a matter of contention, with green activists arguing that companies should be obliged to implement identified measures with short paybacks. These issues were canvassed by the Productivity Commission (Productivity Commission, 2004).

A similar debate surrounds the issue of energy standards—which have been written to apply to motor vehicles, common items of industrial and commercial equipment, household appliances and buildings, including houses. International standards have been widely adopted by manufacturers and builders as an important feature of the quality of their offerings. Most governments have enacted laws requiring new appliances, vehicles, and houses to carry a label indicating their energy efficiency rating. In some jurisdictions products that do not comply with a minimum energy efficiency standard cannot be sold. Labeling and standards promote consumer consciousness of energy costs, but mandatory minimum standards need to be applied carefully, since the exclusion of certain products can be abused to consumers' detriment.

Replacing old energy using equipment with new equipment for the same function almost invariably results in lower energy consumption (per unit of activity). The frequency of capital stock replacement is probably the most important and universal energy efficiency determinant. It also highlights the inevitable trade-off between conservation and writing off assets prematurely. Energy conservation comes at some cost—though the accruing savings may warrant that cost (at some discount rate).

At the household level the same is true but the available capital constraint may be more restrictive: if a household does not have the cash to invest in insulation, double glazing, new and more efficient space and water heating, or replacing old appliances—or if other competing expenditures have priority—then these energy conservation investments will not be made. This has prompted many government programs aimed at overcoming the obstacle—offering, as carrots, cash subsidies, and low-cost loans (usually in conjunction with energy retailers so that the money owed is repaid from actual savings in future monthly bills) or, as sticks, restrictions on the resale of substandard vehicles and houses. Government spending programs have an unfortunate propensity to be mismanaged and abused. The Australian Government's aborted home insulation scheme was a disastrous failure of implementation, highlighting the risks inherent in government activism in such matters.

One classic market failure often used to justify intervention by authorities is the disconnect between an apartment's tenant and its owner when responsibility for the installation and recurrent purchase of capital items such as insulation, glazing, and appliances rests or rested with the building owner who has no responsibility for recurrent energy costs (the agent/tenant dichotomy). This situation can result in suboptimal energy usage. The solution relates to standards, though enforcing them may not be in the tenant's (or the owner's) interest. Other innovative (and voluntary) solutions can sometimes be found in collaboration between building developers, energy utilities and planning authorities.

Of more importance in the broad context of energy conservation is the integration of urban land use with efficient transportation systems, including public transport, cycle ways, and urban road systems. This is covered in detail in Chapter 8 on transport and in Chapter 9 on coordination of infrastructure.

The built environment is widely recognized as the biggest opportunity to achieve energy savings. As noted above, capital stock replacement—with urban renewal—is key in the older, mature cities, though there is potential in design innovation, new materials, and new systems for building heating and cooling beyond simple replacement of old buildings by new ones. Opportunities exist for on-site electricity generation combined with heat recovery for building energy services, as well as for solar power generation using roof-mounted panels (conventional) or with PV collectors incorporated into building cladding and glass (under development). In new and rapidly expanding cities these same opportunities present themselves, usually with fewer practical complications (like neighboring buildings and established services). Promisingly, observing building developments in China and several other countries in Asia, innovative, energy efficient building seems to have won the support of authorities and investors.

An important element of the built environment's energy load—and energy savings potential—is lighting. Energy usage of incandescent globes is now seen to be profligate. Their sale is being phased out in Australia, and other countries are following. There are complaints about the quality of light from the immediate alternatives, compact fluorescents (and concerns about environmental repercussions and hazards in manufacture), but their electricity consumption is much lower. LED lighting technology is advancing apace, offering both light quality improvements and energy savings.

The deployment of smart electricity meters, which facilitate consumer awareness and automated control, can also be expected to support energy conservation.

Future Energy Systems

Technologies underpinning future urban energy systems have been foreshadowed in preceding sections. Their evolution is motivated by a range of objectives: cleaner air, lower greenhouse gas emissions, containing energy costs, and (related) greater energy supply security. These are private motivations as well as the objectives of national, regional, and local governments. Improved energy efficiency is consistent with all these motives.

The cleaner urban air objective primarily relates to particulates and urban smog and implies greater use of (remotely generated) electricity instead of combusting fossil fuels in urban areas (and this includes by moving power stations away from cities), reduced burning of firewood and biomass in urban areas, as well as increased use of public transport, replacement of liquid petroleum fuels by natural gas and LPG, and improved emissions performance of internal combustion engines in vehicles and other equipment. Further into the future, hydrogen energy systems could deliver clean air—though there is an adverse corollary for greenhouse gas emissions if hydrogen is derived from fossil fuels. Indeed many of these possibilities carry implications at odds with other objectives.

Reducing greenhouse emissions implies curtailing electricity generation from fossil fuels, notably coal, unless carbon capture and storage (CCS) technology—which itself is highly energy intensive—can be proven to be cost effective. Demonstrating the efficacy of CCS is particularly important to Australia, given the significance of coal in Australia's domestic energy mix and coal exports for the Australian economy, but it is also vital globally if the world's projected energy needs are to be met whilst achieving substantial cuts in greenhouse gas emissions. A significant price on carbon emissions will be required to drive CCS deployment, substantially altering the economics of electricity supply.

The following sections canvas the tension between conventional large centralized energy supply systems and possible future smaller decentralized alternatives for cities.

Future Centralized Energy Supply Technologies

Electrification has been synonymous with better living standards and urban development for over a century and there is no reason to expect that to change. While step change improvements in efficiency occur in some applications, most efficiency improvement will be gradual and it will tend, as in the past, to be no match for the ever expanding demand for energy services. As the IEA routinely points out, electricity demand will continue to grow at a rate at least as fast as population—and faster in the developing world.

It is conceivable that demand will be met in future by electricity generated at the point of consumption or nearby. However, it is more likely that such decentralized power systems will evolve slowly given the economies of scale of large centralized power stations.

The benchmark here is nuclear power, an established technology with known costs (having met some 80% of electricity demand in France and Belgium for 30 years, and >20% of demand in Korea, Britain, Germany, Canada, and Japan). After wallowing in the doldrums for two decades post Chernobyl, nuclear power in the early part of the twenty first century began to undergo a renaissance, with a rapidly growing number of power stations under construction (Blees, 2008; Cravens, 2007); however, the destruction of the stations at Fukushima following the 2011 earthquakes and tsunami seriously dampened that prospect.

Inhibitions about an extended role for nuclear energy need to confront the cost and readiness of the alternatives. All renewable energy sources are prohibitively expensive by comparison (the wholesale cost of wind energy, the cheapest renewable, is two to three times higher—even without allowing for energy storage which would be necessary for a valid comparison). Technology is delivering progressively safer, more efficient reactors and is on the verge of delivering plants (notably the integral fast reactors) which have greatly reduced output of dangerous nuclear wastes and little, if any, material able to be diverted for weapons. Barring more major mishaps, nuclear power can be expected to be a growing component of the energy mix in countries seized by the imperative to cut greenhouse emissions.

Coal-fired power has been competitive with nuclear anywhere in the vicinity of coal mines and anywhere a ship load of coal can be discharged. This will change as and when power stations are obliged to bear the cost (or, at least, the regulated cost) of greenhouse gas emissions. Modern coal-fired stations are unlikely to be forced to close down, since the cost of requiring closures is so high and the only nonnuclear alternative with bearable costs—gas-fired CCGTs—is a transition solution at best, as gas prices would rise sharply if electricity generation systems came to rely heavily on this technology in the long term. Large coal stations will continue as a feature of energy supply systems for at least 40 years, the lifetime of new plants. Coal's future would be more assured if CCS technologies are successful, though electricity generated from coal with CCS will be much more expensive than nuclear power. Gas-fired power with CCS is at least as feasible as its coal competitor but it is unlikely to make commercial sense given that coal with CCS would always be cheaper. Commercial considerations, however, often bend to political imperatives and the prospect of gas-fired CCGTs with CCS should not be dismissed.

Current policy directions suggest that all the renewable energy technologies will be supported—including by the imposition of mandatory targets, regardless of cost. While these imperatives persist, wind power, geothermal energy, wave and tidal power, among others, will be supported and will erode the dominance of centralized power facilities. For cities, however, many of the implications are the same, since these renewable power supplies will be transmitted into urban centers by the same power lines delivering power from conventional plants.

Accordingly, large centralized power generation systems, generally distanced from urban centers, are here to stay, if perhaps not as prominently as now. Their demise would require the economics of decentralized systems to improve dramatically—which is quite possible, though less so if they too are emitters of greenhouse gases and are required to bear the cost. Centralized, generally distant, power supplies in future will involve transmission and distribution systems to and around urban areas broadly comparable to familiar systems. Underground DC systems may, however, become more common for aesthetic, space, and energy conservation reasons.

Completely new concepts, like the hydrogen economy, probably also involve large centralized facilities also preferably removed from urban areas. Hydrogen is most likely to be manufactured from natural gas or methanol (by reforming) but possibly also from coal, perhaps within an integrated gasification combined cycle power station and perhaps also—more futuristically—from some broadly integrated manufacturing and energy complex producing metals, building materials, petrochemicals, fuels, electricity, and hydrogen. All these processes can only be zero carbon dioxide emitters if the gas is captured and stored, either chemically as a rock compound or by pipeline to underground storage. Relatively pure streams of CO_2 are obtainable in these technologies, so the capture cost may be less than for CCS from conventional power stations.

The idealized hydrogen economy has hydrogen being separated from water by electrolysis, using renewable energy or conventional nuclear power. That system would have zero emissions but the rationale for using electricity to make hydrogen in order to make electricity is far from clear. What would make sense is high temperature (thermo chemical) electrolysis, utilizing the heat from a next generation Very High Temperature Reactor—the focus of the US Department of Energy's Nuclear Hydrogen Initiative (U.S. Department of the Environment, 2003).

Decentralized Systems

Distributed generation systems are the antithesis of centralized generation and its related delivery networks. The first advantage of colocating power generation (and other energy conversion processes) with end users is that the need for transmission and distribution infrastructure could be eliminated. Often, that advantage is problematic, notably if the power is needed on a 24/7 basis. Nonetheless, from an overall system perspective, required transmission capacity should be lowered if consumers supply much of their own power.

What is evident already, certainly in Australia, is that household energy generation systems located within households have gained favor—generally by virtue of substantial incentives, including cross subsidies from other consumers. The Australian Government's renewables scheme and other solar energy programs, and additional incentives legislated by State governments, have induced widespread installation of solar hot water systems and (typically) 1–3 kW PV micro generators on household rooftops. As voters and governments have begun to realize, the programs are expensive, if popular with those able to benefit—but while generous incentives are offered, the enthusiastic take-up will continue.

For the future, the looming prospect is fuel cells, which can generate electricity from a range of fuel sources. Fuel cells lend themselves well to both down-scaling and up-scaling for households and industry (Sorenson, 2005). The energy efficiencies of fuel cells—and hence their emissions—are substantially better than power generation by combustion and this may be the telling advantage, particularly with high emissions prices. In formulating a longer term outlook, it would be sensible to perceive fuel cells making significant inroads into electricity markets, particularly at the commercial and residential levels. Another consequence would be a dilution of the peak evident in wholesale electricity markets (since much of the peak is attributable to commercial and residential loads), ironically delivering even greater dominance to baseload technologies in the pool.

Fuel cells operating on hydrogen could be the holy grail—especially if the hydrogen is separated using renewable energy or other zero emissions energy sources. This would be a clean energy, zero emissions system producing only water vapor and on-hand electricity for urban homes and offices. Fuel cells are not necessarily confined to fixed generator units—they have potential to be installed in ships, trains, and small vehicles, including cars.[23]

That visionary future would involve a new distribution system. Hydrogen is a very low energy fuel and the scale of necessary pipelines, storage tanks at depots and in mobile equipment is very much larger than for natural gas distribution or petroleum products (though storing hydrogen in other forms is possible). This is why the existing natural gas network may afford the pathway to a future hydrogen economy, with reformation of natural gas taking place at multiple decentralized locations.

In the United States, former President George W. Bush launched his Hydrogen Initiative in the 2003 State of the Union Address, envisioning the

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[23] The boron monoxide—hydrogen peroxide fuel cell has of late been thought to be a strong prospect in these applications. More generally, contenders include the proton exchange membrane, alkaline fuel cells, solid oxide fuel cells, and molten carbonate fuel cells. The United States government's Freedom Car project is evaluating internal combustion applications as well as novel fuel cells.

competitive use of hydrogen fuel and a hydrogen-fuelled car by 2020, but experts like the American Physical Society's Panel on Public Affairs (2004) remained skeptical. The Australian Government commissioned a report in 2003 on the prospects for the hydrogen economy (Commonwealth of Australia, 2003). It was optimistic about an ultimate future for hydrogen but cautious about near term progress.

What seems likely to arrive, and establish urban networks sooner, is the electric vehicle. Electric cars are already available. Recharging at home and at office and supermarket car parks presents few problems (though the business model for such services is in its infancy). It seems inevitable that (battery powered) electric cars will become commonplace in most cities within decades. Batteries will continue to be improved, charge times reduced, and distances between recharges increased.

The propagation of electric cars may be accompanied by the widespread deployment of decentralized electricity generation—most prospectively, using fuel cells. However, it is a safer bet, initially anyway, that the electricity will be supplied conventionally from large centralized power stations. In time things could change and the total household load—inclusive of charging electric vehicles—may well give extra impetus to the deployment of small household fuel cells, possibly supplied by hydrogen pipelines. This is highly speculative. Totally different technologies may obviate the hydrogen economy future.

Conclusions

The evolution of cities, and their periodic renewal, is mirrored by changes in the energy systems which support urban economies, and both require a degree of government oversight and direction. The motivations for policy intervention relate to efficiency (pro-competition reform), environment protection (notably mitigating climate change), and energy security (reliable supplies at stable and affordable prices).

Pro-competition regulation in the energy sector focuses on price, capacity, and access issues of electricity and gas networks. The objective is efficiency, achieved by mimicking a contestable market as closely as possible. But the regulatory task is problematic and opportunities to create or unbundle a competitive segment should be sought and fostered.

Averting dangerous anthropogenic climate change will require changes in the way energy is produced and used. Innovative policies will be needed to induce those changes, encompassing greatly increased investment in RD&D, an appropriate regulatory framework, and rapid development of a global carbon market.

Pricing carbon emissions will have powerful ramifications in energy, impacting directly on relative cost structures. The economics of electricity generation will change, possibly radically; and the structure and relative prosperity of national economies will change as well, particularly if trade-exposed emissions intensive industries are not adequately shielded from competition from countries that do not impose comparable emissions penalties.

Security of energy supply is addressed under cooperative international agreements, strategic reserves and contingency planning, as well as through policies aimed at increasing indigenous energy production and allowing markets to work. The favored response to a supply disruption is to allow rationing to be effected by rising prices within a more comprehensive emergency plan and to encourage supply contracts to price priority access in advance.

Energy policy is about risk management: minimizing the risk that energy investments will be insufficient or unduly costly; minimizing the risk of climate change and the risk of devoting unwarranted resources to the task; and minimizing the risk of energy supply disruption and of over-provision of such insurance. Well functioning energy systems operate within regulatory frameworks that foster transparency and assign risks and costs accurately and fairly. Financial and regulatory risks associated with energy investments and contracts often are more significant than is widely appreciated and costly mistakes are ultimately borne by residents and taxpayers.

The governance challenge, and the essence of a properly functioning market, is to ensure that risks and rewards are commensurate. Risks must be made as transparent as possible and assigned where they belong—to those who are responsible for risk-exposure decisions and who stand to be rewarded. This requires sound governance arrangements and the maintenance of high quality regulation, and this is no simple matter.

Capital available for energy infrastructure post GFC—particularly project finance—has greatly diminished, prompting renewed interest in bonds, balance sheet loans, and PPPs. Despite the immediate hiatus, it does seem likely that regulated energy infrastructure offers precisely the kind of investment security sought by conservative investors, so it is far from clear why government funds should be needed.

Contestable energy businesses are inherently risky. Exploration and construction risks are singularly high, operation risks can be very high, and contract positions can be difficult to hedge. Risk management is not a function that government agencies do well, particularly in the event of failure, and conflicts of interest on the part of governments compound regulatory risk. Apart from RD&D, there is no evident economic case for government investment in the energy sector.

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8

Financing and Managing Urban Transport

Cameron Gordon

Introduction

This chapter examines the finance and management of transport in Australian urban areas. Transport, by definition, crosses many analytical disciplines and involves many different policy elements. It is a pervasive activity with large impacts on social, economic, physical, and environmental systems.

The discussion below starts from a key aspect of modern transport, that is, the physical space across which goods, services, and people move from point to point. Australia is unique in that as a country it occupies a huge area; yet its population is mostly concentrated in a relatively few dense cities which are widely separated from each other. This singular context is described at some length to set the stage for later discussion about the transport challenges faced by Australian cities. Some of these challenges are common to all urban areas but some are dictated by Australia's unusual city network. The analysis is framed by a brief review of some relevant urban economics, planning, and central place theory.

Next discussed is transport infrastructure. In Australia, much of this infrastructure is human-made, such as roads and railways (natural paths such as inland waterways often being unreliable), and is driven again by the characteristics of the country's extensive geography and pattern of relatively isolated pockets of human settlement. This infrastructure requires substantial amounts of capital for initial investment, operation, and maintenance.

Geography, topography, and infrastructure all in turn help drive choice of modes of travel, be it automobile, airplane, train, or other means. Like much of the developed world, Australians favor road-based modes to move goods and people, a choice which has some significant consequences, especially in urban areas.

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

Modal choice and system investment are results of private and public decisions, the latter often driving the former. The chapter thus turns to an examination of Australian transport policy. Here intergovernmental considerations are very important with State governments providing or driving most major infrastructure investment and management, while the Australian Government gives strategic national guidance.

Because Australia is so heavily urbanized, much of the transport system is focused on urban transport. Urban areas face unique and interrelated challenges in provision of transport, especially congestion, pollution (which is made worse by congestion and which has greater human impacts because of the population densities of cities) and social equity concerns. Moreover, the relative isolation of municipalities creates an interurban network, where the passenger component is almost entirely based on air travel and where some intercity synergies found in more densely populated nations are absent.

Urban transport investment is typically very resource-intensive because of the expense of securing rights-of-way and the complexity of engineering high capacity systems in dense areas. As discussed below, privatization has been widely used in Australian cities, though this takes a variety of forms and its application is uneven nationally. Some cities, such as Melbourne, use the method much more than others, such as Sydney. Privatization is also not a cure-all, and some of its drawbacks such as the problems of monopoly are described.

Whichever way urban transport infrastructure is financed there is a need for major investment to maintain existing systems and to provide new capacity. In particular, mass transit systems need to be expanded to ameliorate congestion and environmental degradation that primarily auto-based travel has contributed to. Encouraging transport users to shift modes is no easy matter and will require substantial policy and financial commitments.

Urban Transport in Theory

An understanding of urban transport begins with a basic question: why do cities exist? Which leads to a second question: what role does transport play in this?

Economic theory is one of a number of streams of thought which seeks to answer this question. Production, consumption, and exchange, conducted by rational, self-interested, and atomistic agents, constitute the core of traditional economics. Economic geography adds the dimension of physical space to this constellation. Physical space creates friction to be overcome, which implies an additional cost to be factored into the economic decisions of agents.

Since overcoming friction is costly, economic agents, whether they are producers or consumers, set about minimizing the costs associated with that friction. The two most obvious ways to minimize those costs are either to minimize the friction itself, that is, limit the distances which must be covered, or minimize the costs associated with overcoming that friction, such as lowering transport costs through transport innovation or building efficient transportation networks.

The first cost-reduction strategy—limiting spatial dispersion—leads to the formation of economic 'centers' in physical space, around which are economic 'peripheries'. In effect, different parts of a specific area specialize in their various economic functions with denser and generally higher order functions being placed in the center serving lower-order areas in the outer rings. This is the essence of central place theory which provides an economic rationale for the existence of cities (Mulligan, 1984).

