

NCE Cities – Paper 02

STEERING URBAN GROWTH: GOVERNANCE, POLICY AND FINANCE

Lead Authors: Graham Floater and Philipp Rode

Contributing Authors: Bruno Friedel, Alexis Robert

CONTENTS

Page

1 INTRODUCTION 03

PART I STEERING URBAN GROWTH:
AN INTEGRATED APPROACH 07

2 CITIES OF THE FUTURE: COMPACT,
CONNECTED AND COORDINATED 07

3 SHAPING FUTURE CITIES:
COORDINATED GOVERNANCE 12

PART II POLICY INSTRUMENTS:
PLANNING, PRICING AND FINANCE 22

4 PLANNING URBAN GROWTH 23

5 PRICING CONGESTION, SPRAWL
AND POLLUTION 26

6 FINANCING INFRASTRUCTURE 30

7 CONCLUSIONS 37

8 BIBLIOGRAPHY 40

The New Climate Economy

The New Climate Economy (NCE) is the flagship project of the Global Commission on the Economy and Climate. It was established by seven countries, Colombia, Ethiopia, Indonesia, Norway, South Korea, Sweden and the United Kingdom, as an independent initiative to examine how countries can achieve economic growth while dealing with the risks posed by climate change. The NCE Cities Research Programme is led by LSE Cities at the London School of Economics. The programme includes a consortium of researchers from the Stockholm Environment Institute, the ESRC Centre for Climate Change Economics and Policy, the World Resources Institute, Victoria Transport Policy Institute, and Oxford Economics. The NCE Cities Research Programme is directed by Graham Floater and Philipp Rode.

ABSTRACT

We live in an urban age. Over half the world's population now lives in urban areas, while the urban population is expected to reach 60% by 2030. At the same time, the importance of cities for national economic growth and climate change continues to increase. Three groups of cities will be particularly important for the global economy and climate: Emerging Cities, Global Megacities and Mature Cities. When combined, these 468 cities are projected to contribute over 60% of global GDP growth and over half of global energy-related emissions growth between 2012 and 2030 under business as usual.

However, not all countries and cities will benefit from the potential economic gains of urban growth under business as usual. The winners and losers of urban expansion will depend on the policy decisions that national and sub-national governments make over the next few years. Evidence suggests that urban growth that is poorly managed by governments can lead to a range of economic, social and environmental costs, such as traffic congestion, inefficient public transport, air pollution with associated health impacts, and inadequate infrastructure for basic services such as energy, water and waste.

Additional support

Roxana Slavcheva, Nikolas Thomopoulos

Call for evidence respondents (institutions)

Allianz; Atkins; C40 Cities; CDC Climat; Centre for Low Carbon Futures; Citibank; Cities Alliance; City of Stockholm; DFID; DFID South Asia; Energy Foundation for Chinese Cities; Goddard Institute for Space Studies, NASA; Greater London Authority; ICLEI; ICRIER; McKinsey; NYU Stern School of Business; OECD; Renault; Ricardo AEA; Rocky Mountain Institute; Siemens; Transport Studies Unit, University of Oxford; Tsinghua University; Urban Climate Change Research Network (ARC3); UITP; UK Centre for Cities; UN-Habitat; University College London; University of Leeds; Victoria Transport Policy Institute; WBCSD; World Bank; WWF.

Call for evidence respondents (individuals)

Shlomo Angel, David Banister, Michael Batty, Flavia Carloni, Neil Dunse, Ludger Eltrop, Pete Erickson, Michael Erman, Caralampo Focas, Andrew Gouldson, Jean Grebert, Stephen Hammer, Klaus Heidinger, Johan Kuylensstierna, Carrie Lee, Todd Litman, Shagun Mehrotra, Pedro Miranda, Katrin Mueller, Malin Parmander, Martin Powell, Cynthia Rosenzweig, William Solecki, Thomas Telsnig, Sotirios Thanos, Heather Zeppel, Savvas Verdis, Marilu Valente.

Internal Review

Juan Casedo-Asensio, Wanli Fang, William Tompson.

Acknowledgements

Nick Godfrey, Isher Judge Ahluwalia, Dimitri Zenghelis, Annbella Bujak, Gabrielle Hamill, Ian de Cruz, Daniele Viappiani, Jeremy Oppenheim, Ricky Burdett, Mark Watts, James Alexander, Rachel Lewis, Vijay Jagannathan.

LSE Cities

London School of Economics and Political Science
Houghton Street
London WC2A 2AE

www.lsecities.net

This paper should be referenced as

Floater, G., Rode, P., Friedel, B., and Robert, A. (2014): Steering Urban Growth: Governance, Policy and Finance. New Climate Economy Cities Paper 02. LSE Cities. London School of Economics and Political Science.