The dynamics of this process are relatively straightforward. First, agents economize on friction and its associated costs by concentrating activities in places where either the beneficiaries of those activities are closest (and hence need to travel least to get the goods and services they need) or where the inputs necessary to make outputs are closest, or some combination of the two. This is a core rationale that economic geographers give for the existence of cities, namely, that the concentration of consumers and producers in one place limits the friction of distance and its associated costs.

There are also economies-of-scale, which are decreasing costs as a result of larger scale of production. These are generally 'internal' to the economic agent; physical concentration of the activity is implicit in that it is hard to imagine such economies without production at a single point. Agglomeration economies, 'external' to the agent, are much more directly related to physical space for they refer to economic synergies which result from a concentration of separate producers, consumers, and/or input sources at one location. With agglomeration economies, the fact that producers/consumers are so close to one another leads to a free flow of information and services with minimal search, transportation, and other transaction costs thus causing the unit costs of all producers to fall. These are further drivers toward concentration of activity in urban forms, rather than more dispersed alternatives.

Of course, one may ask why cities become differentiated at all and why there is not simply a single plane, perhaps bounded by natural or political barriers, with a single center that slowly dissolves into lower and lower densities of population and activity. The reason is that while economies of scale and agglomeration build cities, diseconomies along the same dimensions limit them. A single mega-city would be too unwieldy and disparate to operate efficiently; multiple cities, suitably sized, at least theoretically optimize gains from trade, concentration, and specialization.

Agglomeration economies and economies-of-scale occur within a single city, but they also occur across different cities. Thus one city may become a center of high finance, while another will become a center of watch manufacturing because it is more efficient for one place to do the one thing and the other place the other so long as the two places trade with one another. This dynamic is the basic thrust of urban hierarchy theory which seeks to explain the characteristics of multi-city networks (Krugman, 1996).

The discussion thus far has focused on settlement patterns as a way of limiting the frictional cost of physical space but of course transport is another key way of achieving this same end. Even in a very dense small city transport of goods, services, and people will be needed. Improvements in the means of mobility pull in two directions: (1) cities and their peripheries can become larger as unit travel time across a given distance falls, the area of equal 'friction' expands as a result; (2) cities can more readily specialize and stay within smaller areas since transport time savings allow greater and cheaper flow of material and people between different economic centers.

There are other theories of urban form which focus on noneconomic factors. One influential school of thought is the Nested Cities thesis, which argues that urban development hierarchies are driven by a complex of spatial, economic, and institutional factors. This line of reasoning argues for the importance of human and institutional factors as a causal driver of city development (Hill and Fujita, 2003). A related though independent philosophy is the Developmental State theory which emphasizes the importance of state-centered rational plans in guiding city growth, a context that is particularly relevant in parts of Europe and Asia (Newman and Thornley, 2005).

There is no predetermined theoretical answer to what city size, or city number is optimal or what transport investments are most desirable. These depend upon the specific characteristics of the area being studied. Certainly the causality is two-way: the way in which cities develop drives the way transport networks develop and vice-versa and these, in turn, depend upon many factors, economic and otherwise. Examination of these interactions in the specific Australian context is the subject of the following sections.

Australian Transport Shed

Much as a watershed refers to the entire geographical area drained by a river and its tributaries, loosely speaking, a transport shed can be said to refer to an entire geographical area where people, goods, and services move from one point to another with the purpose of engaging in social and economic activities. Transport analysis conventionally divides these movements into passenger movements and freight movements.

Within Australia the transport shed has two key aspects. One is extensiveness—the Australian continent is approximately 80% the size of the continental territory of the United States of America. The other is intensiveness—the Australian population in 2011 amounted to approximately 22 million people, compared to a US population of over 300 million. As a result of the harsh climate in the country's interior, most of the populace lives in urbanized areas along the coast, making Australia one of the most urban societies in the world and yet, simultaneously, one of the least densely populated on a national basis.

Consequently, transport activity has two primary aspects in Australia—long-haul movements from points separated by large distances and short-haul movements within generally congested urban agglomerations.

In an international context, Australia is quite distant from other significant landmasses. The closest sizable economy from the country's east coast is New Zealand, a roughly 3.5 h flight from Sydney to Auckland. From most points on the north coast, Indonesia is approximately 4 h away, similar to the flying time between Perth, on the west coast, and Singapore. Other countries are much farther away than these. Thus international passenger and freight movements to and from Australia are, by definition, long-haul.

Intercity freight and passenger movements in Australia are in the same long-haul category mainly because of the concentration of people and economic activity in widely dispersed and quite separate urban/suburban agglomerations. Eighty-nine percent of the population lives in these agglomerations (Australian Bureau of Statistics, 2006). The two largest cities, Melbourne and Sydney, are 863 km from each other and this is relatively close on a comparative basis. The distance between Perth and Sydney is almost five times greater at 3965 km. Perth also happens to be the most isolated large city on the planet.

It should be noted that there are important intraregional movements that do not move between points in the hinterland to a city or one city to another. For example, there is significant long-haul carriage of ores and farm produce to the coast for domestic consumption or export. On arterials connecting urban cores, such as the Hume Highway, Australia's major long haul road, much traffic occurs in short trips between centers located along the highway. Nonetheless, distance in travel is a dominating feature of Australia transport and movement between and within urban centers is a key facet.

While distance is the great obstacle in moving between Australian cities, congestion and sprawl are the main barriers to moving within those urban forms. As sections below describe, the vast majority of movements here, both passenger and freight, are by mechanized transport, mainly truck and automobile.

Australian Transport Infrastructure

Modern transport requires significant amounts of capital investment to support vehicles that carry passengers and freight. Figures 8.1 and 8.2 map out the extent of Australia's major rail, road, and seaport networks.

The absence of significant population or economic centers in large swathes of the country is made clear by the gaps in that network—there is not enough activity in these areas to justify investment in infrastructure. However, even this mapping overstates things. Much of the long-haul network exists not because there is significant activity along the network, but because it is needed to connect the major nodes at the ends of the network, mainly the eight capital cities.

The most extensive of these transport networks is the road network. Official statistics indicate that the overall length of this network has shrunk slightly since 1971, from 884 150 to 817 081km in 2009 (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 1.3). However, some of this shrinkage may be a statistical anomaly due to changing category definitions or inability to collect complete data.

Yet there has been significant improvement in the network. In 1971, 21.79% of Australia's roads were bitumen or concrete covered. By 2009, this proportion had increased to 43.45% (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 1.4).

Quality improvements have increased the speed of travel between nodes and therefore the attractiveness of road travel. It is worth noting, however, that these advances are not without environmental cost, both in terms of increased environmental pollution from greater use of automobiles and trucks, and from the reduction of permeable land surfaces which might contribute to

Figure 8.1 Australian national road network.

Note: Roads depicted are major national links. Some regional thoroughfares, such as the State roads from Sydney to Broken Hill and to Adelaide, are not shown.

Source: Bureau of Infrastructure, Transport and Regional Economics, *Infrastructure Statistics Yearbook 2011*, p. 75.

local ecosystem degradation. Additionally, improvements such as these are not necessarily economically valuable if the roads being improved connect points which people do not wish to travel to (e.g., 'roads to nowhere').

Building and maintaining the road network does not come cheaply. In 1985–1986, all levels of government spent \$11.7 billion on roads measured in real dollars; the equivalent expenditure in 2008–2009 was approximately \$15.8 billion (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 1.2d). Roughly \$4.9 billion of this in the latter year came from the National Government, with States and localities picking up the remainder (Bureau of Infrastructure, Transport and Regional Economics, 2011, Tables 1.2a through d).

The other major extensive network consists of the railways. Much of this network is managed by the Australian Rail Track Corporation (ARTC), an Australian Government–owned corporation established in 1997 that owns, leases, maintains, and controls the majority of main line standard gauge railway lines. This network is estimated to consist of 33 819 km of track. ATRC's maintenance expenditures for 2008 amounted to roughly \$207

Figure 8.2 Australian national rail network and major seaports.

Note: Some private internal freight lines such as those run by mining companies are not shown.

Source: Bureau of Infrastructure, Transport and Regional Economics, *Australian Transport Statistics 2008*, p. 3.

million (Australian Rail Track Corporation, 2009). The ATRC network is primarily a freight-oriented network with the bulk of passenger transport in Australia, especially long-haul, moving by air or road. There is also a substantial network of closed, privately owned rail networks that service mining activities in Western Australia and other privately owned freight networks in Queensland and New South Wales (NSW) that primarily service coal and agricultural goods movement.

Coastal shipping and domestic and international air networks obviously are not built networks along which to move vessels, but there is, nonetheless, a substantial investment required for seaport and airport facilities. Major airport facilities are located near the large cities. Seaports are more varied in their locations, some near urban areas, while others are more remote in order to service minerals and other primary goods production and distribution.

Australian Transport Modes

A significant aspect of transport is modal choice, mode in this case referring to means of travel. The three over-arching modes are air, surface, and water transport. As a result of Australia's size, and because of its almost complete lack of navigable rivers, internal long-haul transport is conducted almost

Table 8.1 Australian transport and storage value added.

Indicator ($ millions)	2005–06	2006–07	2007–08	2008–09	2009–10
Total transport, postal, and warehousing gross value added	54 318	57 457	60 608	59 876	61 298
Road	18 081	19 958	21 200	19 754	20 493
Air and space	4 613	5 014	5 177	4 947	4 882
Rail, pipeline, and other transport	8 214	8 198	8 793	8 953	9 002
Transport, postal and storage services, and storage (a)	23 331	24 282	25 506	26 222	26 921
Transport industry as a percentage of GDP	4.7	4.8	4.9	4.8	4.8

Notes: The reference year for chain volume measures in 2008–2009.
a.Transport services and storage includes water transport.
Source: Bureau of Infrastructure, Transport and Regional Economics, Infrastructure statistics yearbook, 2011, Table 11.1b, Canberra, Australian Capital Territory, Australia.

entirely by air and surface. Some coast-wise shipping movements take place between east coast cities via the ocean consisting mainly of bulk cargoes such as ores, chemicals, and petroleum. International movements of both freight and passengers are obviously entirely ocean and air-based. Tasmania's transport system deserves special mention because it is an island separate from that of the Australian continent, relying more heavily on shipping (rather than road or rail) for interstate, nonbulk transport.

Long-haul internal freight is carried mostly by the surface modes of truck, and to a lesser extent rail, in terms of cargo weight. Considering cargo value, air transport is also significant. The patterns are fairly similar for short-haul movements, though trucks are more dominant here, which is the case worldwide. Long-haul passengers move predominantly by air. Short-haul passengers move more significantly by automobile or common carrier modes such as intercity bus, commuter rail, or bus and rail transit.

Table 8.1 shows one measure of the importance of road-based modes, namely the value added to Gross Domestic Product by various activities. Road transport activities contribute more to the value added than air/space/rail/pipeline, and other modes (excepting water) combined. Only services to the transport sector itself, including storage (which refers mainly to warehousing and distribution), exceed that share.

These economic figures indicate that there has been strong growth in overall travel demand in the passenger and freight sectors. Other figures bear this out. Vehicle Kilometres Travelled (VKT) by all modes of travel has steadily increased in Australia, reflecting the trend worldwide. In 1971–1972, there were 78.78 billion VKT; in 2008–2009, 224.06 billion—an almost threefold increase (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 4.2).

One factor driving overall travel demand has been economic and population growth. Both of these have slowed recently; for how long it is not clear. Equally significant is the relative modal choice, analysis of which follows.

Surface: Road

Surface travel by road and indeed travel by any mode can be broken down in two dichotomous categories: intercity and intracity, and passenger and freight. By most measures, the automobile and truck have been king in Australia, as it is in much of the rest of the world. Overall intercity passenger car travel grew 2.0% per annum between 1970–1971 and 2003–2004. This outstripped the growth rate in the other significant intercity surface mode of common carriage coach which grew only 1.1% per annum during that same period (Bureau of Infrastructure, Transport and Regional Economics, 2006).

In fact, the statistics in coach travel are lower than this period average suggests. Between 1970–1971 and 1988–1989, coach travel grew at a robust 7.4% per annum, a period that witnessed deregulation in the coach sector. However, once air deregulation followed, this trend almost completely reversed itself, with coach travel declining by 6.3% per annum afterward (Bureau of Infrastructure, Transport and Regional Economics, 2006).

Within cities, the picture is much the same. Motorized passenger travel within the eight capital cities has grown almost tenfold over the past 60 years. Private vehicles, almost overwhelmingly cars, now carry 90% of urban area trips (Bureau of Infrastructure, Transport and Regional Economics, 2009).

Meanwhile freight carried on roads had even higher growth rates over the same period. In 1970–1971, 27.1 billion ton-km were moved in Australia. In 2007–2008 that number had almost multiplied eightfold to 190.8 ton-km (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 2.2a).

This tendency to move along highways is reflected in the number of registered motor vehicles. Australia had roughly 3.9 million passenger vehicles and 400 000 trucks in 1971, as compared to 10.6 million automobiles and just under 500 000 trucks in 2004 (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 5.11). The growth rate in number of passenger vehicles has outstripped the population growth rate for the period, indicating that households have, on average, more cars than they used to.

Surface: Rail

There has been a clear and consistent loser in the market for intercity passenger movement: rail. Rail's share of these movements declined by 0.9% per annum. However, while losing significant market share, rail more than doubled its carriage of freight in absolute terms, from 39.7 billion ton-km in 1971–1972 to over 197 billion ton-km in 2009–2010 (Bureau of Infrastructure, Transport and Regional Economics, 2011, Table 2.1e).

Air

If one measures success by modal share and growth, then intercity air travel has been the big winner in Australia over the past three decades. Air passenger travel grew 5.9% per annum from 1970–1971 to 2003–2004, faster than the overall growth in total passenger kilometers. On some key routes, its share of total trips was truly prodigious. Forty-one percent of all passenger trips between Sydney and Melbourne were by air in 1970–1971; this had increased to 78% by 2003–2004. The share of Melbourne–Brisbane trips over the same period increased from 39% to 88%, and from Sydney to Adelaide the numbers went from 37% to 82%. Only in the relatively close markets of Sydney to Canberra has air failed to take much share from automobiles, rail, and coaches, with the surface modes aided both by short travel times and improvement of the Hume Highway in the early 1980s (Bureau of Infrastructure, Transport and Regional Economics, 2006).

Water

Australia has no real internal waterborne commerce as a result of it not having nationwide navigable rivers. Australian navigable rivers were important in the mid to late nineteenth century with riverboats (stern-wheelers rather than side-wheelers because of the narrowness of the rivers) on the Murray/Darling system that ran from South Australia to Queensland to carry wool. However, railways eventually replaced the riverboats and the role of internal waterborne commerce is now mainly a memory.

There was an earlier time when coastal shipping was a major factor in intercity passenger and freight movement since all major Australian cities are on the coast. However, railways and highways and a protectionist coastal trading policy eventually decimated coastal shipping and its role in intercity passenger transport is minimal.

Only in international freight is Australian maritime still important. In 2004–2005, 696 million tons were carried into Australian ports by sea, a roughly 50% increase from the 420 million tons carried in 1995–1996 (Bureau of Infrastructure, Transport and Regional Economics, 2007b, Table 8.4). These figures demonstrate the importance of Australia's geographical position in modal choice for international movements.

Modal Choice Trends

Table 8.2 summarizes the domestic freight and passenger mode splits in Australia for the year 2005–2006. The dominance of road as a carrier of domestic freight is clear here, as it accounts for close to three-quarters of the tons carried during that period. When adjusting for distance that freight was carried, rail dominates, with road carriage a close second. Rail can be a cost-effective mode for long-hauls, and trucks for short to medium hauls, but this can vary by circumstance. Actual passenger numbers for road travel, primarily by automobile, are not collected but the registration numbers show that they must be by far the dominant method of travel in Australia. Other data for urban mode splits, discussed further below, confirm this.

Table 8.2 Summary of domestic freight and passenger activity by modes.

	Road	Rail	Air (a)	Sea (b)	Total (c)
Tons carried (thousands)	1 844 000	641 220	NA	55 249	2 540 469
Ton-kilometers (millions)	168 320	189 040	NA	122 040	479 400
Average distance (kilometers)	91	295	NA	2 209	NA
Passengers (thousands)	NA	643 360	41 824	21 553	NA

Notes: NA, Not available.
a.Domestic air freight not available. Passenger total is for scheduled activity only (domestic and regional).
b.Includes urban public transport ferry services.
c.Total does not include air freight.
Source: Bureau of Infrastructure, Transport and Regional Economics, Australian transport statistics, 2008, Table 7, Canberra, Australian Capital Territory, Australia.

Australian Transport Policy Structures and Mechanisms

Constitutional Context

As mentioned in the introduction, city development is a complex of many factors. Governmental policy is one such factor and one which has had significant influence on urban transport in Australia.

Australia was formed as a union of independent colonial governments. Australia had six independent colonial governments which united in 1901 under a formal written constitution. These now constitute the six Australian States and two Territories. Local governments are the construct of the States, with their authority devolved from above. These local governments none the less often exercise considerable power.

A number of sections in the Constitution are significant with respect to transport policy. Sections 90, 92, and 117 establish a common market, removing barriers of movements of goods and people across State boundaries. Sections 106, 107, and 108 protect the integrity and independence of the States. Section 51 defines the powers of the Australian Government and leaves the residual powers (those not assumed by the Australian Government) to the States. Section 109 provides that where there is a conflict Australian Government law prevails. From an urban transport perspective, the significance of these provisions, especially the common market, is that the only major barriers to intercity trade flows are natural and economic, not political. At the same time, the dual sovereignty of States and the Australian governments allows for the considerable variety of individual city mobility arrangements.

National Policies

Traditionally, States have reigned supreme in transport policy. The Australian Government played a more minor role in this area in the past but has expanded its role over the past 20 years through providing grants and GST revenue to aid transport programs, both of which are still allocated on an ongoing basis. Formally speaking, the Constitution granted the Australian Government powers such as 'naval and military defense', 'currency, coinage, and legal tender', 'immigration and emigration', 'external affairs', and the rather progressive for its time 'invalid and old-age pensions'. Residual powers left to the States included most everyday public services including, but not limited to, transportation of all forms.

From a funding perspective, States still provide the majority of transport funding. However, the Australian Government uses many financial and regulatory levers, as well as planning mechanisms, to try to ensure that the national network and corresponding areas of national need, are properly served.

In particular, federal grant funding is a significant mechanism through which national transport goals are encouraged. This policy regime was significantly kicked off with the Australian Government's Roads to Recovery (R2R) program, enabled by a legislative act of the same name. Grants totaling $1.2 billion were paid directly to Local Government Authorities (LGAs) specifically for road construction and maintenance. This appropriation was capped at that amount and had to be spent by June 2005 or be left to expire, in this way encouraging timely use of the money for its intended purposes. These grants were also in addition to other financial assistance grants. Another $1.2 billion was appropriated from July 2005 to June 2009 at which point the program became a component of AusLink, the National Transport Plan. R2R was funded through special appropriations. AusLink R2R is funded through annual appropriations including $3000 million per annum of formula-based payments to councils (Chan *et al.*, 2009, p. 48). (One note: because of a change in government in 2008, the name 'AusLink' is no longer used; however the plan and its process remains largely the same.)

Recently, three new significant national policy streams related to transport have taken center-stage. One is environmental policy in which the government has called for national reductions in greenhouse gases. While not centered on transport, a program called TravelSmart has been commenced in which Australian residents are encouraged, mostly through voluntary means, to switch from energy-intensive travel modes such as automobile to less energy-using modes such as walking, bicycling, and mass transit (TravelSmart Australia, 2009).

Another major initiative and one with more financial and legal heft is the launching of Infrastructure Australia (IA). IA was instituted with the election of the new Labor Government in 2008. IA's mission is to 'develop a strategic blueprint for our nation's future infrastructure needs and—in partnership with the States, territories, local government and the private sector—facilitate its implementation' and to 'provide advice to Australian governments about infrastructure gaps and bottlenecks that hinder economic growth' (Infrastructure Australia, 2009). With the onset of the Global Financial Crisis, IA also took on an extra implicit role of helping to reflate the economy. Roughly, A$20 billion is slated to be spent through the program. Many of these projects are transport-related.

Finally, the Australian Government has recently announced that it will be developing national planning criteria to be considered by States and localities and perhaps to be mandated in cases where federal funding is provided for urban infrastructure. The impetus for this latest policy initiative has been projections that Australia's population could climb 60%, to 35 million, by the year 2049 as well as concerns that climate change could lead to permanent flooding of coastal areas that have been the subject of heavy development in the past. A Commonwealth take-over of current planning powers of other levels of government is not being sought. Instead the Australian Government is seeking to provide incentives to those governments to build more public transit and add density to current areas of development rather than allowing sprawl (Franklin, 2009).

The Australian Government has other influence in the transport arena. It has led the development and adoption of standard transport policies, legislation, and regulations, using entities such as the Australian Transport Council and the National Transport Commission. The Australian Government's control over international trade has given it influence on any movements involving imports or exports which in the past was used to enforce the two airline policy.

State Policies

Traditionally, States drove most of transport policy and spending in Australia. They still remain primary actors in most transport areas. This means that State policies are not necessarily nationally coordinated. However, since most Australians are agglomerated in urban areas, and these are the province of State governments and their various instrumentalities, this is not always a bad thing. Local conditions and needs can sometimes be best met by more locally based governments.

On the other hand State fiscal constraints and parochial interests may lead to outcomes that are not ideal. For example, State governments tend to focus their long-distance transport spending on their intrastate systems, with interstate land transport being a secondary consideration. The improvements in interstate transport infrastructure have largely been funded and driven by the Australian Government. The Australian Government's urban planning initiative, mentioned in the previous section, is similarly intended to provide more commonality where pressures of climate change and population growth might call for it. There is tension between levels of government which is discussed below in relation to finance and intergovernmental relations.

Box 8.1 describes some of these tensions and the issues that arise between levels of government, particularly State and city, in the case of Sydney (NSW) and Melbourne (Victoria) when planning for growth-responsive transport. It should be noted that in both cases there have been very recent changes of State government, so policies may change significantly in the future.

Local Policies

LGAs can exercise significant transport policy influence. Because local jurisdictions are the creation of States, their de facto power varies from State to State, even though in theory they are all subject to control by their respective

Box 8.1 Planning for transport and growth in Sydney and Melbourne.

Australia's two largest cities, Sydney and Melbourne, have been engaged in long-term planning and policy initiatives to grapple with the strains between urban growth and transport infrastructure. Both cities are creatures of the States in which they reside and State plans are not always coordinated or aligned with local ones.

The New South Wales 'State Plan' outlines two main explicit transport objectives: 'A High Quality Transport System': 'Increasing share of peak hour journeys on a safe and reliable public transport system' and 'Safer roads'. Two additional transport objectives—'Jobs closer to home' and 'Improve the efficiency of the road network'—are contained in 'Improved Urban Environments'.

The City of Sydney's plan, 'Sustainable Sydney 2030', gives more prominence to transport under two separate categories: 'Integrated Transport for A Connected City' (containing 'Support and plan for enhanced access by public transport from the Sydney Region to the City of Sydney'; 'Develop an integrated Inner Sydney public transport network'; 'Reduce the impact of transport on public space in the City Centre and Activity Hubs'; and 'Manage regional roads to support increased public transport use and reduced car traffic in City Streets') and 'City for Walking and Cycling' (containing 'Develop a network of safe, linked pedestrian and cycle paths integrated with green spaces throughout both the City and Inner Sydney'; 'Give greater priority to cycle and pedestrian movements and amenities in the City Centre'; and 'Promote green travel for major workplaces and venues in the City'). Other transport development related objectives, scattered across other categories are: 'Manage and strengthen existing fine grain precincts in the City Centre'; 'Increase the supply of small scale spaces for retail and small businesses on streets and lanes'; 'Create a network of Activity Hubs as places for meeting, shopping, creating, learning, and working for local communities'; 'Develop and support local economies and employment'; 'Define and improve the City's streets, squares, parks and open space, and enhance their role for pedestrians and in public life'; and 'Ensure new development is integrated with the diversity and "fine grain character" of the surrounding parts of the City'.

The NSW plan has a broader focus on infrastructure investment and reduction in congestion and travel times. The Sydney plan is much more focused on redevelopment and densification. In many ways, this disjunct is not surprising given the differences in State and local authorities. Only the State can plan, design, and pay for infrastructure while Sydney and local councils have more scope to develop local land use planning (though the State has significant authority in this area as well). (One note: the State plan will certainly change since as this book goes to press a new government has been elected.)

Even accounting for these differences in jurisdictional competency and powers, integration between the two plans is uneven. With respect to transport and transport-related objectives, the Sydney 2030 plan provided a cross-index between State and City plans which found either no or only some connection or support between the two in key transport policy areas, most of these alignments around reducing travel times to work and increasing public transit usage. On development goals there was little meeting between the two. Moreover, with respect to big ticket infrastructure investments in Sydney, the State government cycled through numerous initiatives, one replacing another at fairly rapid pace, with little sense of what the final programme will be.

Melbourne, somewhat by contrast, appears to have only one major plan, 'Melbourne 2030', which appears to have been developed contemporaneously with the State plan, 'Victoria in Future 2008'. This plan closely integrates urban, suburban, and fringe development and land-use with transport investment. Transit-oriented development (TOD) is explicit and well defined in the plan, while largely absent in the NSW and Sydney initiatives. In general the State government of Victoria has been much more activist and close in its management of Melbourne's transport system than NSW has been in Sydney, even though both governments manage their respective city's transport network. Partly this may have to do with the much smaller geographical size of Victoria, a large share of which is accounted for by the Melbourne urban agglomeration. Once again, however, a recent change in government will certainly change some of these details and quite possibly priorities.

Source: Sustainable Sydney 2030: Appendix 1—Sustainable Sydney 2030 and the State Plan; Melbourne 2030: A planning update—Melbourne@5 million (December 2008).

State governments. Thus in Queensland, Brisbane City Council, which covers much of the metropolitan area, has extensive transport powers, including bus services and major infrastructure works. In NSW, Sydney is comprised of a number of LGAs, each responsible for a few suburbs. As a result planning for major transport infrastructure in Sydney is dominated by the NSW State Government but, as Box 8.1 indicates, this dominance does not always translate into integrated policy.

One issue of paramount importance in local transport planning is land release and the use of development contributions. State and LGA interests are often not aligned, and the singular pursuit of individual interests is often done at the expense of the larger social good (see Chapter 2 on urban management principles and Chapter 9 on coordination of infrastructure). For example, State and local policies sometimes ignore or work at cross-purposes with respect to pricing of development impacts and proper capture of increases in value that public investment can create. These mis-incentives can go both ways. In some cases, they encourage underdevelopment, as when value capture provisions are inadequate. In other cases, overdevelopment is the result, as when there is underpricing of negative externalities associated with the development. The situation, as far as transport is concerned, is worsened when there is no coordination between State infrastructure programmes and local development initiatives.

Public Finance of Transport

In terms of transport finance, Section 51(ii) of the Constitution gives the Australian Government Parliament the authority to levy any form of taxation. Section 90 prohibits States from imposing 'duties of custom and excise'

Table 8.3 Government funding of road-related expenditure, 2008–2009 prices ($ million).

Source	2004–05	2005–06	2006–07	2007–08	2008–09
National	2 514.8	4 832.9	2 994.7	2 754.2	4 934.3
State/territory	5 102.78	2 883.98	5 876.87	7 532.56	6 636.61
Local	3 760.9	3 340.5	3 583.4	4 077.2	4 215.7
Total	11 378.5	11 057.3	12 455.0	14 363.9	15 786.6

Notes: Figures include road construction, maintenance, and some administration and planning costs associated with those activities. Local government figures include funds donated from non-public sector sources. Components may not add to total due to rounding.
Source: Bureau of Infrastructure, Transport and Regional Economics, Infrastructure statistics yearbook, 2011, Tables 1.2a, 1.2b, 1.2c, 1.2d, Canberra, Australian Capital Territory, Australia.

(to ensure internal free trade). This might be interpreted as rough equality with concurrent taxing powers given to both governments except for excise taxes.

However, Section 96 of the Constitution allows Parliament to 'grant financial assistance to any State on such terms and conditions as the Parliament thinks fit'. The Australian Government used this power to withhold grants from States that levied income taxes, a use of authority upheld by the courts; thus States no longer impose income taxes. The result has been that the States have been limited in developing their own sales taxes. States rely for about half their revenue from Australian Government grants. Their other taxes are sundry ones with increasing reliance on gambling taxes (gambling is legal throughout Australia).

Australia adopted a Goods and Services Tax (GST) in 2000. This is an Australian Government tax but under the Intergovernmental Agreement on Commonwealth-State Financial Relations, all the GST revenue, minus administration costs, goes to the States. Thus, the States do have access to this revenue but the tax and the tax base itself remain under Australian Government control.

The Australian Government Parliament can give States tied or untied grants. Special purpose (i.e., tied) grants can be given to either a State or local government. They are often used to bypass State governments (e.g., on local roads, flagpoles for schools). General purpose grants usually go to the States, but because control is less than with special purpose grants such grants are not often favored by the Australian Government.

Additionally, the Australian Government and States together share tax revenue and distribute it to more 'needy' states (e.g., Tasmania) through the Commonwealth Grants Commission as General Purpose Grants. The Commission compares the level of services available to the citizens of all States, the revenue base in each State, and then redistributes some of it. Table 8.3 makes clear that when it comes to actual transport expenditures, it is States and localities that do most of the spending.

It should be noted that there can be cost shifting which involves State governments trying to arrange their affairs so that costs are transferred to the account of the Australian Government, while the Australian Government tries to establish the regulation of its programs so that any increase in its funding transport is not offset by an equal reduction in State spending. These elements are not necessarily captured in these statistics.

Intergovernmental

One can therefore see a tension in Australia between governmental center and periphery. The central government has strong fiscal powers and the courts are increasingly granting the government stronger administrative and policy authority. The States still actually deliver, or at least are responsible for many, if not most, public services but have relatively little independent taxing power.

There are some long-term cooperative elements of federal arrangements in Australia to help smooth over these conflicts and provide for coordinated planning and execution. Section 101 of the Constitution, for example, establishes the device of an Inter-State Commission. Although there have been a number of Commissions in the past there are no present Inter-State Commissions for transport. The modern equivalent is a voluntary grouping called the Council of Australian Governments (COAG) that first began in the early 1990s in the framework of national competition policy, with the National Government making payments to States that implemented competition reforms.

One key competition reform was the replacement of State sales taxes (many different rates on different commodities) with the single, uniform, national GST. The power to do this was obtained by parallel legislation passed in all the States and by the National Government. Differential levies on petrol, taxes on real estate and a few minor other exceptions continue (which is why the Australian Government will not give some States their full payment under the Competition reforms).

In 2004, the Australian Government of the time issued a white paper which spelt out a national transport policy called 'AusLink'. Formally collaborative with State governments, and in many ways a continuation of past policies, the report establishing AusLink nonetheless asserted some national policy goals (something not done before). The AusLink White Paper differed from previous arrangements in several respects in that it:

- proposed a rolling, 5 year plan with a 20 year planning horizon;
- identified the National Network, including links to ports and airports, and is intermodal, including roads and rail lines in the corridors;
- set out strategic directions for the development of the National Network with corridors to be the basis for future funding priorities;
- proposed sharing funding of the National Network with the States on the basis of bilateral agreements to be negotiated with State governments;
- proposed a possible role for the private sector;
- identified the Government's investment priorities; and
- proposed a project assessment methodology, which includes cost-benefit analysis, to enable projects to be compared in future plans in terms of value for money.

The name 'AusLink' has since been dropped by a successor government, but the basic principles and framework outlined above remains. This involves corridor planning by the States and Australian Government cooperatively. The States have the detailed information, so are supposed to be closely involved in corridor planning. After that, there is a reasonably robust cost-benefit process to identify the most worthwhile projects. The methodology is agreed upon, although there is inevitable discussion about technical aspects such as estimating future network effects of projects. Some projects and programs are not always subjected to cost-benefit analysis.

This national planning scheme is not limited to roads and railways but also covers landside access to ports and airports. The concept is to implement projects of greatest national benefit, without distortion between different modes. The national plan is limited to the identified national corridors. Neither the funding nor the methodology applies to other roads or railways not deemed under the framework as being 'national'.

Australian Urban Transport in Detail

Australia is an urban nation. However, not all cities are equal when it comes to transport needs. Perth is growing rapidly because of the resources boom in Western Australia as is Brisbane because of a resources boom and lifestyle draws of Queensland. Sydney's population is growing more slowly in percentage terms as is Melbourne's, but because the latter two cities are growing on a larger base, the absolute increase in the number of people in these cities is still higher than Perth and Brisbane. Adelaide being situated in the primarily agricultural State of South Australia is stagnant as are most 'country' areas of the nation. Moreover, since States and their LGAs are the governments primarily responsible for running cities, there is considerable variation in urban transport policy, with no explicit national urban strategy.

Table 8.4 provides a broad summary of passenger movements within cities. These and other related data will form the basis for the discussion that follows.

Urban Mass Transit

Perhaps the most significant issue in Australian cities is the movement of people within metropolitan jurisdictions. Total travel in urban areas grew ninefold from 1945 to 1995 and that growth continues to the present (Bureau of Transport Economics, 1999; Bureau of Infrastructure, Transport and Regional Economics, 2011).

Approximately nine out of ten of these trips involve automobiles on an average all-day basis when measured in passenger-kilometers travelled (PKT). Put another way, trips on Urban Public Transit (UPT) accounted for only 10% of these journeys, though if one considers proportion of peak hour commuting trips only that share looks better, that is, 16.1% for the eight capital cities in 2006. Between 2003–2004 and 2007–2008, the overall rate of growth in UPT trips was 16 times the growth rate in automobile

Table 8.4 Summary of Australian capital city passenger movements by mode.

Australian capital city urban public transit (UPT) and motorized vehicle trips (2006)							
City	UPT commute share (%)	UPT all day share (%)	HRT rips	LRT trips	Bus	Ferry	Cars
Sydney	22.70	13.30	5.28	0.02	2.3	0.121	46.3
Melbourne	14.80	8.60	2.78	0.62	0.99	0	44.77
Brisbane	14.70	9.00	1.08	0	0.91	0.02	18.48
Adelaide	10.60	5.70	0.19	0.02	0.62	0	12.73
Perth	11.00	6.50	0.4	0	0.84	0.0006	16.2
Hobart	7.10	4.30	0	0	0.1	0	2.06
Canberra	8.60	5.70	0	0	0.29	0	4.42
Darwin	5.10	7.20	0	0	0.08	0	0.89
ALL	16.10	9.50	9.73	0.66	6.13	0.1416	145.9

Notes: UPT commute share expressed as % of all motorized trips; UPT all day % of all PKT.
All other quantities expressed as total PKT.
Source: Compiled by author from Australian Government, Bureau of Infrastructure, Transport and Regional Economics, Urban passenger transport: How people move about in Australian cities, Information Sheet 31, 2009, Canberra, Australian Capital Territory, Australia.

travel, but the share of UPT relative to autos is so small that this has not shifted the relative modal share much at all during the period (Bureau of Infrastructure, Transport and Regional Economics, 2009).

Although there is a tendency to think of UPT as a uniform technology, it is not. Transit can utilize rail modes, either heavy rail transit (HRT), such as commuter trains and subways, or light rail transit (LRT) which has lower capacity and lighter rail cars; or it can run along roadways using buses. Where there are significant intra-urban waterways, ferries can also be used, as in Sydney. Table 8.4 shows that Sydney is unique in using all four types of transit technologies. All the others, save Brisbane, lack ferry transit, and several, namely, Hobart, Darwin, and Canberra, lack rail transit as well. Sydney and Melbourne carry significant volumes of transit traffic by rail. Otherwise bus is the dominant mode.

This portfolio of urban transit is significant. In general, travel speeds and user experience are best on rail transit because of their dedicated fixed paths and because they do not typically mix with general automobile traffic and thus are not affected by road congestion (though Melbourne’s trams, an LRT-type mode, do mix with and are affected by that traffic). However, rail transit is very expensive to build (though LRT is typically cheaper than HRT) and more expensive to operate than buses. Also, because of their fixed paths, rail networks face significant lags in responding to changes in patterns of economic and population concentrations, something that bus networks can more readily adjust to.

The transit technology portfolio thus presents an important set of choices, with corresponding challenges, to urban managers seeking to increase the use of transit generally. Users prefer rail and are more likely to choose that over

Box 8.2 Urban mass transport investment in Perth.

Perth's experience with transit expansion indicates the challenges and opportunities presented by large new investments in urban public transit. Perth, situated in the State of Western Australia has many characteristics that are considered hostile to UPT: low relative population density; a historical pattern toward sprawl in land use and development; and isolation from other regional centers (Perth is considered the most isolated large city on the planet).

These characteristics had helped to create a very automobile-oriented city. In fact, by 1995, when the government of WA launched a comprehensive transport plan to buttress mass transit, statistics seemed to indicate that Perth was less dense and more car-friendly than the classic auto city of Los Angeles, having less than half the latter's urban population density, only about a third of its urban job density, more than twice as much road length per person and roughly 20% more autos per person (Renne, 2008).

Recognizing that the environmental and mobility impacts of this pattern were unsustainable, the State Government launched its 'Perth Metropolitan Transport Strategy 1995–2029' plan. This plan outlined three interdependent elements: (1) better coordination of the components of the transport system; (2) greater integration between the transport system and land uses; and (3) improved efficiency in the use of transport infrastructure and services (Western Australia Department of Transport, 1995). Continued large investments were also to be made in Perth's urban rail network, building on past programs of rail expansion.

The Western Australian government has implemented these strategic elements in a muscular fashion. Its latest expansion to its rail network was the completion in 2007 of the 80 km rail to Mandurah (at a cost of $1.5 billion), bringing the system-wide total to around 200 km of fast electric rail line. This is in contrast to the situation in 1990 when the city had no electric rail line at all (Newman, 2005). The result of this investment has been a dramatic expansion of inner city commuter rail capacity. In 2007, 117 rail carriages arrived in the Perth CBD during peak hour, 174 in 2008 and by 2021, if rail expansion continues as planned, the number will be 416. Potential growth in peak hour CBD rail capacity in Perth is 25% by 2010, and 162% by 2021 (Glazebrook, 2008).

The government's initiatives on Transit Oriented Development (TOD) have been similarly aggressive. The Network City Action Plan aims to limit urban sprawl and encourage infill by providing for 60% of required additional dwellings in existing urban areas and 40% in new growth areas (Renne, 2008).

These policies have had some effect on increasing UPT patronage. Annual rail passenger boardings increased from approximately 7 000 000 in 1991 to close to 30 000 000 in 1997 (Newman, 2000). More recently, rail patronage grew by 41% to March 2008, after the opening of the new line to Mandurah (Glazebrook, 2008). Total boardings reached 73.550 million in 2008/2009 (Public Transit Authority, 2009). However, as earlier figures indicate use of UPT relative to automobiles remains low. The challenge remains of making significant modal shifts occur and this is apparently a very long-term evolution.

their cars, but buses are much cheaper to provide and quicker for transit authorities to implement. Rail networks require the securing of rights-of-way, something that is costly and sometimes impossible to secure in already dense urban pockets; while buses do not have this problem, their reliance on roads tends to make them more subject to the vagaries of traffic jams. Additionally buses tend to pollute more on a unit basis than rail though 'clean' buses may ameliorate this problem.

There is also the issue of building transit systems to meet existing needs and anticipate or channel future ones. Density is the watchword of transit technology choice—the greater the unit population density, the more cost-effective rail technologies will be. Accordingly, where significant investments are to be made to serve a future population of unknown density there is the risk of building an expensive network that will have few riders.

These are difficult choices for urban policymakers to get right. Technology, however, does make some of these choices less stark. For example, bus only lanes with fixed stops, elaborated stations, and traffic signal prioritization (often generally referred to as Bus Rapid Transit, or BRT) have many of the advantages of rail but at lower capital cost (though greater capital cost than regular buses). Smart technologies can make operation and utilization of existing transit infrastructure more efficient, effectively raising transit capacity with little additional capital cost. Despite such smart technologies, the fact remains that transit cannot be a widespread alternative to automobile travel without very large new investments and motivations to users to make the switch to it. This has not yet been accomplished (Box 8.2).