Disclaimer

This paper builds on the LSE Cities research and publications including the Green Cities and Buildings chapters for UNEP's Green Economy Report, research by the LSE's Economics of Green Cities programme led by G. Floater, P. Rode and D. Zenghelis, and P. Rode's study of integrated planning, design and transport. This paper was submitted in July 2014.

While every effort has been made to ensure the accuracy of the material in this report, the authors and/or LSE Cities will not be liable for any loss or damage incurred through the use of this paper.

© LSE Cities, London School of Economics and Political Science, 2014.

In our first cities paper of the New Climate Economy project for the Global Commission on the Economy and Climate, we set out a new model of urban development for well-managed growth – the '3C model'. This alternative model – compact, connected and coordinated – aims to lock-in pathways with economic and climate benefits for cities. Three pillars underpin the model. The first pillar is compact urban growth through managed expansion and/or retrofitting that encourages higher densities, contiguous development and mixed neighbourhoods. This type of development is not about urban containment, but rather about how urban expansion is managed in order to develop dense, transit-oriented urban forms. The second pillar is connected infrastructure developed through investment in innovative urban infrastructure and technology such as Bus Rapid Transit systems, cycle superhighways, electric vehicles, smart grids, energy efficient buildings and essential water, sanitation and waste services. The third pillar is coordinated governance implemented through effective and accountable institutions that support the coordinated planning and implementation of programmes of activity and investment across public and private sectors and civil society, particularly for land-use change and transport.

In this paper, we first examine the importance of the third pillar of the 3C model: coordinated governance. Governance will be particularly crucial in many Emerging Cities where current levels of capacity are often insufficient for implementing the policy programmes needed to move towards compact urban growth and deliver effective, connected infrastructure. Four elements of coordinated urban governance are essential: (1) multi-level governance with effective coordination of national, regional and city policies; (2) city leadership and financial authority; (3) transparency and accountability; and (4) policy integration at the local level. Municipal governments can also use international and regional networks of cities to transfer knowledge and innovation more effectively.

We then review the most promising policy tools for delivering the 3C model. These include: (1) planning policy instruments; (2) pricing instruments; and (3) finance mechanisms. This paper is the second of three New Climate Economy papers on cities for the Global Commission on the Economy and Climate. In the first paper, 'Cities and the New Climate Economy: the Transformative Role of Global Urban Growth' (NCE Paper 01), we examine patterns of global urbanisation, and introduce the 3C model of well-managed growth (Floater, Rode et al. 2014). In the third paper, 'Accessibility in Cities: Transport and Urban Form' (NCE Paper 03), we analyse compact urban growth and connected infrastructure in greater detail (Rode, Floater et al. 2014).

1 INTRODUCTION

The pace of global urbanisation is one of the greatest challenges that governments face in the 21st century. Over half the world's population now lives in urban areas, and urban populations are forecasted to increase by roughly 2.3 billion between 2014 and 2050 to reach 66% of the global population (UN DESA 2014).

Analysis suggests that under business as usual economic growth, three broad groups of cities will play a particularly important role in the global economy and climate over the next two to three decades: Emerging Cities (fast growing middle income cities in countries such as China and India), Global Megacities (middle and higher income cities with populations over 10 million) and Mature Cities (higher income cities where carbon emissions per capita are already high). These three groups, representing only 468 cities in total, will account for over 60% of global income growth and 50% of energy-related greenhouse gas emissions growth between 2012 and 2030 (Floater, Rode et al. 2014). The three city groups are discussed further in Box 1.

However, under current trends, not all countries and cities will benefit from the potential economic gains of urbanisation. The winners and losers of urban growth will depend on the policy decisions that national and sub-national governments make over the next few years. Evidence suggests that urban growth that is poorly managed by governments tends to lead to a range of economic, social and environmental costs, such as traffic congestion, inefficient public transport, air pollution with associated health impacts, and inadequate infrastructure for basic services such as energy, water and waste (Floater, Rode et al. 2014). In contrast, cities with well-managed urban growth, supported by effective infrastructure provision and integrated policy programmes for reducing the negative externalities of urban expansion, can achieve relatively high levels of productivity and competitiveness while minimising the costs.

This raises an important question for policy makers: how can governments manage the growth of cities to capture the benefits of productivity and growth, while reducing the costs of urban poverty, pollution and carbon emissions?

This question is of particular importance and urgency in rapidly growing Emerging Cities in regions such as China, India and South-East Asia. For these cities, decisions by national and city governments made over the next few years will lock-in the footprint of urban form and infrastructure for decades – even centuries – to come. If Emerging Cities are planned and managed well, using effective, integrated and targeted public interventions, they could lock-in higher levels of productivity associated with the accessibility of compact, mixed-use developments, efficient public transport systems and coordinated services (World Bank 2014). These well-managed cities would also lock-in a range of co-benefits such as better sanitation, higher levels of air and water quality, reduced road deaths and lower carbon emissions (Arrington and Cervero 2008; IPCC 2014; Litman 2014).