Congestion

Because of the growth in travel demand, and the relatively contained boundaries of cities, the ability of transport infrastructure to meet that demand is increasingly limited. The result of this excess demand relative to transport network supply is congestion.

Historically, with the advent of large-scale automobile use, people responded to congestion in urban areas by moving outward, building new roads and, to a lesser extent, passenger rail lines, to service new areas of settlement. This worked for some time, but as growth spread congestion increased in both newer areas and the already congestion-laden older areas. This is simply the result of the physical reality that there is only so much travel capacity that is ultimately available in a given region and certain levels of growth in travel, consistently experienced in Australia, make that capacity more and more crowded.

Table 8.5 shows some estimates of the costs that congestion imposes on transport users. Time spent travelling has a value, an opportunity cost that lowest possible travel times could minimize. Congestion obviously increases travel times (and also degrades reliability of travel, that is, the certainty that a given trip will take a certain amount of time on most occasions). As one

Table 8.5 Estimated urban values of travel time, freight, and passenger movement.

Vehicle type	Occupancy rate Person/vehicle	Value per occupant $	Freight-value per vehicle-hour $	Vehicle operating cost Cents/km
Cars				
Private	1.6	9.23	NA	NA
Business	1.4	29.52	NA	NA
Rigid trucks				
Light truck (two axle, four tires)	1.3	19.32	1.00	4.5
Medium truck (two axle, six tires)	1.3	19.69	2.72	9.8
Heavy (three axle)	1.0	20.22	9.31	10.5
Articulated trucks				
Four axle	1.0	20.94	20.05	14.3
Five axle	1.0	20.94	25.57	16.6
Six axle	1.0	20.94	27.57	17.1

Source: Centre for International Economics, 2006, Table 4.1 (based on Austroads data), Canberra, Australian Capital Territory, Australia.

can see from the table for business uses, the estimated value of a unit of travel time is roughly $20–$30. Private time spent travelling for purposes other than business is assumed to be less valuable, but still above $9 (Centre for International Economics, 2006).

These costs accumulate to very high levels. The *Bureau of Infrastructure, Transport and Regional Economics* estimates that the avoidable cost of congestion (i.e., where the benefits to road users of some travel in congested conditions are less than the costs imposed on other road users and the wider community) for the Australian capitals (using an aggregate modeling approach) totals approximately to $9.4 billion for 2005. This total is comprised of $3.5 billion in private time costs, $3.6 billion in business time costs, $1.2 billion in extra vehicle operating costs, and $1.1 billion in extra air pollution costs (Bureau of Infrastructure, Transport and Regional Economics, 2007a).

There is no single solution to this problem. Reducing travel demand is an obvious answer. However, as income and economic output expand (these generally being seen as desirable) travel demand will tend to increase. Flex schedules (to put people on transport capacity at staggered hours, therefore limiting peak hour bunching) is one way of managing that demand. One alternative means of demand management is pricing such as tolling, causing people to ration their use of existing transport capacity. Furthermore, there is the possibility of using information communications technology (ICT) to allow people to work at home or at other distributed locations. If widely implemented, this could obviously reduce travel demand, and the strain on existing networks substantially. However, this has not yet been achieved on a large scale and would require major changes in the way people live and work.

Increasing capacity is obviously part of the solution, especially UPT which carries many more people per unit of capacity than the automobile. The problem of financing and encouraging use of UPT has already been mentioned above.

Privatization

Much of Australia's transit has private participation, particularly in Melbourne and Perth. Many roads are privatized and all major airports are operated by private firms. Australia has probably one of the most extensively privatized transport systems in the world, though government has retained an interest in all transport services.

Privatization has both national and State components. At the national level the rail network was spun off into the ARTC which now maintains and operates that network on behalf of private operators. Similarly, airports were corporatized and then privatized by the Australian Government, mainly in the form of sales of very long-term leases to private companies (more specifics are provided in Chapter 2). However since States run cities, it is States that have been responsible for privatizing most urban transport hubs, not the Australian Government.

This has created a patchwork driven by States and concentrated in municipalities. Some systems perform well (Perth and WA), others are troubled (e.g., Sydney's Cross Harbour Tunnel—see Box 8.4) and many are expensive (e.g., Melbourne's CityLink which is discussed in more detail in Chapter 4). National coordination of privatization is probably desirable in some form, simply to ensure some sort of uniformity in and efficiencies of such arrangements. IA has thus been working toward development of a set of principles to guide Public Private Partnerships ('PPPs') though these are still mainly conceptual.

Certainly, Australia has shown that privatization in transport is quite feasible, though not always with guaranteed operational results. PPPs have the advantage of relying on private capital markets to fund large-scale investments that the public sector might not be able to afford. However, by definition, private investors want profit opportunities and many of the needed investments that might be justified on social grounds might not be attractive to the private sector. There are also significant policy risks that must be considered before entering into PPP agreements, especially preservation of the public interest in the operation of any privately built and operated facility.

It is a precept of economics that a social optimum in terms of consumption and production is reached where prices exist for goods and services and where such prices (P) reflect the marginal cost (MC) that it took to produce those goods and services. Such an optimal condition is summarized by the formula P=MC. Transport PPPs provide a number of challenges stemming from this precept and violations of it that are found in the real world. These major issues involve pricing, market structure, and network externality which are discussed below with respect to roads specifically, though they apply to other facilities with similar characteristics such as rail and transit.

Roads (and indeed any network facility like it) are not pure 'private' goods because they can be jointly consumed. An apple, for example, can only be consumed by one person at a time and that person's consumption will by definition make the apple unavailable to anyone else. Hence an apple is a private good. But a road can be consumed by multiple people at the same time and has a degree of 'publicness' to it. After a certain point, congestion sets in and everybody's consumption of the road is degraded; they cannot travel as fast or as reliably as they did when there was no congestion.

Here is where pricing becomes important. Obviously, 'free' (i.e., untolled) roads will become more congested than a priced road, everything else being equal. So if we imagine two parallel roads, one tolled and one untolled, the priced road will be less congested than the free one for obvious reasons. If one then assumes that there is only one road, it stands to reason that the road will be more efficiently used if a price exists, because people will have to pay for consumption of the road where there is a toll and they will be more efficient in using it than if it is offered to them for nothing.

This reasoning is fine as far as it goes but at this point the details of the real world intrude. First, to be efficient, P must equal MC. If the price is too low, or too high, a social optimum will not be reached. Second, the road itself must be able to carry the socially optimal amount of traffic. If a road's capacity is too small to carry the traffic it needs to, then imposition of a price at a sufficiently high level will certainly reduce traffic at some point but will not address the travel requirements of the economic area being served. Third, there is the issue of modal alternatives, which is really the second point on a broader scale: can the existing transport system handle all the traffic that it needs to, either overall or in specific parts of the system? If there is some structural deficiency in the system, pricing will not necessarily yield an efficient transport outcome (Peters and Gordon, 2009).

Market structure is fundamental to this. Market structure refers to the degree of competitiveness in any given market. The P=MC optimum rests upon assumptions of perfect competitiveness. However, roads are clearly not in that category, being single facilities which must be provided by a single operator. Roads, like many other public utilities are therefore prone to monopoly in provision, or perhaps oligopoly in the case of two or more roads serving similar areas. Without some sort of prior and/or continuing constraint, such as a regulatory authority or a binding agreement between the government and the private operator, there will almost certainly be a pricing above MC that will maximize operator profits but will fall short of a social optimum.

There is an additional issue of administrative costs. Theoretical discussions of pricing assume costless administration, but tolling does have a deadweight loss component in the form of collection and other administrative burdens. Costs of collection for road tolling typically run in the range of 10%–45% (Peters and Kramer, 2003; Short *et al.*, 2007). These costs include the cost of administration (management, staff and capital of toll collection systems), violation costs as well as consumer time costs and pollution costs. In other words, pricing on transport facilities is needed to ensure optimal use but the actual act of pricing leads to significant deadweight losses.

This theoretical discussion is a partial equilibrium analysis. Roads provide the means of obtaining the service of transportation which is a derived demand based on general equilibrium across all markets, including demand for land and housing. In that sense a P=MC condition met on an individual road taken as an individual market may nonetheless result in a suboptimum from a general equilibrium point of view. Thus, system-wide economic optimality requires attention to all relevant policies.

Finally roads, and other similar transport assets, are networks where the value of the whole network is greater than the value of the individual parts considered in isolation. This outcome is referred to as network externality, and can be negative (as with congestion or over-pricing) and positive (as with the addition of a new key link in an existing network). Privatization in Australia and elsewhere in the developed world is typically done on an individual facility basis, such as a specific road, tunnel or train link. Although the PPP process may necessitate such an approach, network externalities must not be lost sight of.

Australian cities have made wide use of transport privatization and have met all of these challenges. Urban managers will continue to do so as the need for financing new facilities and maintaining existing ones will continue to grow and the tapping of private markets for capital will be a necessary supplement to general revenue funding. Thus, Australian cities are unique in having a wide breadth of experience in the use of PPPs for urban transport. The key is probably to leverage the lessons learnt from that collective experience and avoid unnecessary mistakes. Additionally, it should be noted that while clearly a useful method of meeting capacity needs, privatization is not a cure-all. Public revenues will certainly be necessary on large scales to meet all future needs.

Box 8.3 on Melbourne's multimodal program of privatization describes how that city met some of the challenges described above. Box 8.4 on Sydney's Cross City Tunnel PPP provides some cautionary tales about greenfield projects.

Technology

Many proposed transport policies rely heavily on technology. Road pricing in particular relies heavily on the use of transponders (or cameras in some cases) to obtain information about vehicles using roadways. This information is then digitized and processed using information technology to bill users, collect fees and identify and assess penalties for noncompliance. In urban transit, unified automatic fare collection systems such as 'smart cards' and 'smart signs' that tell travelers where trains and buses are in the system and when their estimated times of arrival are, are almost commonplace. Looking into the future, there has been some experimentation internationally with 'VKT' charges in which drivers are charged not just for the time and place of road usage but the length of travel as well.

Box 8.3 Private sector involvement in Victoria's transport infrastructure.

Victoria has privatized much of its transport system over the past 15 years which provides some interesting policy lessons. Privatization began in earnest in the State of Victoria in the 1990s under a Liberal government. Liberal Premier Kennett conducted a successful turnover of the State's electricity generation to private enterprise and then turned his attention to transport. Melbourne's trams and trains were first liberalized and then, during Kennett's second term, outright privatized. The building of the new Melbourne arterial road, CityLink, was also bid out to the private sector under Kennett, and this road used e-tolling exclusively, something unique at the time. The Kennett government also privatized freight rail.

Victoria is an interesting case because of the scale and scope of its privatization. Except for a recent renationalization of the relatively insignificant State freight rail system, all major modes and means of travel are privately operated and sometimes effectively privately owned (the lease and franchise being the primary means of public to private transfer). Its experience, while not necessarily an endorsement for or against wholesale privatization is nonetheless a reminder that transport is not just about a single mode, especially in urban areas, even though privatization may be chosen for just a single mode.

It should be pointed out, however, that there were many different arrangements and operators in the privatization of Melbourne and Victoria transport. The Citylink arterial was a greenfield investment, where the private sector put up its own money in return for a long-term lease (approximately 35 years). The trams and trains were brownfield turnovers of existing systems conducted through franchise agreements. The freight line was a straight brownfield sale to a private operator. The airport was a long-term brownfield lease, this time through the Australian Government.

Why these different arrangements? The simple answer is that although there is one system for providing mobility through transport facilities and services, the elements of that system have different economics, histories, and institutions. For urban arterials, greenfield investments were clearly needed but financing capacity was limited. For transit, the immediate need was improved operation and lowered public subsidy of the existing system. Passenger rail also has different economics than freight rail, and airports are different from highways.

Victorian privatization has spanned decades and a number of governments of different parties with differing short-term priorities and long-term ideologies. Indeed, this will be the case for most transport PPPs since transport is a long-term investment. Political considerations will always be present but the underlying fundamentals of providing transport should not be lost sight of. Transport, while provided through individual facilities, is in fact about the desired outcome of mobility. This is an important thing for public leaders to keep in mind when either resisting or promoting privatization and certainly important when designing its implementation.

Sources: Clarke and Hawkins (2006) and Allsop (2007).

Box 8.4 Ridership projections and the Sydney's Cross City Tunnel PPP.

In the beginning of the 2000s, the New South Wales Government put tenders out for a road project that, it was hoped, would reduce inner city congestion on runs from the CBD east to CBD west. The project ultimately built with private capital was the Sydney Cross City Tunnel, a 2.1 km long underground thoroughfare running east-west between Darling Harbour and Rushcutters Bay. The PPP was between the New South Wales (NSW) Government and the Cross City Motorway Consortium (CCMC) with a 30 year concession period after completion of construction.

The economics of the project seemed to be advantageous. Travel time savings to individual drivers of up to 20 min were projected and original predictions of initial uptake of the tunnel were 35 000 vehicles per day, increasing to 90 000 by the end of the first year of operation. Characteristics such as these were attractive to private bidders as they seemed to represent a benefit high enough for drivers to be willing to pay for and at volumes great enough to represent significant annual cash flows for the builder-operator.

However, initial actual usage amounted to only 20 000 vehicles per day, 1 month after the opening. Even a 3 week toll-free period, then extended by another 2.5 weeks, increased usage to 53 000 vehicles per day, well below the 1 year peak that was projected; usage dropped by almost half when the toll was reinstated.

Part of the problem appeared to be the Tunnel's price. The toll was set at \$3.56, double that for vehicles longer than 12.5 m and higher than 2.8 m, making it the most expensive toll in the city. An additional administration fee of at least \$1.60 was added to a 1–7 day pass purchase. This price was pegged to increase quarterly by the amount of increase in the Customer Price Index (CPI). While prices such as this made the cash flow projections of the project appear attractive prospectively, they were apparently more than the perceived worth of the travel time savings offered to drivers, and thus reduced actual traffic and revenue flows significantly below what was expected.

Moreover even at lower prices, preproject traffic projections seemed to be too high. East-west CBD traffic flow is not amongst the highest in the city and there are numerous alternative routes to the tunnel. To encourage, not to say force, riders into the tunnel, the NSW Government closed a number of those alternatives, as per prior agreements with the consortium. Citizen response was, to put it modestly, unpleasant and the government soon reversed these closures.

The net result was that traffic, and hence revenues, were not enough to make the project viable. The consortium went into receivership and has since been sold, at a great discount, to a new private operator. The road reverts to public ownership in 2030. The lesson of the Cross City Tunnel is that it is hard to get usage estimates right, that not all projects are amenable to privatization, and that PPPs do not eliminate risk, even for private operators.

Sources: Phibbs (2008) and Zou *et al*. (2008).

The benefits of such technology in optimizing urban transport are quite clear. But 'intelligent transport systems' or ITS, to use standard parlance, can be quite costly. Such systems also require careful planning design and implementation. A good idea in theory can become an albatross in practice.

Costs of transponders, IT systems, compliance systems, and the like can run into hundreds of millions or even billions of dollars annually, especially when considering the costs of managing and acting upon the huge volumes of information that such systems can generate. The London congestion pricing scheme has created an additional 123 million pounds in revenue for transit investment; however, roughly 40% of the revenue goes to collection costs (Peters and Gordon, 2008).

Of course, London's congestion pricing system is especially complex being a cordon price which requires extensive monitoring of the full network of roads within the pricing zone. Congestion pricing along single roads requires much less in the way of technology which lowers the cost of that technology, which demonstrates that careful advance design is essential. Even in these simpler deployments, however, administrative costs will not be negligible.

The experience of Australian cities in implementing ITS has not been especially positive. Sydney has been far behind schedule with implementation of a transit smart card to allow seamless transfer across transit modes. Its incarnation in the form of 'MyZone' has been plagued with problems of availability (initially many newsagents refused to carry it because of poor incentives and the card was difficult or impossible to obtain in many parts of the city) and it still falls short of a true smart card (Australian Broadcasting Corporation, 2010). Meanwhile, Melbourne's 'myki' card, similarly well behind schedule and over budget, has been plagued by problems even in its initial and limited roll-out (The Age, 2010). These problems have been smoothed out but their cautionary lessons are clear.

Technology clearly is an integral part of better managing urban transport in Australia and there have been successful examples of improvements and enhancements both inside the country and abroad. But a simplistic attitude toward technical improvements is dangerous and the benefits of adoption need to be clearly understood and weighed against the costs.

Land Use Planning

State governments hold large amounts of undeveloped land and additionally have a great deal of unified influence over land development policy. UPT is often proposed as a solution to the transport capacity problem and indeed it is certainly part of it. Zoning and other land-use policies are another necessary part of the solution, to make sure that development is centered around transit hubs and stops (something referred to as Transit-Oriented-Development or 'TOD').

The general issues of interface between transport and land-use are addressed at more length in Chapters 5 and 9 (and also referred to in the Perth case study). The point to be made here is that fragmentation of governmental responsibilities can present some obstacles to having effective

TOD and coordination between transport providers and land users. Even something as basic as parking rules, which generally are set by local councils, can work at cross-purposes. In Sydney, for example, councils often want to relax parking rules during peak hours to encourage local shopping, even though this can interfere with priority bus lanes run by the State Transportation Authority. While there are always going to be some conflicts between different interests, it is best to have these come out early in the planning process, not after implementation when such problems are much harder to resolve.

Country Access

Rural and country town integration and access still resonate across Australia and are important elements in transport investment policy. On the face of it, this might seem to be irrelevant to urban transport policy. However, two considerations dictate otherwise. The first is that an urban–rural balance is important for overall economic and social health and planners are right to be concerned with the vibrancy of outlying areas and beyond. Indeed, some current urban transport ills, such as congestion, arise from the urban primacy of Australian cities. Some diversification in settlement might be a useful palliative from a transport point of view, assuming efficient use of scarce environmental resources, especially water, is possible with such diversification.

The second is that country access investment, if not managed properly, can lead to a 'beggar-thy-neighbor' approach to funding urban needs (and vice-versa, as many rural interests complain). Intrinsically resource allocations are necessarily political, but one should avoid looking at urban and rural transport needs as antagonistic. In fact, cities rely on their hinterlands and the reverse is also true. Urban transport plans should integrate these needs, not work against them.

Environmental Footprint

A critical element of any transport shed is its sustainability both economically and environmentally. From this standpoint, Australia's system of widely dispersed urban agglomerations is perhaps especially challenged. Great amounts of energy must be expended covering the long distances within the country and between it and other countries while the intra-urban movements on a unit travel basis tend to be especially costly because of the difficulties associated with urban traffic. Transport in general is a large contributor to greenhouse gas emissions (23% of the world energy-related GHG emissions coming from that sector in 2004) and the energy- and distance-intensive modalities of Australian transport are especially challenging in this regard (Kahn *et al.*, 2007, p. 235). Table 8.6 illustrates the specific estimates of GHG and other emissions for Australian transport.

Of course, transport's environmental impacts are not strictly an urban issue, but because so many Australians live in and travel around cities, it is especially

Table 8.6 Australian transport direct greenhouse gas emissions—Co_2 equivalent (gigagrams)—by transport mode.

Financial year	Motor vehicles	Rail (excl. electric)	Maritime	Aviation	Total
1974–1975	33 033	1 910	3 437	2 791	41 200
1979–1980	40 687	2 023	3 750	2 765	49 258
1984–1985	46 871	2 040	2 880	3 017	54 844
1989–1990	54 735	1 753	2 383	2 833	61 764
1994–1995	59 929	1 755	2 319	5 003	69 074
1999–2000	65 779	1 884	2 101	5 352	75 194
2004–2005	72 281	2 267	2 579	5 678	82 897
2009–2010	73 724	2 629	2 829	7 792	87 075

Notes: Transport accounted for 14.4% of Australia's national greenhouse gas emissions in 2005 according to the Australian Greenhouse Office's, National Greenhouse Gas Inventory 2005.
Source: Bureau of Infrastructure, Transport and Regional Economics, Infrastructure statistic yearbook, 2011, Table 9.4, Canberra, Australian Capital Territory, Australia.

important there, not taking into account the broader issue of climate change and how it might affect the long-term habitability of Australia itself.