The quality of government intervention will also be important for the growth of Global Megacities and Mature Cities, where policy makers will face choices over how to retrofit existing city footprints, and how to upgrade existing infrastructure. Global Megacities have potential to grow in the financial and business services sector where agglomeration effects – face-to-face meetings, rapid transport, access to skilled labour pools – will be a factor in determining their competitiveness. Ensuring high levels of accessibility with efficient transportation systems will require nodes of compact urban growth, serviced by connected infrastructure. Knowledge-led Mature Cities such as Stockholm will face similar choices to these Global Megacities at a smaller scale, while Mature Cities such as Houston, with a starting position of historical sprawl and motorisation face the choice of business as usual, or redensification to levels where public transport becomes more cost effective.

Furthermore, while lower income cities in regions such as Sub-Saharan Africa will not have a major impact on the global economy and climate over the next two to three decades, they will become increasingly important beyond 2050 as their economies continue to grow. Consequently, avoiding lock-in of inefficient, high carbon infrastructure will increase as a challenge for these lower income cities in the longer term.

¹Poorly managed growth is defined here as urban development that results in economic, social and environmental costs. These costs can result from, among others, urban sprawl, inefficient public transport infrastructure, energy inefficient buildings, air pollution, social exclusion and a lack of basic services such as energy, water and waste.

Box 1

New Climate Economy Cities

In the first cities paper for the Global Commission, 'Cities and the New Climate Economy: the Transformative Role of Global Urban Growth', analysis showed that 468 cities will account for over 60% of global income growth and 50% of energy-related greenhouse gas emissions growth between 2012 and 2030. These 'new climate economy' cities comprise three groups: Emerging Cities, Global Megacities and Mature Cities.

Emerging Cities

Emerging Cities are defined as metropolitan areas with current populations of between 1 and 10 million and per capita income levels between US\$2,000 and 20,000. This definition covers around 291 cities worldwide, including many in China, India and other emerging economies. Examples include Kuala Lumpur, Puebla, Pune, Ulaanbaatar and Kunming. The group includes many rapidly growing and industrialising cities. Accounting for 15% of global urban population growth between 2012 and 2030, these cities are projected to contribute 27% of global income growth and 35% of energy-related emissions growth between 2012 and 2030 under business as usual. Average per capita emissions in these cities are estimated to grow from 5.2 tonnes of CO₂ equivalent in 2012 to 7 tonnes of CO₂ equivalent in 2030.

Global Megacities

Global Megacities are defined as large economies with populations above 10 million and per capita income over US\$2,000. This definition covers around 33 cities, including Beijing, Delhi, Shanghai, Mexico City, Jakarta, Rio de Janeiro, Bangkok, Tokyo, New York and London. Under a business as usual scenario between 2012 and 2030, these cities are projected to contribute around 8% of global urban population growth, 16% of global income growth, and 11% of global emissions growth. By 2030, they will represent around 10% of total world emissions. Average per capita emissions in Global Megacities will grow from 6.2 tonnes of CO₂ equivalent in 2012 to 7.1 tonnes of CO₂ equivalent in 2030.

Mature Cities

Mature Cities are defined as metropolitan areas with populations between 1 and 10 million and per capita income levels above US\$20,000. This definition covers around 144 cities, including Stuttgart, Minneapolis, and Hiroshima. Mature Cities will contribute only 3.5% of global population growth between 2012 and 2030 under business as usual. However, they will play a significant role in the global economy over the same period, contributing around 18% of global income growth. Although carbon emissions growth in Mature Cities is projected to be relatively low, at 4.3%, average per capita emissions in these cities are already high at around 12.5 tonnes of CO₂ equivalent. Under business as usual, these high rates are projected to remain stable, dropping slightly to 12.1 tonnes of CO₂ equivalent in 2030.

Source: Floater, Rode et al. 2014.

In this paper, we examine the governance arrangements and policy instruments that national, regional and city governments can use for delivering a new model of urban development: a model that aims to capture the benefits of urban growth while minimising its negative impacts. This '3C model', introduced in the first NCE cities paper, comprises three pillars: compact urban growth, connected infrastructure and coordinated governance (Floater, Rode et al. 2014). We focus here on the third pillar, coordinated governance, as well as the policy instruments required to deliver all three pillars.

In Part I of the paper we first describe the 3C model, before exploring the importance of coordinated governance for delivering the model effectively. We examine the importance of integrated governance both across levels of government and across sectors of the economy. In Part II, we examine the most promising policy instruments available to national, regional and city governments to underpin integrated policy programmes for delivering the 3C model. These instruments fall into three broad groups: spatial planning, fiscal instruments and finance. The aim is to provide policy makers with a guide to the tools at their disposal within an integrated framework. Furthermore, for cities that are only starting to build capacity for integrated

governance, a number of individual policy instruments could be used independently, particularly for raising infrastructure financing.

The paper uses a mixed-method approach. First, evidence from the literature has been reviewed and synthesised. Second, a call for evidence in 2014 has been used to gather and synthesise further information on cities, the economy and climate as part of the New Climate Economy project. Third, the paper also draws on a 2012 survey of officials and other key stakeholders in 90 cities worldwide on the green economy (Rode, Floater et al. 2013).

The three groups of new climate economy cities face different challenges in implementing the 3C model (see Table 1). For Emerging Cities, early planning and major transport infrastructure projects will have a substantial impact on compact urban growth and connected infrastructure more widely. For many Global Megacities and Mature Cities, redensification will be more of a priority. Similarly, some cities – particularly many Global Megacities – will have the capacity to raise finance and deliver large infrastructure projects, while other cities will need to build effective institutions and technical capacity.

However, it would be over simplistic to suggest that all cities within a group should follow a blueprint of urban development. Every city has a unique set of characteristics and starting positions that will shape the effectiveness of different approaches. In particular, we have resisted the temptation to structure policy instruments or policy recommendations into the three city groups. Rather, we set out a set of promising policy instruments that any city at any stage of development may choose from, depending on its city-specific circumstances. More importantly, cities and national governments can develop an urban strategy based on the principles of the 3C model while retaining the flexibility to tailor its implementation to local circumstances.

Table 1: Implementing the 3C model in different cities

	Compact Urban Growth	Connected Infrastructure	Coordinated Governance
Emerging Cities	Design in compact city features from the start, including integration of industrial and residential areas, and efficient public transport routes. e.g. Chenggong (China)	Introduce surface-based public transport based on bus and Bus Rapid Transport systems and rapid rail where appropriate, along with provision of infrastructure for non-motorised travel. e.g. Bogotá (Colombia)	Build capacity for integrated land-use and transport planning, access to private finance and international funds. Policy support from national and regional governments and the international community where appropriate. Develop best practice through city networks. e.g. Curitiba (Brazil), Lima (Peru)
Global Megacities	Redensify through regeneration of existing city cores and multiple hubs, brownfield redevelopment, and urban retrofitting. Initiate well-managed growth of urban periphery. e.g. Beijing (China)	Expand existing public transport systems and increase share of public and non-motorised travel. e.g. Mumbai (India)	Integrate land-use and transport planning with regulatory, fiscal and financial policy instruments across municipalities within the metropolitan area. Policy support from national and regional governments. Provide best practice leadership for other cities. e.g. London (United Kingdom)
Mature Cities	Redensify through regeneration of existing city cores and supporting hubs, brownfield redevelopment, and urban retrofitting. e.g. Hamburg (Germany)	Major opportunities to introduce cycling and non-motorised travel (in mature sprawling cities redensification also required to make public transport more cost effective). e.g. Copenhagen (Denmark)	Integrate land-use and transport planning, including use of regulations. Policy support from national and regional governments. Develop best practice through city networks. e.g. Barcelona (Spain)

PART I STEERING URBAN GROWTH: AN INTEGRATED APPROACH

2 Cities of the future: compact, connected and coordinated

2.1 Market failure: why urban growth needs public intervention

While the potential benefits of urban growth are substantial, evidence suggests that urban growth which is poorly managed not only reduces potential economic benefits, but also has significant negative impacts on the environment and on the quality of life of urban citizens (see for example, Davis, Caldeira et al. 2010; Bourdic and Salat 2012; EMBARQ 2013a; IPCC 2014; Litman 2014; WHO 2014). Where markets operate effectively, efficiently and equitably governments should not intervene. However, urban growth that is purely market-based leads to a number of market failures, which in turn can hinder productivity and overall economic growth. Among these market failures are urban sprawl, congestion and longer travel times, negative externalities of pollution and carbon emissions, network externalities, reduced agglomeration effects on innovation and skills matching, and imperfect and asymmetric information (Floater, Rode et al. 2013).

Urban sprawl can be defined as the uncontrolled expansion of urban development characterised by low density, segregated land-use and insufficient infrastructure provision. Sprawl can also take the form of leapfrog development, with development 'leaping' over undeveloped land (OECD 2013). Urban sprawl, including peripheralisation, is a result of poorly managed urban expansion. It tends to increase the time spent commuting and on other forms of travel, which in turn reduces productivity and in some cases quality of life.