Many of the issues discussed thus far inevitably involve issues of environment. Travel using resource-intensive and polluting modes is going to increase ecological impact. In the push to meet immediate urban transport needs, there can be a tendency to overlook these impacts for expediency's sake. Most Australian cities have responded to this by developing 'green' urban plans to guide growth and transport investment. The key will be to stick to these plans.

Safety

As with environment, safety is not just an urban issue. In certain ways many of the classic traffic safety problems, such as traveling at too high a speed, or fatigue after driving long distances, are more likely to occur during the long-hauls outside of cities.

However, the congestion that occurs on facilities designed for far lower traffic flows can lead to truly serious accidents simply because if one car has an accident, many others are affected. Even new facilities when packed with automobiles can have this problem as the 2008 tunnel fire in Melbourne demonstrated.

Australia is fortunate in that its strong public information and enforcement policies, as well as rebuilding and redesign of 'black spots' along dangerous stretches of road have given it a traffic fatality rate that has been well below the OECD average traditionally. Its fatality rate is now slightly above that of average, as Table 8.7 shows although this has been due to a fall in overall OECD fatality rates in recent years that has outstripped continued falls in Australia. Australia still compares more favorably with the United States, similar to it in that both are countries with large landmasses.

Table 8.7 Traffic fatalities per 100 000 population, 2009.

Country	Fatalities	Country	Fatalities	Country	Fatalities
United Kingdom	3.78	Ireland	5.42	Hungary	8.19
Sweden	3.87	Denmark	5.50	Slovenia	8.42
Netherlands	3.91	Spain	5.92	Czech Republic	8.61
Israel	4.16	Canada	6.36	New Zealand	8.90
Norway	4.42	OECD Median	6.36	Luxembourg	9.51
Japan	4.53	Italy	6.74	USA	11.01
Switzerland	4.53	Australia	6.80	Poland	11.98
Germany	5.06	France	6.84	Greece	12.93
Finland	5.24	Austria	7.58		
Iceland	5.33	Portugal	7.90		

Source: Bureau of Infrastructure, Transport and Regional Economics, (2010), International road safety comparisons, 2009, p. 1, Canberra, Australian Capital Territory, Australia.

Social Exclusion

A final but important issue is social exclusion. This refers to gaps in the urban transport network that leave poor and disadvantaged residents without proper easy, low-cost access to necessary social functions such as work and leisure.

This has become an especially severe problem as urban sprawl has consolidated without a corresponding increase in the transit network. Western Sydney is a prime example of this problem, and Melbourne shows evidence of it. The tendency in urban transit expansion plans has been to focus on the business connections, that is, bringing people from outlying areas into the CBD. This focus, however, tends to ignore connections between points in the outlying areas and many of these areas are in greatest need. There has been recognition that these issues exist, but to date not much has been done to address the problem. At a minimum, more needs to be done to at least measure the extent of the problem. Such data collection is presently uneven and often nonexistent (Peters and Gordon, 2008).

Conclusions

In general, Australian cities face some major transport challenges simply because the country is heavily urbanized. Congestion, pollution, poverty—these are things playing out right now in Australian urban areas. The solutions—more sustainable modal choices, better coordination across levels of government, TOD, to name a few—will require resources and public and private commitment.

Financing will be critical. It is likely that more resources, not less, will be required to meet all the needs and requirements that Australian cities will have for ensuring mobility and access for its residents. Waste and misallocation, never desirable under optimum circumstances, will especially need to be avoided as public budgets are likely to remain constrained. This argues for heterodoxy in the methods used to provide urban mobility through transport investment and the means of financing, whether public, private, or a combination of both. Moreover, transport policy will need to remain integrated with other interrelated policies, such as those pertaining to land use, economic development, and the environment.

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9

Principles and Systems for Coordination of Infrastructure Investment across Portfolios

Marcus Spiller, Praveen Thakur, and Kath Wellman

Introduction

It is evident from the proceeding chapters that there is strong momentum within sectors for efficiencies in the funding and management of urban infrastructure. Much has been driven from broadly based microeconomic reforms, but technological innovation and environmental imperatives have also been influential.

Most, if not all of these reforms have had a *sectoral* focus. That is, they are aimed at improving value for money *within* given sectors. However, the nature of cities and the potential for economies of scale and scope necessitate not only sectoral efficiency, but also cross sector coordination to ensure an orderly and efficient roll out of services. This is not only to ensure that the population size and density is sufficient to support the efficient delivery of services, but also to ensure integration across sectors where this has the potential to provide additional social benefit. As noted in Chapter 2 urban infrastructure has a propensity to impact on other sectors; energy on water, water on energy, transport on energy, transport on health and educational facilities and the like. These impacts can be either positive or negative. Managing these externalities has the potential to improve outcomes for communities and for the environment, as well as improve the efficiencies of individual sectors.

This coordination of infrastructure investment and management over a metropolitan area requires knowledge of the particular characteristics of infrastructure sectors and how they impact on each other as well as inter and intra governmental coordination. These form the main themes for the chapter.

Urban Infrastructure: Finance and Management, First Edition.
Edited by Kath Wellman and Marcus Spiller.

The chapter is structured in two parts. The first section introduces a conceptual framework to classify infrastructure in terms of its spatial impact on cities. Here infrastructure is characterized as either 'city shaping' infrastructure that impacts on the spatial characteristic of cities; where people live and how they travel to work or services and 'follower' infrastructure that generally services the pattern of settlement which has been established through other forces. An Australian case study illustrates how this can be applied.

The second section examines the governance of metropolitan areas and the cross jurisdictional tensions which arise from differing goals and objectives. In a liberal democracy, aligning these goals and objectives remains a formidable challenge for National, State (or provincial), and local governments.

City Shaping and Follower Infrastructure

Certain types of infrastructure investment trigger a broader set of adjustments in settlement patterns which, in turn, can either support, or work against, efficient service delivery in other sectors. These infrastructure investments can add to, or help contain, the underlying demand for taxpayer funded facilities and services. They may be crucial in bringing about settlement patterns which are preferred on social, environmental, and economic grounds. They have the potential to unlock social value beyond the scope of an intrasectoral analysis.

Other policy determined factors outside the direct control of any infrastructure agency also profoundly influence the cost of delivering services. For example, planning rules on the timing of land release for urban development will affect efficiency in infrastructure provision by determining where and when a critical mass of demand for various services is achieved (see Chapter 5).

Against this background, cross sector coordination systems need to address two core issues. The first area in which cross sector coordination can generate substantial social value relates to strategic deployment of resources into infrastructures which have the power to *shape* urban development within the constraints set by topography and resource endowments. While a range of regional infrastructure initiatives such as employment centers or hospitals could fall into this category, the crucial criterion is the capacity to affect comparative accessibility across the region in question. Here, accessibility is defined in terms of travel time to opportunities, whether these relate to employment, customers, suppliers, education, health care, shopping, or recreation. Travel time to opportunity at any given point can be improved either by redistributing jobs or social services such as hospitals or universities across the region and/or by changing the transport environment. The former tends to be significantly more difficult than the latter, because of agglomeration inertia. Thus, a key urban management issue is how best to use investment in high level transport infrastructure (urban freeways and major passenger rail, for example) to redirect the locational decisions of businesses and households to achieve a desired urban form and economic structure.

The second key issue in infrastructure coordination is to achieve inventory and investment timing savings in the rollout of infrastructure to growth areas or districts undergoing extensive redevelopment. This goes to the issue of efficient capacity utilization and maintenance of service standards in the face of ever-present constraints on the pool of resources available for economic and social infrastructure such as arterial roads, university subcampuses, hospitals, major high schools, bus routes, and subregional cultural, recreational, and sporting facilities.

These particular infrastructure items are likely to meet a ‘regional significance’ test because they will generally serve more than one city council area; they are long lived and often come with hefty price tags. However, in most cases, they *follow* demand rather than shape it. In this sense, they have much in common with local infrastructure such as local networked water services (water supply, sewerage, and drainage), roads supporting district level circulation, district parks, maternal and child health centers, and the like.

An important public policy goal with this follower infrastructure relates to its timely and efficient delivery once demand thresholds have been met. The difficulty of achieving this goal is often most acute in greenfield urban expansion, but can also occur in urban redevelopment. Effective cross-portfolio coordination would mitigate the erosion of regional infrastructure efficiency caused by fragmented urban growth. Such fragmentation has led to demand thresholds being triggered in more places within a given time frame than is necessary or desirable, and lost opportunities for colocation or coprovision of services as a result of independent planning on the part of providers.

In the long term the strategic deployment of city shaping infrastructure is potentially of greater policy importance than optimization in the roll out of urban services in growth areas. Failures in the coordinated delivery of follower infrastructure will ultimately be ‘cured’ as a particular growth area reaches maturity and gaps in the spatial pattern of development are closed. In other words, the inefficiencies involved in providing regional level social and economic infrastructure into fragmented or distributed growth areas are significant, but essentially transitional, in nature. By contrast, failure to positively direct the city shaping power of driver infrastructure can leave a permanent problem in terms of unsustainable urban form, heavier ongoing demands for infrastructure, and a competitively disadvantaged regional economy.

‘Predict and Provide’ versus ‘Creating the Future’

Distinguishing between those infrastructure decisions which will reshape the pattern of development across a city region and those infrastructure decisions which will merely serve that pattern of development is of vital importance.

Box 9.1 Gestation period for major transport projects in Melbourne.

	Melb CityLink	Melb Western Ring Road	Melb EastLink
Total build cost	$AUD 2 billion (2000 $ value)[1]	$AUD 631 million (1999 $ value)	$AUD 2.5 billion (2008 $ value)
Year the project was first mooted in official policy discussions	1957[2]	1954[3]	1960s[4]
Year the project was formally adopted in policy	1995[5]	1987/1988[6]	2002[7]
Year in which the Government committed to build the project and allocate the necessary resources	1995[8]	1987/1988[9]	2003–2004[10]
Year in which construction commenced	1996[11]	1989[11]	2005[12]
Year in which construction was completed	2000[13]	1992–1999[14]	2008[15]
Gestation period (years)	43	45	Approx. 43

[1] *http://www.vicroads.vic.gov.au/Home/RoadsAndProjects/RoadProjects/InnerCity/CityLink/ProjectOverview.htm*

[2] Following the 1954 (MMBW) Planning Scheme, the 1957 highway plan proposed an inner ring road around the CBD, a series of freeways to the east, south-east and north-west, and a number of by-passes. http://www.abp.unimelb.edu.au/gamut/pdf/citylink-background-report.pdf
In 1992 the Kirner Government called for expressions of interest to build, own and operate the Western and Southern Melbourne bypasses.
http://www.vicroads.vic.gov.au/NR/rdonlyres/D15F5451-D005-45EF-BC1B-6646AD711381/0/projms.pdf

[3] The *1954 Melbourne Metropolitan Planning Scheme* featured the first tangible proposals for ring roads for Melbourne's western suburbs. Reservations were set aside for two ring roads known as R3 and R5. The Western Ring Road was later proposed as part of the *1969 Melbourne Transportation Plan.*
http://www.redreaming.info/DisplayStory.asp?id=107

[4] As part of the development of Melbourne's outer suburban orbital road network, land was reserved for the proposed Scoresby Freeway.
http://www.connecteast.com.au/page.aspx?cid=521

[5] The *CityLink* project was ratified in the *Melbourne CityLink Act* 1995 Section 14.
http://www.austlii.edu.au/au/legis/vic/consol_act/mcla1995212/s14.html

[6] The Western Ring Road was part of a development and management strategy for Melbourne's road system. The Victorian Government then commissioned a study to integrate the initiative with national economic objectives.
http://www.redreaming.info/DisplayStory.asp?id=107

[7] September 2002 the Victorian Government combined the Scoresby Freeway and Eastern Freeway Tunnel projects into the Mitcham–Frankston Freeway Project (later called *EastLink*).
http://www.connecteast.com.au/page.aspx?cid=521

[8] Pursuant to the *Melbourne CityLink Act 1995, Transurban* was required to design, build, and finance the construction; to operate and levy tolls; and to maintain *CityLink* for a period of 34 years ending 2034. Design and construction of City Link was undertaken by TOJV under contract to *Transurban*.
http://www.vicroads.vic.gov.au/Home/RoadsAndProjects/RoadProjects/InnerCity/CityLink/ProjectOverview.htm

[9] The Federal Government accepted the Western Ring Road for funding as a National Arterial Road. *http://www.redreaming.info/DisplayStory.asp?id=107*

[10] April 2003 the Victorian Government announced that the Mitcham–Frankston Freeway would be built as a toll road by a private operator. May 2004 the Mitcham–Frankston Project Bill was introduced into Victorian Parliament. October 2004 The Victorian Premier announced *ConnectEast* as the winning bidder for the Mitcham–Frankston Project, awarding it the Concession Deed to build and operate the tollway for 39 years. *http://www.connecteast.com.au/page.aspx?cid=521*

[11] May 1996 http://www.vicroads.vic.gov.au/Home/RoadsAndProjects/RoadProjects/InnerCity/CityLink/

[12] http://en.wikipedia.org/wiki/Western_Ring_Road

[13] *http://www.connecteast.com.au/page.aspx?cid=521*

[14] *http://www.vicroads.vic.gov.au/NR/rdonlyres/D15F5451-D005-45EF-BC1B-6646AD711381/0/projms.pdf*

[15] http://www.connecteast.com.au/page.aspx?cid=*521*

If regional infrastructure is viewed simply in terms of its capacity to meet demonstrated user demand, without focused regard for the spillover effects on business and household locational decisions and urban form, the metropolis in question will be at risk of ongoing capture by a 'predict and provide' model of regional planning. That is to say, the incremental impact of major infrastructure decisions, particularly in transport, may be to simply reproduce past patterns of urban development which, in an Australian context, are characterized by car-dependence and diluted agglomeration economies. These are likely to place heavier demands on future communities for economic and social infrastructure.

There is a propensity for major infrastructure decisions to become 'locked in' because of the long gestation periods involved and the consequent reinforcement of previous planning efforts (Text Box 9.1). Breaking the 'predict and provide' cycle can therefore be a major challenge in the design of infrastructure coordination systems.

An alternative model of regional planning would define a preferred future where the quantum and nature of demand may be caused to shift in advantageous ways. This alternative approach requires additional scrutiny on major infrastructure decisions so that any city shaping potential they may hold might be actively directed at delivering the preferred urban form and spatial economic structure, bearing in mind that major infrastructure investments are likely to be at least as powerful a tool for sculpting growth than other instruments typically mandated to this purpose, for example, statutory land use plans (see Chapter 5).

A good example of using major infrastructure decisions to build a preferred future rather than reproducing the inefficient patterns of past development is provided by rail investment in Perth which has been described from a sector-specific perspective in Chapter 8 on transport.

Perth has hitherto been known as the archetypical low density, car-dependent Australian city. Investment in modern heavy rail commuter infrastructure is being used to transform this urban structure. Even though operating conditions in the new suburban rail system are not always ideal (for example, some train services run down the centre line of freeways) commuter traffic on

Table 9.1 Estimated impact of Melbourne 2030 on vehicle travel (year 2030).

Scenario	Vehicle trips	Vehicle km traveled	Vehicle hours traveled
Base case	2 523 192 966	40 531 147 167	1 132 100 557
M2030	2 217 934 260	34 967 908 008	875 260 857

the network continues to increase (see Chapter 8, Box 8.1). Heavy rail has supported more compact forms of satellite development in the northern growth areas of Perth. More recently, investment in a new southern line to Mandurah has established the potential for a string of Transit Oriented Developments (TODs), which are actively being pursued by the Western Australian Government, in line with the vision set out in successive metropolitan strategies.[1]

Failure to harness the city shaping power of major infrastructure decisions can be costly. For example, estimates prepared by SGS Economics & Planning Pty Ltd (2005) suggest that achievement of the preferred settlement pattern set out in Melbourne's (then) metropolitan strategy, *Melbourne 2030*, would in the year 2030 deliver major savings in vehicle usage and its associated externalities (including greenhouse gas emissions) compared to a Base Case which reflected trend growth evident in the late 1990s (Table 9.1). Moreover, Victoria's Gross State Product under the settlement pattern of 2030 was predicted to be permanently higher by around 3% in 2030 when compared to the Base Case. Applying this 3% increase to current GSP figures, the Melbourne 2030 vision would represent a $2 billion to $3 billion 'windfall' in aggregate tax receipts, two thirds of which would accrue to the Commonwealth. For more information on *Melbourne* 2030 see Chapter 2.

One strength of utilizing strategic infrastructure to shape the city is that it is a demand-based approach and does not put total reliance on supply involving land release across a number of local governments (whose self interest can and often does over ride that of the city as a whole). Metropolitan planning visions such as Melbourne 2030 are unlikely to be achieved if strategic infrastructure investment is not used to reshape locational preferences of households and businesses.

Identifying Infrastructure Projects with 'City Shaping' Power

A key task in designing an appropriate cross-government coordination strategy is to identify those projects which have the potential to reshape the pattern of development and economic activity across the region. This is likely to distil

[1] The Planning and Transport Research Centre (PATREC) in WA is undertaking a 4-year research project to document the impacts of transit-led development in new rail corridors. http://www.patrec.org/

to a relatively small number of projects, as few infrastructure investments have the capacity to significantly shift accessibility profiles across a metropolitan area. Having said this, the smaller the city, the more likely a greater range of transport projects will meet the accessibility shift criterion, because existing accessibility contours will be less subject to inertia.

These strategic projects would require special treatment within the coordination system both in evaluating their contribution to sustainable development objectives, and in the ongoing management of investment decisions. As discussed below, other regionally significant but not strategic infrastructure projects (i.e., 'follower' projects) could be managed via appropriate land development sequencing programs which do not require detailed information or analysis of each project.

Generally speaking, identification of city shaping projects will require the deployment of a suitable land use and transportation simulation model, which can measure shifts in relative accessibility across the region in question, given the addition (or withdrawal) of particular strategic links and/or the spatial reallocation of substantial numbers of jobs through other policy interventions. Only projects that can demonstrably and significantly raise (or lower) the relative accessibility of individual or groups of travel zones[2] would merit strategic designation.

Having demonstrated that a particular project will, in fact, have a significant effect on the locational decisions of households and businesses, an evaluation process is required to measure whether this impact will help or hinder achievement of regional settlement pattern objectives, as set out in planning policy documents, such as metropolitan strategies.

One approach to evaluate the prospective city shaping effect of a project which, prima facie, has strategic significance is to apply historically observed locational elasticities (i.e., measured sensitivity of employment or population growth at the travel zone level to changes in relative accessibility). If the historically observed tendency for households and businesses to adjust their location in response to a change in an area's relative or absolute accessibility is assumed to carry over to new projects, it is possible to quantify the impacts of such projects vis-à-vis a range of specific regional objectives; for example, the push given to consolidation as opposed to outward spread in the pattern of urban development, and the assistance (or otherwise) offered to key regional industry clusters and economic nodes through the reinforcement (or not) of agglomeration economies.

The Victorian Government's 2008 East West Link Needs Assessment (EWLNA) Study provides a case study utilizing this approach. The study examined the merits of introducing an alternative to the West Gate Bridge to connect the western and eastern segments of metropolitan Melbourne.

[2] A 'travel zone' is a small area identified for transport modeling purposes. They typically accommodate about 500 households, or the employment equivalent.