To an extent, longer commuting distances can be offset by increasing the speed of travel, which is facilitated by rapid, motorised modes of public and private transport. However, in many cities motorisation has reached excessive levels, leading to traffic congestion and a range of social and environmental costs that undermine the benefits of agglomeration. These costs include health impacts from increased air pollution, vehicle-related deaths and climate impacts from higher carbon emissions. Urban sprawl also leads to higher public infrastructure costs, as dispersed development requires higher levels of infrastructure per citizen or firm. In effect, sprawl is subsidised by the tax payer, making dispersed development artificially cheap.

Poorly managed cities can also reduce the positive agglomeration effects of cities. If interactions between people and businesses are not facilitated by the design and operation of cities, the potential for knowledge sharing, innovation and access to pools of labour and skills is reduced. This, in turn, can reduce the productivity levels of a city. Other positive externalities that can be supported through planning include those associated with the provision of parks and recreation areas for public use.

Network externalities occur when the value of joining a network is dependent on the number of other users. Examples include public transport, phone networks, social networks, fast broadband, electricity grids and community-based energy efficiency initiatives. Although these networks represent key services, the value of these networks may not be realised without government frameworks and support, as the risks of uncertain uptake by users may dissuade the private sector from investing in them.

Another market failure resulting from poorly managed urban growth is imperfect and asymmetric information. For example, the efficiency of energy and other resources is often not maximised by individuals and firms due to imperfect information (Gillingham, Newell et al. 2009; Dobbs, Oppenheim et al. 2011). Firms and householders may be unaware that, following an upfront cost, insulation measures could reduce their operating costs significantly. Governments can play a role in providing objective, evidence-based information to allow firms and individuals to make more informed decisions.

In some cases, these market failures have not been recognised by policy makers in the past, particularly in countries where energy and resources have been cheap and abundant. In other cases, while the need for public intervention to address market failures has been recognised, governance and institutional failures have prevented the implementation of effective, efficient and equitable policy programmes that represent well-managed urban growth. For this reason, we pay particular attention to the third pillar of the 3C model – coordinated governance – in section 3 of this paper.

2.2 The 3C model of urban development

Addressing the market failures associated with poorly managed – or unmanaged – urban growth will require a new urban development model for many cities. In particular, three pillars are crucial: compact urban growth, connected infrastructure, and coordinated governance. These pillars are discussed in more detail in our first New Climate Economy paper, 'Cities and the New Climate Economy: the Transformative Role of Global Urban Growth' (Floater, Rode et al. 2014). The three pillars are overlapping and mutually reinforcing, and integrated policy programmes are required to capture the benefits of urban growth fully. This 3C model – compact, connected, coordinated – is already being developed by a few leading cities such as Copenhagen, Stockholm and Singapore: cities that also display high levels of economic productivity, social benefits and reduced environmental impacts. And while the specific policies used in these cities will not necessarily be directly transferable to others, the general 3C approach – and the associated options for policy intervention – should be relevant for cities at different stages of development and different starting positions.

Pillar 1: Compact urban growth supports the primary function of cities: facilitating access to other people, goods and ideas. Compact growth is represented by relatively dense, proximate development, with high levels of accessibility to local employment and services (OECD 2012a). This type of development is not about urban containment or even solely about high density, but rather about how urban expansion is managed in order to develop dense, transit-oriented urban forms. Accessibility is generated by different combinations of urban form and transport which ultimately create economies of scale, agglomeration effects and networking advantages.

Physical proximity is the first principle of achieving accessibility in cities. Compact cities come in many forms, but all are human-scale cities with high-density, mixed-use urban form and good quality urban design. They include the European city model, transit-oriented development, new urbanism and polycentric urban development (Kelbaugh 1989; Calthorpe 1993; Thomas and Cousins 1996; Gertz 1998; Power and Burdett 1999; Burgess 2000; Rogers and Power 2000; Williams, Burton et al. 2000; Burton 2002; Burton, Jenks et al. 2003; Cervero 2003; Gehl 2011; OECD 2012; UN HABITAT 2012). Compact urban development typically focuses on urban regeneration, the revitalisation of urban cores, the promotion of public and non-motorised transport, and high standards of urban management (Williams, Burton et al. 2000; Breheny 2001).

Pillar 2: Connected infrastructure helps capture the economic benefits of compact urban form. Connected infrastructure is cost and energy-efficient, low carbon, climate resilient and socially inclusive, and should draw on an appropriate mix of low to high-tech solutions. In transport this includes systems and technologies such as Bus Rapid Transit, cycle superhighways, car and cycle sharing, smart grids, information systems, charging points and electric vehicles. In the building sector, it cuts across innovative designs, heating, cooling and lighting technology, building control systems and new construction materials. Similarly, smart urban utilities cut across more efficient energy, waste and water infrastructure.

Pillar 3: Coordinated governance and effective institutions will be critical to delivering the new urban development model. City-level governance is an important scale for collective decision-making and action (World Bank 2010; OECD 2012a; UN HABITAT 2013), particularly for the integrated policy intervention needed for infrastructure development and spatial planning. National-local, national-regional and regional-local interactions also play a crucial role, and call for a review of national policies that have an impact on urban development to identify areas of policy incoherence and potential synergies (OECD 2013a; OECD 2014e forthcoming). While some larger cities have skills and resources to deliver the new urban development model, many other cities lack capacity. Institutional strengthening is particularly important in small- and medium-sized developing cities, where transparency, democratic decision making and corruption-free infrastructure procurement are often lacking (UN HABITAT 2013).

2.3 The 3C model in action: evidence of tipping points

Evidence from case studies suggests tipping points towards more compact, connected, and coordinated urban pathways. More compact urban growth and redensification is already taking place in some leading, better-managed cities and is increasingly an emerging trend in other cities.

Emerging Cities are demonstrating the economic, social, and broader benefits of investing in more compact, connected urban pathways. Sustained investment by Curitiba in its Bus Rapid Transit system, cycle ways, pedestrian ways and zoning policies have resulted in the city having one of the lowest accident rates in Brazil. Its carbon emissions per capita are 25% lower than the

Brazilian urban average, it has 30% lower gasoline consumption and only 10% of citizen income is spent on transport, – one of the lowest proportions in the country despite a threefold increase in population since the 1960s (Rogat, Hinostrroza et al. 2008; Ricardo AEA 2011; Barth 2014). Curitiba is now one of the most affluent cities in Brazil, and its experience has been replicated in other cities such as Bogotá, Lagos and Johannesburg.

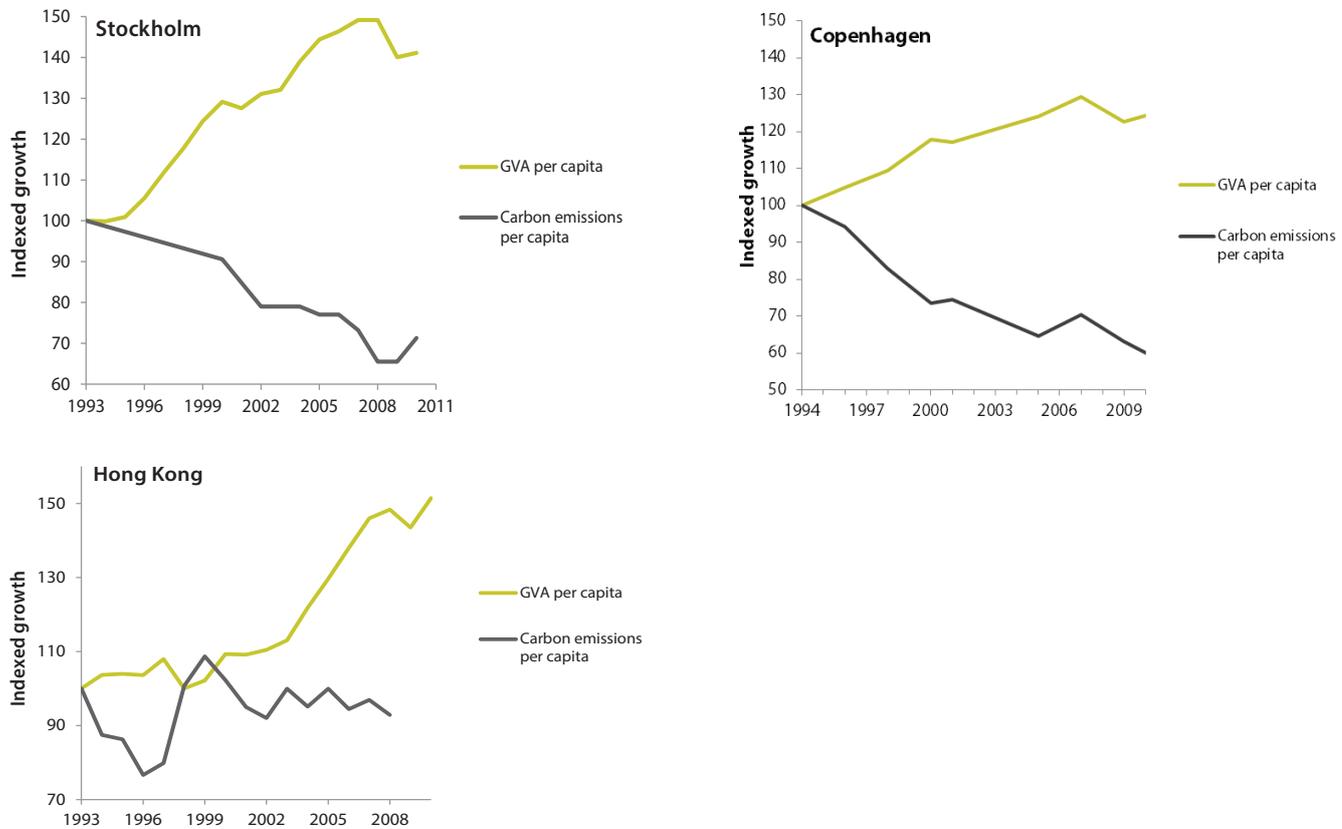
Global Megacities are demonstrating how to remain competitive through more compact, connected, and coordinated urban development. London, for example, remains one of the world's most dynamic, competitive, and fastest growing cities. Yet since 2000, population growth in London has been concentrated within a 10 km radius of the city centre and 53% of all newly constructed floor area between 2004 and 2011 was located within 500 metres of a rail or underground station (Rode 2014). Car ownership in London decreased by 6% between 1995 and 2011, while the city's economy grew by around 40% (Rode 2014). And the city has reduced air pollution close to WHO guidelines, with a particular emphasis on reducing private vehicular emissions through policy measures such as congestion charging and low emissions zones (Lee and Erickson 2014).