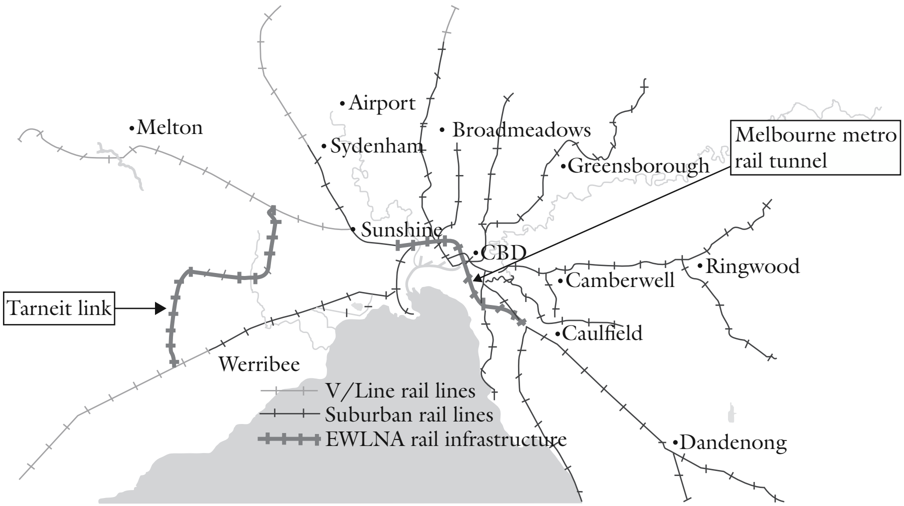

Figure 9.1 Major rail projects in option D.
Source: Eddington, R., Investing in transport: East west link needs assessment (March 2008), Report to State Government of Victoria.

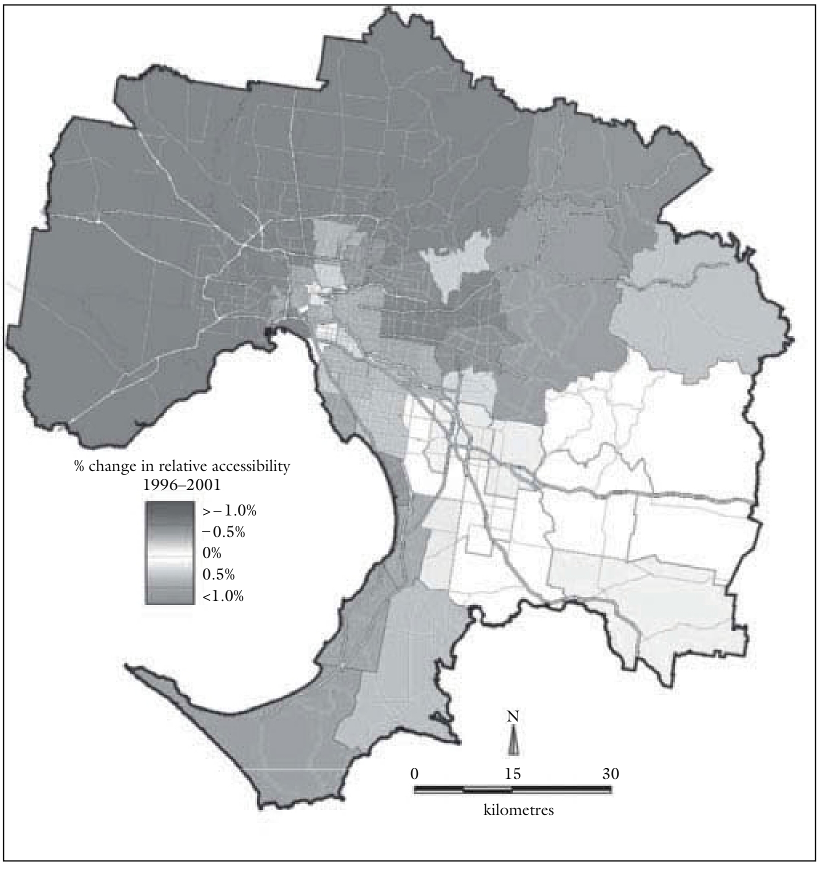

Figure 9.2 Estimated accessibility shift 1996–2001.
Source: SGS Economics & Planning Pty Ltd (2008).

Three options were identified in the EWLNA Study:

1. *Option A*—a direct freeway to freeway connection between the Eastern Freeway and Westgate Bridge;
2. *Option B*—a direct connection between the Eastern Freeway and the west via Sunshine Road; and
3. *Option C*—a range of capacity upgrades and road management initiatives utilizing largely existing infrastructure.

All these options were to be accompanied by three major public transport investments as follows:

1. A CBD Rail Tunnel
2. A bus rapid transit to Doncaster
3. A Tarneit passenger rail link

These public transport enhancements were collectively known as Option D (see Figure 9.1).

Modeling the city shaping impacts of these options began with the retrospective measurement of change in relative accessibility across the metropolis. Between 1996 and 2001, the northern and western subregions of Melbourne and the inner east experienced gains in relative accessibility due to the completion of two strategic projects—the Western Ring Road and CityLink, which connected the Monash Freeway to the Tullamarine Freeway (Figure 9.2).

The growth (or decline) in employment by sector and households at the small area level over the same intercensal period was then related, through regression analyses, to changes in each area's relative accessibility. This produced a locational elasticity coefficient for each sector, including households.

Higher value added activities, where agglomeration economies and knowledge worker skills are of greater importance, tended to show the greatest sensitivity to changes in relative accessibility (Table 9.2). These findings resonate with those of Graham (2005) regarding the impact of agglomeration economies on productivity by sector in the United Kingdom.

The next step was to estimate the changes in relative accessibility across Melbourne that would occur as a consequence of the different EWLNA options. The estimated shifts in relative accessibility generated by the various options are illustrated below.

For Option A+D, accessibility advantages are distributed in 'butterfly' form, but with the greatest advantage conferred on the inner west and the Eastern Freeway corridor which extends well into the more privileged eastern suburbs of Melbourne (Figure 9.3).

Option B+D was found to provide a similar accessibility shift, but with a more widespread distribution of accessibility advantage in the west (Figure 9.4).

Table 9.2 Sensitivity to accessibility shift by industry sector.

	Dependent Variable	
Independent Variable	Coefficient	T-Statistics
Agriculture, forestry and fishing		
Relative accessibility	−133.877	−2.945
Households	−0.001	−2.155
Adjusted R-squared	0.856	
Mining		
Relative accessibility	657.408	22.629
Households	−0.007	−27.636
Adjusted R-squared	0.788	
Manufacturing		
Relative accessibility	11 121.740	167.675
Households	0.103	45.432
Adjusted R-squared	0.971	
Electricity, gas and water supply		
Relative accessibility	987.991	30.414
Households	−0.008	−29.914
Adjusted R-squared	0.884	
Construction		
Relative accessibility	2 192.353	18.183
Households	0.016	9.187
Adjusted R-squared	0.974	
Retail trade		
Relative accessibility	9 570.861	24.587
Households	0.055	82.751
Adjusted R-squared	0.959	
Accommodation, cafes and restaurants		
Relative accessibility	14 116.840	8.221
Households	0.097	109.587
Adjusted R-squared	0.900	
Transport and storage		
Relative accessibility	4 509.116	9.913
Households	0.034	276.615
Adjusted R-squared	0.899	
Communication services		
Relative accessibility	−4 610.176	−7.108
Households	0.028	37.521
Adjusted R-squared	0.799	
Finance and insurance		
Relative accessibility	22 349.960	19.005
Households	0.219	21.411
Adjusted R-squared	0.774	

Table 9.2 (*Cont'd*)

	Dependent Variable	
Independent Variable	Coefficient	T-Statistics
Property and business services		
Relative accessibility	27 477.650	22.837
Households	0.208	14.834
Adjusted R-squared	0.908	
Government administration and defence		
Relative accessibility	10 940.970	9.024
Households	−0.105	−7.183
Adjusted R-squared	0.770	
Education		
Relative accessibility	26 265.010	15.947
Households	0.090	36.292
Adjusted R-squared	0.899	
Health and community services		
Relative accessibility	11 112.410	56.792
Households	0.034	18.812
Adjusted R-squared	0.937	
Cultural and recreational services		
Relative accessibility	4 729.788	27.129
Households	0.034	32.984
Adjusted R-squared	0.756	
Personal and other services		
Relative accessibility	4 590.718	2.780
Households	0.021	8.488
Adjusted R-squared	0.998	
Households (total occupied dwellings)		
Relative accessibility	217 772.200	14.797
Total employment	0.230	29.516
Adjusted R-squared	0.900	

Source: SGS Economics & Planning Pty Ltd (2008).

Option C+D was found to have a relatively modest impact, perhaps bringing into question the strategic designation of these projects. However, the inner west would be the main beneficiary of this approach, in terms of shift in relative accessibility (Figure 9.5).

By relating locational elasticities derived from previous accessibility shifts to future elasticity shifts, it was possible to estimate the population redistribution effects of each of the options. Option C+D was found to contribute most to urban consolidation. Option B+D had a neutral effect in this regard, while the accessibility shifts generated by Option A+D were assessed to be most likely to provide a spur to outward urban growth (Table 9.3).

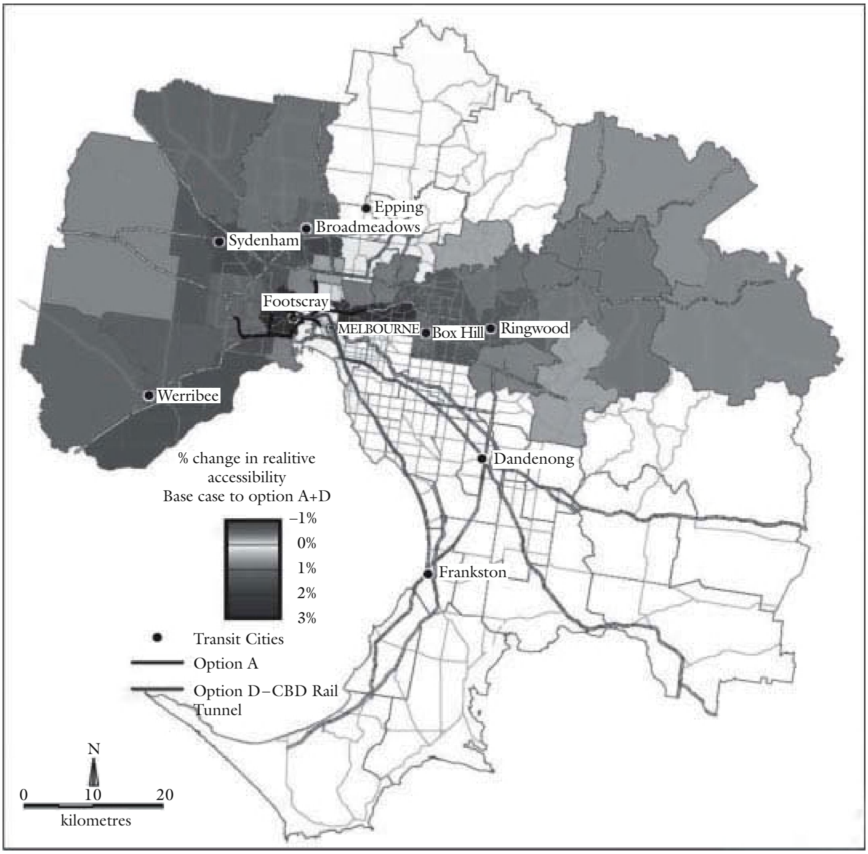

Figure 9.3 Accessibility impact—option A + D.
Source: SGS Economics & Planning Pty Ltd (2008).

Likewise, locational elasticities were used to estimate the impacts of the options in terms of the redistribution of future jobs. Options A+D and B+D were found to provide the greatest stimulus to the suburbanization of jobs. In policy terms, Option B+D was arguably the most consistent with the 'Melbourne 2030' strategic plan. This option had a neutral effect on outward urban expansion, but delivered more, badly needed, employment into commuter suburbs on the urban fringe (Table 9.4).

Designing Coordination Systems

To recap, an effective cross sector coordination system must address:

- The institutional arrangements required to ensure that the city region in question gets the most advantageous strategic infrastructure package which is affordable; that is, they should harness the city shaping power of key projects rather than settling for an outcome which unduly reflects inertia in project planning and funding streams;

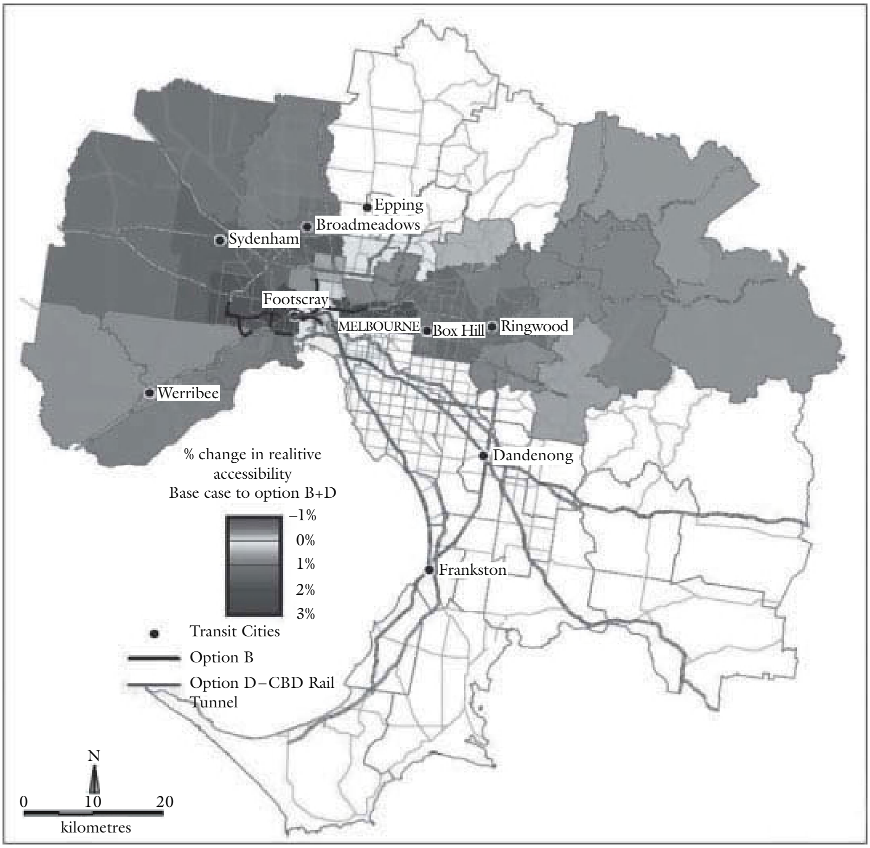

Figure 9.4 Accessibility impact—option B + D.
Source: SGS Economics & Planning Pty Ltd (2008).

- The institutional arrangements required for the coordination of follower infrastructure to contain inventory costs by, in effect, fostering a just in time approach to investment.

Coordinating City Shaping Infrastructure

The process we have described for sorting regional infrastructure projects into 'strategic' and 'follower' categories and then subjecting the former to detailed assessment on economic, social, and environmental sustainability criteria would aim to ascertain the best possible alignment of infrastructure resources with regional development objectives as set out in planning policy documents (like Melbourne 2030). As noted, the process would not be captive to previous infrastructure planning efforts, nor to current conventions regarding the allocation of national, regional, and local funding pools for infrastructure investment. The preferred deployment of available resources would be determined on the merits of the various infrastructure packages, that is, on their contributions to regional objectives as measured through

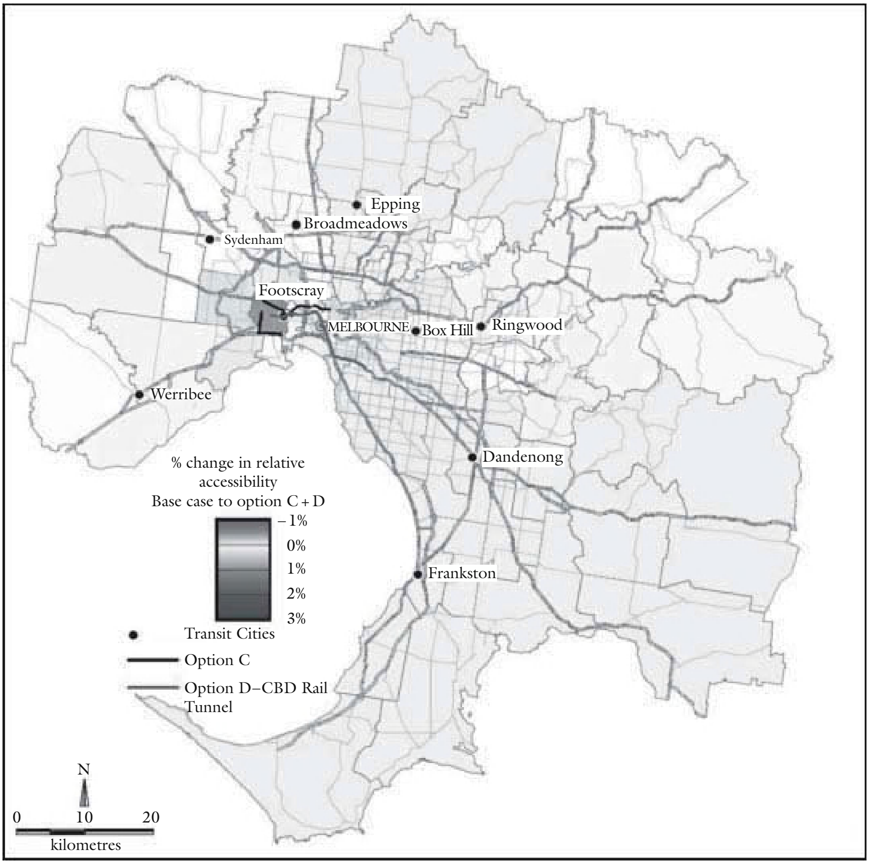

Figure 9.5 Accessibility impact—option C + D.
Source: SGS Economics & Planning Pty Ltd (2008).

cost-benefit analysis, economic impact analysis and, as a vital part of these, the impact on urban structure. It could well be that the regionally preferred package of strategic projects, and by implication, the residual funding for follower projects, will be different to that which has been thrown up by historic planning processes.

Clearly, there is a major policy challenge in resolving any gap between an infrastructure program for the region in question, as identified through the processes outlined above and a program which is already in place as a result of organic planning. Strong regional governance will be required to mediate the power and demands of infrastructure agencies, many of which will be focused on business outcomes as a result of the intrasectoral microeconomic reforms noted at the start of this chapter.

Once regional governance has resolved the inevitable tensions in the first iteration of a plan for strategic projects, there will need to be a process for similarly testing the merits of subsequent infrastructure projects which, prima facie, have strategic significance in the sense that we have defined in this paper. Broadly speaking, the logic of these ongoing appraisals will need

Table 9.3 Net shifts in households due to changes in relative accessibility, options A + D, B + D, and C + D compared to base case.

	Change in number of households, option A + D versus base case	Change in number of households, option B + D versus base case	Change in number of households, option C + D versus base case
Additional household growth in established SLAs	−487	25	2960
Additional household growth in fringe SLAs	487	−25	−2960

Source: SGS Economics & Planning Pty Ltd (2008).

Table 9.4 Net shifts in total employment due to changes in relative accessibility, options A + D, B + D, and C + D compared to base case.

	Change, option A + D − BC	Change, option B + D − BC	Change, option C + D − BC
	Total employment	Total employment	Total employment
Stimulus to increased infill development	−5353	−4093	1170
Stimulus to urban sprawl	5353	4093	−1170

Source: SGS Economics & Planning Pty Ltd (2008).

to be consistent with that for the initial version of a strategic infrastructure plan. The principles and processes involved in the ongoing coordination of strategic infrastructure are shown in outline terms in Figure 9.6. Two key analytical tools to support the coordination process are the locational elasticity model and a regional macroeconomic model to simulate productivity effects of different urban forms. In the first instance, proposals for major transport investments would be tested for regional significance or city shaping power. While, in theory, creating employment nodes through university, hospital, and similar investments can affect locational elasticities, it is much more likely, as we have argued earlier, that major transport projects will have the greatest impact on relative accessibility, especially in large cities. This is simply because any new employment node will be small versus the mass of jobs already in situ across the metro area.

Those projects which are found to have strategic significance would be streamed into a further evaluation process within the coordination model, while nonstrategic or follower infrastructure would be managed via a development sequencing framework (see below).

The additional economic scrutiny placed on strategic infrastructure projects could involve the creation of a range of investment scenarios or packages. Ideally, these would be formulated on the assumption that capital

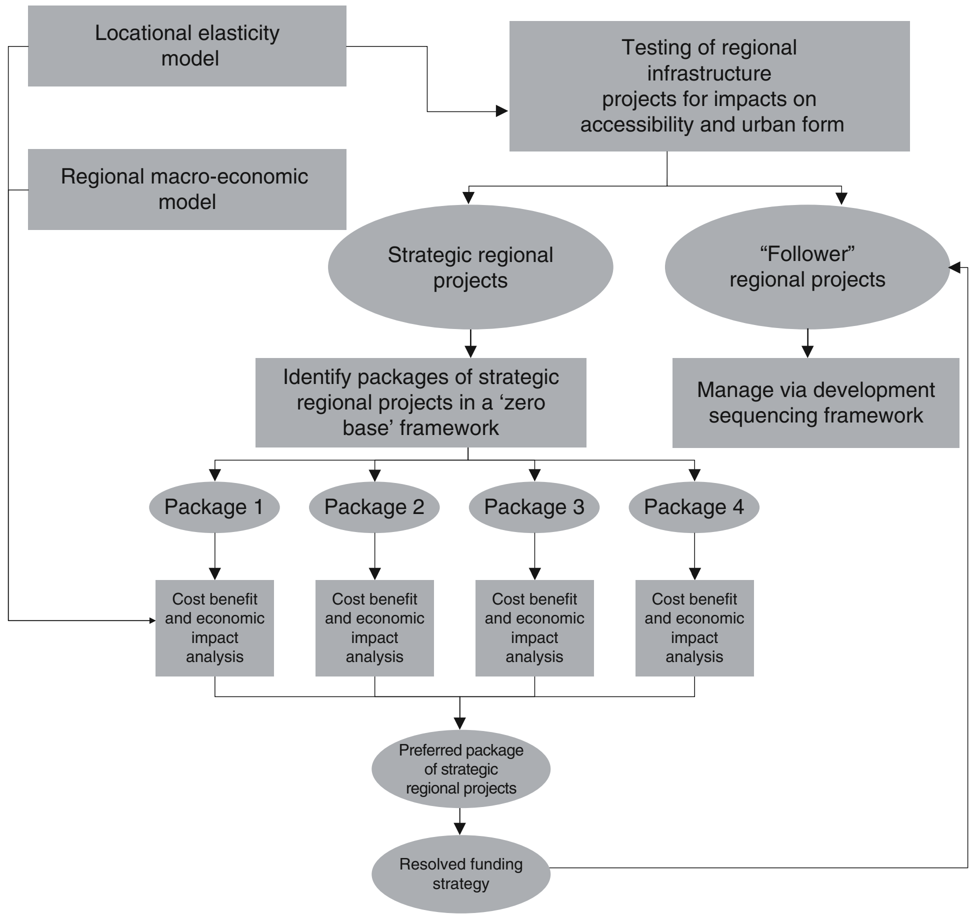

Figure 9.6 A model for coordinating strategic infrastructure.

funds can be redirected from other projects which may be in the pipeline due to historic or organic planning processes.

Each package of strategic projects would be evaluated using the cost-benefit techniques discussed in Chapter 3. This would include the impact on urban form, as illustrated with the case study of Melbourne's East West Link, bearing in mind that urban form will drive a number of substantive economic benefits including, but not limited to, logistical efficiency and innovation potential of the regional economy.

The cost-benefit process will ultimately produce a preferred package of strategic infrastructure projects which, among other things, best supports the regional planning framework for the metropolis in question.

The process outlined in Figure 9.6 can be put into effect through centralized coordination institutions or within the context of distributed responsibility for infrastructure planning. In any event, as explained below, clarity and authority about the desired urban form at the metropolitan level is essential and likely requires strong regional planning governance. In the case of distributed investment planning, all proponents of potentially strategic projects would be encouraged to undertake a self assessment of their plans using the logic outlined, and this self assessment would then be appraised and debated within an appropriate regional governance framework.

Coordinating Follower Infrastructure

The coordination of follower infrastructure will require some form of market-based development sequencing in which a preferred pathway for development in a planning district is identified, based on minimization of the total cost of social and economic infrastructure. Although most obviously applicable in greenfield growth areas, the concept of a preferred pathway for development would be equally relevant in areas undergoing progressive redevelopment or wholesale regeneration. The idea is to make a forecast of a reasonably efficient pattern and timing of development (and, implicitly, the pattern and timing of demand for infrastructure services) and then adopt this as the notional benchmark for services planning by all infrastructure agencies. Agencies would not necessarily be required to endorse this assumed sequence or pattern of development; rather it could be offered to them as a plausible scenario for asset management and services planning purposes. The incentive for these agencies to adopt the preferred sequence of development would, in part, stem from a common sense of regional purpose. More importantly, adoption of the preferred sequence of development would provide them with a vital tool to manage financial risks in the roll out of infrastructure investments, as we outline below.

For their part, developers would not be obliged to remain within the staging set down in this least cost pathway. They would be free to pursue out of sequence projects provided they are prepared to meet the additional costs of supplying economic infrastructure, and provided they are prepared to bring forward the provision of social infrastructure in their preferred location.

The benchmark sequence of development would be reviewed regularly (say, every year) and as required, as new information comes to hand on land demand and as out of sequence development approvals alter the geography of infrastructure capacity in a district.

As well as paying for the acceleration costs (effectively the bridging finance costs) for water supply, sewerage, drainage, education, health, transport, and other infrastructure, developers would be required to contribute to local infrastructure costs on a share of usage basis as set out in a development contributions plan (see Chapter 5 for more discussion on development contributions).

The notion of requiring out of sequence developers to accelerate infrastructure provision at their cost is certainly not new. There are several examples across Australia of where an out of sequence developer was required to fully fund the accelerated infrastructure, with the Council or government agency in question either buying back the facility at the time when its creation in the subject location was scheduled, or collecting contributions from intervening developments and passing these back to the original out of sequence developer, without interest. The innovation in the context of an effective cross-portfolio coordination system would be that these practices are codified and operated

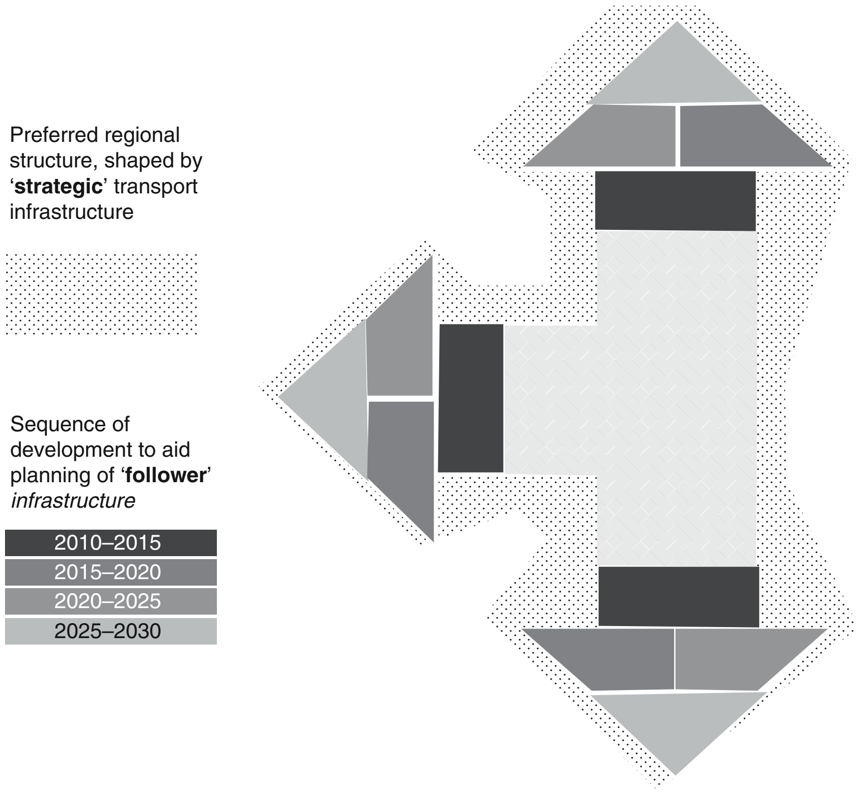

Figure 9.7 Coordinating 'strategic' and 'follower' infrastructure.

on a consistent basis across the metropolitan geography and across all infrastructure providers.

Infrastructure providers at the local, regional, and national level would have a vested interest in adopting the preferred pattern of development in a codified sequence, as they would otherwise be exposed to additional financial risk when attempting to negotiate compensatory payments or actions on the part of out of sequence development proponents.

The relationship between the phasing of strategic infrastructure versus follower infrastructure in an effective coordination system is illustrated schematically in Figure 9.7. Strategic infrastructure is leveraged to help bring about a regional settlement pattern that is preferred on economic, social, and environmental grounds. Follower infrastructure is then managed via a spatial sequencing process, which ensures that providers can externalize the risks associated with fragmented or leap-frog development.

Challenges

Implementation of this ideal model for cross-portfolio policy integration at the metropolitan level faces two major challenges; the commercial focus of economic infrastructure agencies and the paucity of institutions for city wide policy integration. We examine these challenges in the following pages and argue that a strong nationally driven approach is required if significant progress is to be made on strategic urban infrastructure coordination in an Australian context.

The Emergence of Business Focused Infrastructure Agencies

Ironically, the microeconomic reforms which drove intrasectoral efficiencies and underpinned strong productivity growth during the past two decades now pose some governance and coordination challenges as communities set about unlocking a new wave of productivity growth catalyzed by the innovation and logistic efficiencies of compact and sustainable cities.

A consistent feature of the infrastructure management models that took hold in Australia with National Competition Policy is the explicit or implicit separation of ‘purchaser’ and ‘provider’ roles in the delivery of publicly funded facilities and services. The underlying principle is that, in the first instance, governments need to focus on the outputs and outcomes they want to achieve and the level of resources they want to dedicate to these outcomes (the ‘purchaser’ role). Once these decisions are made, the government can contract with a ‘provider’ on a best value basis, preferably without prejudging the merits of provision by a public sector agency or a private sector entity.

The expected benefits of these reforms include a sharper commercial focus on core business by providers, who would not be distracted by political interference in day to day operations. Also relevant is more transparent and accountable decision making on the part of governments regarding policy and resourcing priorities.

Now, with some decades of experience with splitting ‘purchaser and provider’ roles in infrastructure delivery, a substantial critique of the model is emerging. Part of this focuses on cost duplication and lost productivity. In the delivery of complex urban services like public transport, health, and housing, it is difficult for provider agencies to do their jobs properly without some form of in-house policy capability, if only to provide the means to communicate effectively with central purchaser agencies and accurately interpret their requirements. Meanwhile, purchaser agencies may lose touch with the practical difficulties of providing services to their predetermined standards, leading to disputation and expensive learning through trial and error.

Another important critique is that commercialized or corporatized provider agencies lose the capability or the motivation to leverage their resources to meet wider government objectives as well as their narrowly defined roles (Flanagan, 2008).

While the commercialization and corporatization of infrastructure agencies have brought operational efficiencies and more careful stewardship of the financial resources made available by governments, the focus on commercial objectives has the potential to blind infrastructure agencies to the external impacts of their investment decisions, and the opportunities they might offer to other agencies of government in the pursuit of holistic spatial policies concerning urban consolidation or improved access to opportunity for marginalized groups. It cannot be taken for granted within a purchaser-provider framework that agencies holding the city shaping power of strategic infrastructure decisions will exercise this authority with due regard for the wider impacts.

A solution to this tension between intrasectoral and cross-sectoral efficiency objectives can be found in the theory of separating purchaser and provider roles in infrastructure, namely, through the payment of compensation for undertaking 'noncore' functions. While this is conceptually clear, few Australian jurisdictions appear to have embraced the community service obligation payments approach. In part, this may be because no government agencies are tasked with finding efficiencies in cross-sectoral coordination and government-owned enterprises are not provided with incentives to nominate community service obligation opportunities.

Reversing microeconomic reforms is not warranted, but new governance structures are needed if city shaping powers of major infrastructure decisions are to be turned to positive effect. This has been noted by the former Secretary to the Australian Treasury, Ken Henry (2010, p. 1).

> *Thoughtful and effective competition policy is essential to quality infrastructure outcomes. However, recent experience also demonstrates the importance of long-term planning and, in particular, the governance structures surrounding infrastructure planning and financing. This experience suggests that it is likely that continued and significant institutional reform will be required, over time, to improve planning and governance arrangements in many countries, including Australia.*

Institutional reform may include the formation of new institutions with specific mandates to pursue cross sector efficiencies, such as the Victorian Growth Areas Authority, described in Chapter 2. Another approach might see infrastructure agencies making bids for State capital, managed through a coordinating agency. The business cases required of these infrastructure agencies would direct them to rigorously explore and measure, cross sector impacts as well as intrasector performance.

Whatever the approach, there will need to be strong institutions to champion metropolitan planning policy and the development of alliances across sectors and government to implement strategic metropolitan infrastructure decisions. Metropolitan planning and the institutions of metropolitan governance form the subject area of the second section of this chapter which follows.

Planning and Governance at a Metropolitan Scale

Metropolitan Plans set a strategic long-term framework to coordinate infrastructure development and urban land use in major metropolitan areas. These plans seek to coordinate land development and redevelopment with social and economic infrastructure as well as broader social and environmental objectives. The function and values behind metropolitan plans have changed over time from a predominantly 'public health' perspective (outlined in Chapter 5), through an interest in accessibility and social equity concerns, place making, urban consolidation, the productivity and competitiveness of cities to, more recently, an interest in the economic, environmental, and social sustainability of cities (see Hamnett and Freestone [2000] for a history of metropolitan planning in Australia).

Generally, metropolitan plans can be thought of in three parts: the mission and its associated goals and objectives; the social, economic, and environmental policies related to these goals and their associated instruments for implementation; and the governance structure through which these policies are enacted.

Mission

A metropolitan mission is a statement of what the plan seeks to achieve. To be successful this mission needs to have broad acceptance within the community and with key stakeholders such as national, State, and local governments and the private sector. Mission statements are usually based on stable, shared community values. Many of these encapsulate generic values such as livability, inclusiveness, vitality, and sustainability. Associated with the mission are a number of goals. Three goals which underlie most metropolitan plans and which have direct impacts on urban infrastructure are:

1. Ensure adequate and affordable supply of land to accommodate private and commercial purposes;
2. Maximize accessibility of jobs and services for the regional population to minimize aggregate travel (and travel time) and social exclusion; and
3. Adapt the city to changes due to climate change and mitigate harmful city impacts on the biophysical environment.

Policies and Policy Instruments

These broad goals rely on policy in a number of areas. These typically involve several government agencies and require coordination within and between governments and the private sector. These areas include:

- Social policies related to housing, health, and education;
- Urban consolidation policies related to land release programs and brownfield development;
- Transport policies related to accessibility and energy, (including TOD);
- Economic development policies;
- Environmental policies including policies on water management, open space systems, and urban biodiversity;
- Energy policies;
- Local development plans.

It is important for the function and efficiency of the metropolis that there is a review of these policies to coordinate them for maximum efficiency and net social benefit. As noted earlier, those sections of transport policy which shape regional locational demand for land and associated urban services should be analyzed not only for their intrasectoral effectiveness, but also their influence on the efficiency of providing other economic and social infrastructures. Policy utilizes a range of implementation instruments including markets, legislation and regulations, fiscal measures, financial measures, institutional arrangements, advocacy, and knowledge management (see Chapter 2). As well as aligning policy it is important to take a coordinated approach to implementation, particularly in how policy instruments are used. This coordination of policy and the policy instruments used in implementation are key challenges for metropolitan urban governance

Urban Metropolitan Governance

The governance of metropolitan areas in almost all cases requires collaboration between two or more levels of government; national, local (as in a unitary state such as Britain) or national, State or provincial, and local (as in the case of federations such as Germany, the United States, Canada, and Australia). It is only in city states such as Singapore or in the past Hong Kong that a single government, the national government, has responsibility for metropolitan governance.

The three-tiered structure of governance in Australia of national, State, and local governments has meant that responsibilities for cities have been fragmented, primarily between State and local governments with the Australian Government's responsibility retained in integrating major metropolitan cities (primarily through transport networks, ports, and telecommunications). Metropolitan plans require both vertical and horizontal integration of government functions to coordinate land development (new land release and land redevelopment) within and across local government boundaries. This need for complex integration of policies, finance, and management provides substantive governance challenges. Local governments have a loyalty to their local constituents, who may have strong objections to State responsibilities such as social housing, regional waste facilities, or transport hubs being located in their communities. Moreover, these local governments are likely to be competing for economic development with neighboring local government areas. State urban responsibilities impact on a number of departments and agencies, including government trading enterprises and public–private partnerships involved in the delivery of social and economic infrastructure services. The obligation of State economic infrastructure agencies to deliver high quality, consistent output in an increasingly competitive environment will focus their attention inward rather than across sectors unless there is substantive incentive for them to do otherwise.

Due to the high capital costs and the long-term nature of economic and social infrastructure investment, metropolitan plans are usually long-term plans spanning 20 years or more. However, due perhaps to political expediency and the short-time frame of an election cycle, long-term planning in Australia has significant weaknesses. A recent survey by Infrastructure Australia found a systemic lack of long-term infrastructure planning, with major project proposals requiring significant development before they could even be assessed (Henry, 2010).

The long-term nature of metropolitan plans and the large capital investments required necessitate that governance of metropolitan plans is explicit in defining both what a metropolitan plan should achieve (its mission), the policy, and policy instruments that will be used to achieve this vision (see Chapter 2) and the governance arrangements which will ensure transparency and accountability. This requires robust institutional arrangements, strong political leadership, and financial capacity. It is not surprising that given the systemic lack of long-term infrastructure planning and recurrent lapses in the political will to drive long-term plans, most (recent) metropolitan plans in Australia are known by their tendency to fail in implementation. Below we describe some of the governance structures which have been utilized in Australia to coordinate development across metropolitan areas. Most have had mixed success.

Until the mid 1980s, a number of Australian jurisdictions retained British style regional planning authorities that prepared detailed development control schemes and policies which would act as the basis for land use regulation of their constituent local governments. Local governments either operated under delegation from the regional authority, or were statutorily obliged to prepare their local schemes in conformity with the strategic directions and prescriptions set out in the overarching regional plan. The regional planning bodies were ordinarily statutory authorities of the State Government, though in some cases they also had a regional democratic mandate. For example, the regional planning authority for Melbourne—the Melbourne and Metropolitan Board of Works (MMBW)—was accountable to a forum of delegates sent by some 50 local councils that made up the metropolitan area at the time. This approach achieved vertical integration, but fell out of favor for a variety of reasons. Prominent among these was that State Governments came to see metropolitan authorities as challengers for the role as pre-eminent policy makers for cities.

Post regional authorities, vertical integration has been pursued either through directive policy issued by State Governments, or, through collaborative regional planning models. The former model, in which regional strategies are developed through largely nontransparent, technocratic processes by State agencies and handed down as an overarching policy framework for local government, has tended to meet with strong resistance—passive and active from councils.

Experience suggests that the noninvolvement of local government in such processes leaves the regional policy framework inherently unstable. Without a sense of ownership of these plans, or an acceptance of the subsidiarity mandate which State Governments might claim in this area, Councils have no particular incentive to optimize the plans' effectiveness and to properly consider and implement them in their day-to-day decision making. In response, State Governments may resort to various arbitrary implementation measures sometimes featuring a degree of coercion (for example, setting population targets with threats of funding sanctions if these are not met). If anything, such responses tend to provoke further passive resistance to imposed regional policy positions.

Some jurisdictions have responded to these circumstances by promoting a collaborative approach to regional planning in which local councils would work with State agencies and in some cases with the private sector and communities to develop appropriate high-level policies which would be reflected in local planning schemes. This approach avoids heavy handed intervention by way of a separate State authority. Enforcement of the regional plans emerging from these collaborative processes is largely a matter for peer supervision among constituent local governments.

This was the approach initially favored by the Queensland Government upon its revival of regional planning in that State from the early 1990s through to the mid-2000s. The *South East Queensland (SEQ) 2001 Project, Creating our Future-Towards a Framework for Growth Management*, followed by the *South East Queensland 2021—A Sustainable Future* (Queensland Government, 2002), encapsulated this model of regional planning. However, this approach based on consensus and collaboration did not bind individual partners, with the result that plans were rarely implemented in a coordinated manner. After years of unsatisfactory progress in harmonizing the activities of local authorities and economic infrastructure sectors, the Queensland Government ultimately resorted to a more directive approach, including the establishment of an Office of Urban Management, initially attached to the State Treasury. This centralization of planning power is now, itself, encountering resistance from local councils which are reasserting their claims to drive spatial policy, particularly since the reconfiguration of local government into significantly larger, quasi-regional, bodies in 2008.