Mature Cities such as Stockholm, Copenhagen, Portland, Hong Kong, Hanover and Singapore have all demonstrated, through efficient land-use and sustained investments in public transport, that it is possible to grow prosperous economies, while simultaneously reducing greenhouse gas emissions and air pollution (see Figure 1). For example, while Stockholm reduced emissions by 35% between 1993 and 2010 from a low starting point, the city's economic output grew by 41% over the same period – one of the highest growth rates in Europe (Floater, Rode et al. 2013). Since 1990, Copenhagen has reduced its carbon emissions by more than 40%, while experiencing a real growth of around 50% (City of Copenhagen 2012; Rode, Floater et al. 2013; Floater, Rode et al. 2014a). All of these cities consistently feature highly in rankings of the world's most competitive cities.

Most cities do not have the starting positions or knowledge-led economies of Stockholm, Copenhagen and Hong Kong. For example, carbon emissions in rapidly growing, industrialising cities will inevitably increase in the industrial sector in the short-term. However, the reduction in carbon emissions in the transport and heating sectors in leading green economy cities suggests that a combination of compact urban growth and connected public transport and non-motorised transport infrastructure could be used by other cities as part of a lower carbon growth pathway in these sectors.

Figure 1

De-coupling of economic growth and carbon emissions production in Stockholm, Copenhagen and Hong Kong



Sources: Rode, Floater et al. 2013; Floater, Rode et al. 2013, 2014a.

Over the last decade, redensification has been taking place in a range of Global Megacities and Mature Cities (OECD 2010). Examples include London, Brussels, Tokyo, Hamburg and Nagoya, cities that have moved back towards more concentrated forms due in part to land-use regulations and investment in public transport. Beijing is reversing the trend of sprawling cities in China: population density in Beijing’s core has already increased by 50% (World Bank 2014). And the Sacramento region in the United States demonstrates how an urban area can swiftly reverse a trend towards urban sprawl through land-use and transport planning. Two years after a growth management plan was implemented, two-thirds of the housing growth in the region was achieved through in-fill in attached or small-lot detached housing, a significant rise in density for the region (Ewing and Rong 2008; Ewing 2008).

Cities at different levels of development are implementing policy programmes for addressing urban connectivity through smarter urban infrastructure and new technology – particularly in transport. Bus Rapid Transit (BRT), for example, is transforming cities in many developing countries, increasing productivity and land value while reducing carbon emissions and air pollution. Currently, over 160 cities have implemented BRT (EMBARQ 2013), which can carry up to 2 million passengers per day at less than 15% of the costs of a metro (Menckhoff 2005). The upgrading of cycle infrastructure – including city-wide upgrades in Copenhagen, cycle superhighways in London and cycle hire schemes in Hangzhou, Paris and New York – has increased benefits for local economies, the urban environment and individual health. At the same time, a range of smarter transport systems – such as car sharing and electric vehicles – have taken off in numerous cities worldwide (EMBARQ 2013). Developments in other sectors are also significant. Singapore, for example, is piloting new approaches to smart grids, while Copenhagen has one of the world’s most innovative city-wide district heating systems, supplying 97% of the city with clean, reliable and affordable heating (Floater, Rode et al. 2014a).