The Queensland experience, and those of other State Governments that have struggled to gain traction with their centrally determined metropolitan planning strategies, has led to a revival of interest in the formation of an intermediate sphere of planning governance in the shape of metropolitan authorities with various forms of democratic mandate. The success of the Greater Vancouver Regional District and the Greater London Authority, have galvanized this interest. The institution of a fourth tier of governance and the allocation of development control responsibilities in line with subsidiarity principles to this regional authority may create the opportunity to discipline local development pressures in favor of regional interests without embroiling State Governments in the day to day politics of planning. This could well lead to greater efficiency in land use regulation notwithstanding the creation of another set of institutions with an interest in urban development (Spiller, 2004). However, there are complexities. Metropolitan areas of governance would need to be defined and setting boundaries to a city is problematic particularly over time. The integration of the city to its region would still remain a State responsibility and any metropolitan authority would still need to deal with the power of urban economic infrastructure sectors. It is unlikely that States would transfer government trading enterprises to a metropolitan authority, thereby requiring further coordination mechanisms.

As things stand, metropolitan plans and governance of these plans in Australia are now primarily a responsibility of State Governments delivered through their planning and infrastructure departments. These departments publish metropolitan strategies to integrate long-term planning with urban infrastructure investment. The major challenge for these metropolitan plans is to gain compliance in implementation across State sector agencies and local government and acceptance by the community. This does require managing the demand for land and for development as well as dealing with supply through land release programs. Proactive planning and development of strategic infrastructure coupled with incentives for sector agencies to comply with metropolitan plans are required for success.

Role of the Australian Government

The Australian Government has a responsibility in the integration of Australian cities and in the national productivity benefits of efficient cities. Despite this responsibility and in contrast to the national governments of Britain and the United States of America, which have demonstrated a prolonged involvement in urban policy, the Australian Government's involvement in metropolitan planning of cities has been sporadic.

In the 1970s, Prime Minister Gough Whitlam expressed a strong interest in cities:

> *A national government which cuts itself off from responsibility for the nation's cities is cutting itself off from the nation's real life. A national government which has nothing to say about cities has nothing relevant or enduring to say about the nation or the nation's future. (ALP Election Policy Speech November 1972)*

Under the Whitlam government, the Department of Urban and Regional Development had responsibility for implementing the Australian Government policy on urban issues. These included regionalization of policy delivery to deal with locational disadvantage, the introduction of Area Improvement Plans, provision of additional funding to reduce the backlog in sewerage works, the promotion of new cities and decentralization initiatives, Land Commissions to stabilize suburban land prices, and coordination of Australian Government activities in relation to urban policies (Huxley, 2000). This policy had a strong social agenda as had urban policy in Britain and the United States at that time (DiGaetano and Klemanski, 1999). The Department was abolished after Whitlam's dismissal in 1975 and Australian Government interest in cities did not revive until a later Hawke–Keating Labor Government undertook the Better Cities Program in 1995, 1996 in collaboration with State and local governments. This was a national initiative to align spending of Australian, State and local governments to improve the management of urban development in submetropolitan districts. Its particular focus was urban renewal. The objectives and performance of the Better Cities Program are described in Chapter 2.

The Better Cities Program was dismantled in 1996 under Prime Minister John Howard's government which had limited interest in cities. However during this time, the House of Representatives Standing Committee on Environment and Heritage set up an Inquiry on Sustainable Cities (HRSCEH, 2005). Part of the scope of the Sustainable Cities Inquiry was to look at the environmental impact of sprawling urban development, major determinants of urban settlement patterns, and desirable patterns of development for the growth of Australian cities. The Inquiry recommended a subsidiarity-based model for the division of urban policy responsibilities across the different spheres of governance, whereby the Australian Government would share the tax dividend from more efficient and sustainable cities with the States as an incentive for these jurisdictions to undertake the difficult planning and institutional reforms necessary to deliver better cities. However, the Inquiry's recommendations were ignored by the Howard Government.

One Australian Government intervention during the Howard government which did have a major impact on the structure of cities was the privatization of metropolitan airports and the transfer of planning responsibility for these to the Commonwealth Department of Transport and Regional Development. A number of these airports have become the location for major investments in office and retail space with concomitant impacts on transportation and the location of economic activities in the cities involved. Often, these impacts have not been consistent with the metropolitan strategies of the State and Territory Governments in question.

More recently in 2008, the Australian Government under (then) Prime Minister Kevin Rudd and the Council of Australian Governments (COAG) took a renewed interest in cities and the effective coordination of urban infrastructure for long-term economic, social, and environmental benefits (Rudd, 2009). The Australian Government has set up a Major Cities Unit under Infrastructure Australia. New Commonwealth-State arrangements have been put in place to jointly assess compliance of State produced metropolitan strategic plans with the nationally adopted performance criteria promoting efficiency and sustainability in urban development. The Australian Government has declared that it will link future infrastructure funding to this compliance, following a model similar to that promoted in the House of Representatives Standing Committee on Environment and Heritage Inquiry on Sustainable Cities noted above. This is expected to send strong signals to sector agencies to coordinate infrastructure investment across portfolios and have an active voice in the development of metropolitan plans. The involvement of the Premiers Offices through COAG should expedite cross-government infrastructure coordination at a State level. The challenge will be to provide strong incentives to sector agencies to identify cross sector efficiencies and to properly fund community service obligations where sector agencies incur costs for greater social net benefit. As shown in the earlier case study of Melbourne 2030 (SGS Economics, 2005), the productivity benefits from coordinated urban development are substantial with a potential increase in aggregate tax receipts for the Australian Government in the billions of dollars. Thus, there is great financial scope for the successful operation of the incentive driven proposals, currently before COAG, to bring together coalition between infrastructure sectors and governments at all levels to coordinate infrastructure delivery.

Conclusions

This chapter has argued that intrasectoral infrastructure efficiency, fostered through micro-economic reform, particularly National Competition Policy, is not sufficient to optimize the productive potential and sustainability of major cities.

Some infrastructure decisions, particularly those that alter the geography of accessibility across a metropolis have major consequences beyond the commercial charter held by the infrastructure agencies in question. These decisions effectively determine the shape, structure, and density of cities and therefore influence resource use, access, and connection within cities and the innovation potential of regional economies.

Strategic infrastructure decisions which shape the geography of cities need to be made within a wide policy context. This is proving difficult because infrastructure agencies obliged to deliver high quality, consistent output in an increasingly competitive environment will focus attention inward rather than across sectors, local governments will continue to prioritize local development goals over metropolitan goals and institutions previously entrusted with articulating links between sectors and across government in an urban setting have often been weakened or abolished. Strategic infrastructure investments at a metropolitan scale are unlikely to be made without strong political alignment of key decision makers and the financial capacity and political will to implement decisions on infrastructure investment. Achieving urban governance structures and processes which support timely, accountable, efficient, effective investment, and management of strategic metropolitan infrastructure remains an important political and professional challenge, particularly in a liberal democracy where power is shared.

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Glossary

Agglomeration economies Benefits that firms obtain when locating near to each other. Often associated with networks and economies of scale and scope.

Anthropogenic Anthropogenic factors are human activities that change the environment.

Aquifer A layer of underground sediment which holds water or allows water to flow through it.

Asset specificity Assets that are either purpose- and/or location-specific fixed assets.

Australian Energy Regulator The national economic regulator of energy networks.

Balance sheet loan A loan that the lender retains on its books rather than selling to another financial institution or to individual investors.

Baseload generators Electricity generators that generate electricity for baseload power. These generators usually have high sunk costs and low variable costs.

Baseload power The overnight electricity load for power generation continuing through part of the day.

Betterment The value accruing to land resulting from the failure to apply user charges to services supplied and from the scarcity premium attached to development approvals.

Betterment levy Payment/s to the community for the right to offer higher/better uses on the site.

Bilateral monopoly Market consisting of one seller and one buyer. The parties ordinarily enter an exclusive postcontract condition where ongoing obligations exist between them.

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Bilateral monopoly exploitation Risk of each party in a bilateral monopoly exploiting their exclusivity of service under contract to exploit the other party in the performance of ongoing contractual obligations.

Biomass Organic matter that can be converted to fuel and is therefore a potential energy source.

Bonding mechanism A financial consideration which is at risk in the event of operator default or opportunism.

Bounded rationality The rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time they have to make decisions. Thus, people do not know everything and are not capable of always doing the right thing.

Bundling Integrating functions into a value chain.

Catchment An area of land where runoff from rainfall drains to one drainage system such as a stream or river.

Central Borrowing Agencies Statutory authorities established to borrow funds (usually through the issuance of bonds) on behalf of the State or Territory government and public entities such as government trading enterprises, local authorities, education institutions, and health and community service providers that they represent.

City shaping infrastructure Infrastructure that has the capacity to affect comparative accessibility across a region.

Climate change Long-term and large-scale changes in the earth's climate attributed to changes in the earth's atmosphere.

Community Service Obligation An obligation placed on a Government Trading Enterprise to implement, regulate, or maintain functions or outcomes of social or other benefit extending beyond the Enterprise's commercial objectives.

Competitive neutrality Exposure of government trading enterprises to the same incentives, penalties, and regulations faced by private sector businesses.

Contestable markets Market marked by low or no barriers to entry and exit. Existing actors will behave competitively when there is a lack of barriers to prevent new companies, and therefore competition, from entering the market.

Corporations Act *Corporations Act 2001* (Cth). Federal Act establishing rules and regulations for dealing with corporations in Australia.

Decommissioning risk Risk associated with the withdrawal from active service, closing down, and removal of infrastructure.

Development assessment process Legislated and administrative processes for the assessment of development proposals.

Development contribution Payments required of developers for user charges, impact mitigation levies, betterment levies, and inclusionary zoning provisions.

Development risk The risk associated with the physical construction and warranty phases of infrastructure development.

Dividend A taxable payment declared by a company's board of directors and given to its shareholders out of the company's current or retained earnings.

Ecological footprint Per capita use of the earth's scarce resources based on land required to produce resources or absorb waste.

Economic infrastructure Physical assets available for conducting business activities, including energy, transportation, water, and other distribution networks.

Economies of scale Reduced unit-cost derived from undertaking production at a large scale.

Economies of scope Reduced unit-cost of production derived from undertaking complementary activities.

Effective Quality of meeting - intended outcomes.

Efficient Quality of achieving high levels of beneficial outputs relative to inputs.

Efficient transaction A transaction that delivers the fundamental objectives of the desired outcome while economizing on the costs associated with the transaction process.

Electricity interconnectors Interconnect State and regional electricity networks.

Embedded electricity generation Generation connected within the urban distribution network, as opposed to larger power plants that are located outside urban areas. It typically involves micro to low capacity units, a wide variety of technologies, and diverse operating characteristics and connection requirements.

Energy security Reliable supply of energy at stable and reliable prices.

Equity The monetary value of a property or business beyond any amounts owed on it in mortgages or other claims.

External governance The authority and systems utilised by ministers and government agencies for the control and supervision of public organisations.

Financial measures Priorities and policies of government with regard to revenues, assets, and liabilities.

Financing risk Risk associated with variations to the costs of finance for a project.

Fiscal measures Revenue raising activities of government such as the structure of taxation and excises, and the pricing for goods and services.

Follower infrastructure Infrastructure that follows demand rather than shapes it.

Franchise A right granted by the public sector to a private sector entity to access, occupy, operate, and maintain public infrastructure to deliver services over a period of time.

Fundamental Transformation Transformation which occurs post transaction whereby the discipline and benefit of competition no longer exist.

Greenfield development Urban development which occurs on previously nonurban land often at the periphery of cities.

Greenhouse gas Carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and tropospheric ozone.

Gross Pool Market Used to describe a market for a commodity where all transactions for that commodity occur within that market.

G-20 The Group of Twenty Finance Ministers and Central Bank Governors, established in 1999 to bring together important industrialized and developing economies to discuss key issues in the global economy.

Headwork charges Levied by infrastructure providers to a developer for the cost of infrastructure provision.

Horizontal fiscal equalization Distribution of Federal taxes collected by the Federal Government in the form of revenue grants to the States according to formulae that calculates the needs of each State relative to their capacity to pay taxes. The system is overseen by the Commonwealth Grants Commission.

Impact mitigation levies Payments to make good unanticipated adverse effects of development.

Incentive conflicts Arise from conflicts in the objectives of different parties in an agency relationship.

Inclining block tariffs A charging structure where charges are increased for each succeeding block of the commodity purchased by a consumer. A consumer who purchases a lot of a commodity such as water will pay a higher unit cost than a person who purchases a minimum amount.

Information Asymmetry Situation where information between parties is not evenly or fairly distributed, meaning one party has more, or better, information than the other.

Inputs The resources used in a program or project.

Intermediate Power The load on power generation for the shoulder period between baseload power and peak power.

Internal governance System of directions and control within an organization which is the responsibility of the governing body, usually a board, and senior management of the organization.

Legislation and regulation Legislation is the law enacted by a legislative body of government. Regulations are rules and ordinances enacted pursuant to relevant legislation.

Locational elasticities Measured sensitivities of variables such as population or employment to changes in relative accessibility.

Material adverse effect Any event which materially or adversely affects, or could be expected to materially adversely affect, the assets, liabilities, other financial conditions, or operations of an entity involved in financing infrastructure.

National Electricity Market A gross pool market (physical market) combining the interconnected regions of the five eastern States of Australia and the ACT.

Natural monopolies As a result of the nature of a particular market, efficiency is realized through only one efficient provider in that market.

Net residual land value The realizable value of a development less the development costs (minus land costs) that the developer must meet in bringing a project to the market. It provides a maximum price which a developer should bid for a piece of land.

Non recourse debt Debt carrying defined claims to a projects revenues, assets or contractual rights, and without contractual rights or nonstatutory claims to debt against the project sponsors or shareholders.

Off-budget financing Public infrastructure financing activities by government, not considered part of general budget appropriations.

Operational policy Clear statements of governmental intent that guides detailed operational decisions.

Operational risk Risk associated with the ongoing operation of a facility.

Opportunism Despite the spirit of the contract, a counterparty is expected to take opportunities to benefit from loopholes if technically possible.

Outcome Result that a program or activity aims to achieve.

Outputs The goods and services that a program or project produces by applying inputs.

Peak power The maximum load for power generation.

Peaking generators Electricity generators that generate electricity for peak loads. These generators generally have low plant costs and high variable costs (e.g., gas, hydro).

Performance-based planning Plans that specify required outcomes but allow developers to nominate the method by which the objectives are to be achieved.

Prescriptive planning Plans which specify both what and how development outcomes are to be achieved.

Private benefit infrastructure Infrastructure where users should meet the cost of supply.

Public–private partnership (PPP) A contract between the public and private sectors on financing the provision, management, or maintenance of public infrastructure.

Realizable value The discounted stream of income generated by a project.

Regional planning strategies Regional plans that set broad growth directions, development constraints, and population/employment distribution targets.

Regulatory risk Risk associated with the potential for government legislation, regulations, and agreements to impact upon, and thereby alter, a particular project.

Renewable Energy Target Target for at least 20% of Australia's electricity supply to be generated from renewable energy by 2020.

Residual returns Rights to earn returns from operating the asset net of operational and reinvestment expenses.

Residual rights Equity in the ownership of property.

Residual value expropriation Decisions of companies that adversely affect the residual value of an asset but go undetected.

Revenue bond A bond issued by government and secured by revenues generated by a public infrastructure project.

Ring fence When a regulated public utility business financially separates itself from a parent company that engages in nonregulated business.

Scarcity-based water pricing Pricing that reflects the value of water to alternative uses during periods of water shortage.

Sewage The waterborne wastes of a community, including human wastes.

Sewerage The physical infrastructure that supports the management of sewage.

Social infrastructure Facilities and services of social benefit which are paid for by the general taxpayer, as opposed to the immediate user.

Social rate of return Return on investment which recognizes economic, social, and environmental benefits, taken from the perspective of the society as a whole.

State planning policies Policies developed by State governments that regulate and constrain development outcomes which are deemed to be of significance to the State.

Storm water Rainfall runoff from urban areas.

Strategic planning Process of defining direction or goals and making decisions on allocating resources to pursue these outcomes.

Sunk cost Past costs which have already been incurred and cannot be recovered.

Third-party access Access by an external third party to a monopoly network.

Transaction completeness The integrated structure of the PPP agreement facilitates the management of incentive conflicts as well as the alignment of interest between parties.

Transaction governance Managing the supply of an asset and ongoing aspects of a PPP under agreed rules over a long period of time.

Transport shed Geographical area where people, goods, and services move from one point to another with the purpose of engaging in social and economic activity.

Unbundle Structural separation of value chain either as an accounting construct or for independent control or ownership.

Underwriting standards Guidelines established to ensure that safe and secure loans are issued and maintained.

Urban governance The interplay of institutions, administrative structures, and processes by which urban decisions are made and implemented.

Urban growth boundary (Victoria) A boundary, with statutory effect, that defines areas for future urban expansion.

Urban management The integration of inputs from separate fields of professional practice, management, and politics, to achieve urban development that meets stated societal objectives.

Urban water cycle The flows of water into, out of, and through urban areas.

User pays Pricing in which the user pays the full cost of a service.

Value chain Traces a product or service from origin to destination tracking progressive increase in value along the chain.

Variable cost A cost that changes in proportion to a change in a company's activity.

Waste water Water that, following capture by the community, does not currently have a form of beneficial recycling. It includes sewage, grey water, and stormwater.

Water grid managers A manager who can purchase services of water grid assets and sell the water produced by or delivered through water grid assets to water grid customers.

Water security Can be assessed as the probability that water use will need to be restricted by substantial increases in price, or by severe nonprice restrictions on the basis of long-term rainfall and runoff projections.

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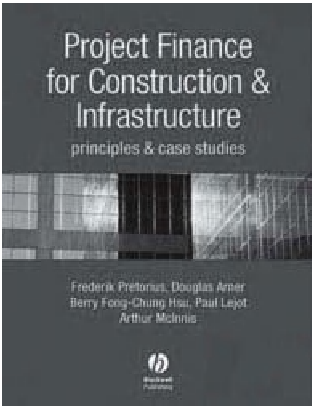

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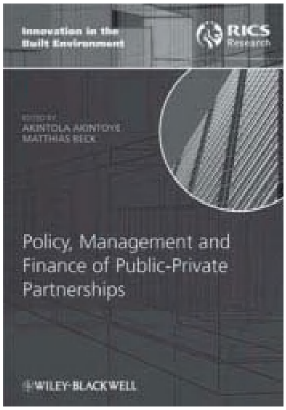

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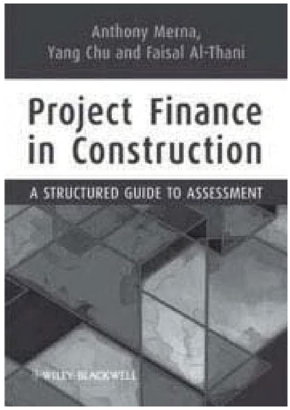

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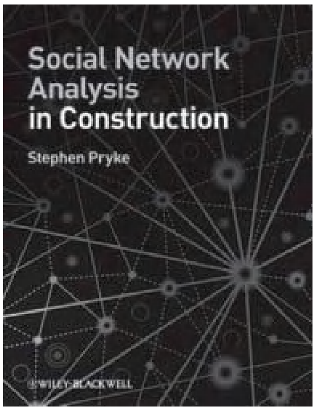

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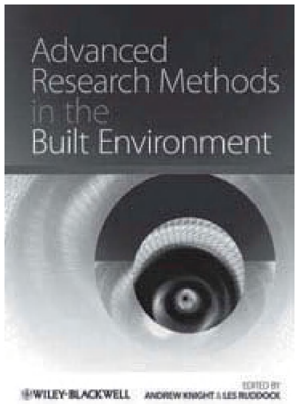

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