Bogotá has become a globally recognised leader in promoting a better planned, transit-orientated city with innovations in public transport, driven by strong leadership from successive city administrations and the adoption of integrated planning (LSE Cities 2008). Its headline project is the TransMilenio Bus Rapid Transit (BRT) system, which has been replicated worldwide in cities such as Guangzhou and Ahmedabad (Rode and Burdett 2011). The Bogotá BRT carries 2.2 million passengers per day and operates at a profit (EMBARQ, 2014). The city has built upon the BRT principle of accessible, equitable transit, with a city-wide network of bicycle paths which connects residents to public transport connections, community spaces and parks (Siemens and C40 2013). Innovative projects in the pipeline include the piloting of electric and hybrid buses and an electric taxi fleet.

The coordination of land-use and transport is improving in some countries and cities through strengthened urban institutions. Over two-thirds of OECD cities now have a municipal governance body to coordinate sustained programmes of public investment in urban infrastructure (OECD 2014). These cities tend to be denser, have higher GDP per capita, and attract more skilled people (OECD 2014). Cities such as London are providing strong, replicable models for coordinating public transport investment. Transport for London, for example, is a single agency that oversees all urban transport modes ranging from non-motorised transport, public transport, and road traffic, with the authority to take decisions across local administrative boundaries. And countries such as India and South Africa have developed plans to help coordinate land-use and transport decisions between the local, regional, and national levels, along with initiatives to use e-governance for greater public participation, more efficient operations and strengthened governance.

Chinese policy makers are recognising the importance of shifting towards a new urban pathway based on more compact, connected and coordinated urban development to boost urban productivity and reduce the escalating costs of urbanisation. China has established a significant national programme of 100 low-carbon demonstration cities embedded in all major departmental plans, and cities such as Chenggong district in Kunming are showing signs of shifting towards higher density, mixed-use, transit-orientated development (Energy Foundation 2014).

For all the examples of cities successfully moving (or striving) towards more compact, connected, coordinated urban development above, these remain the exceptions. Business as usual urban development shows a continuing trend of sprawl, motorisation, air pollution and increased carbon emissions. If a global shift towards the principles of the 3C model is to happen, a range of governance failures will need to be addressed, and integrated programmes of policy intervention implemented effectively. The following section discusses the importance of the third pillar of the model – coordinated governance – while Part II of the paper explores some of the most promising policy tools for delivering this alternative pathway.

3 SHAPING FUTURE CITIES: COORDINATED GOVERNANCE

Governments will need effective institutions and coordinated governance to deliver the new urban development model. Governance will be particularly crucial in many Emerging Cities where current levels of capacity are often insufficient for implementing the policy programmes needed to move towards compact urban growth and deliver effective, connected infrastructure.

Four elements of urban governance are essential: (a) multi-level governance including national, regional and city coordination alongside inter-municipal co-ordination at the local level, (b) city leadership, including strategic visioning and financial authority, (c) transparency and accountability and (d) horizontal policy integration at the local level. As well as these elements, municipal governments can use international and regional networks of cities to transfer knowledge and innovation.

3.1 Multi-level governance: national, regional and city coordination

Pursuing urban development that features compact urban growth, connected urban infrastructure and coordinated governance calls for a multi-level governance approach to policy making. Multi-level governance is characterised by the sharing of policy-making authority between different levels of government: either horizontally across different ministries or agencies at the national level; horizontally across sectors or municipalities at the local level; or vertically between national, regional/provincial and municipal levels of government (Charbit and Michalun 2009; Charbit 2011). Due to the cross-cutting nature of urban policies and environmental policies, pursuing compact, connected, coordinated urban growth often involves multiple national ministries, regional governments and multiple sectors at the local level. The nature of these interactions varies depending on the degree to which national governments have decentralised and devolved authority to sub-national governments. However, whatever the national government framework, effective coordination of national, regional and municipal levels of government will be necessary.

To improve policy coherence between different sectors and different levels of government, attention should be paid to the interactions among these entities and the degree to which their policy priorities align or diverge (OECD 2013b). In a global survey of 90 city governments conducted by LSE Cities, 51% of cities reported that national policy frameworks did not adequately support their municipal green agendas – particularly in North America and Europe (see Figure 2). In addition, 55% of cities reported little significant involvement in green strategy development on the part of the economics department in municipal governments (Rode, Floater et al. 2013). Most municipal governments involve the departments of environment, planning and transport in developing their overall green strategy. However, the departments of finance, economic development and technology are rarely involved. Policy frameworks tend to support the city's green agenda most at regional/provincial level, less so at national level and least at supranational level. Policy areas most often supported by higher-level policy frameworks include energy generation and energy efficiency, as well as climate change, transport and air pollution. However, a number of cities reported in the survey that national and state governments often undermined their green transport and energy objectives (see Figure 3).

Figure 2

Support from regional, national and supranational governments for urban green policies, as reported by 90 cities worldwide

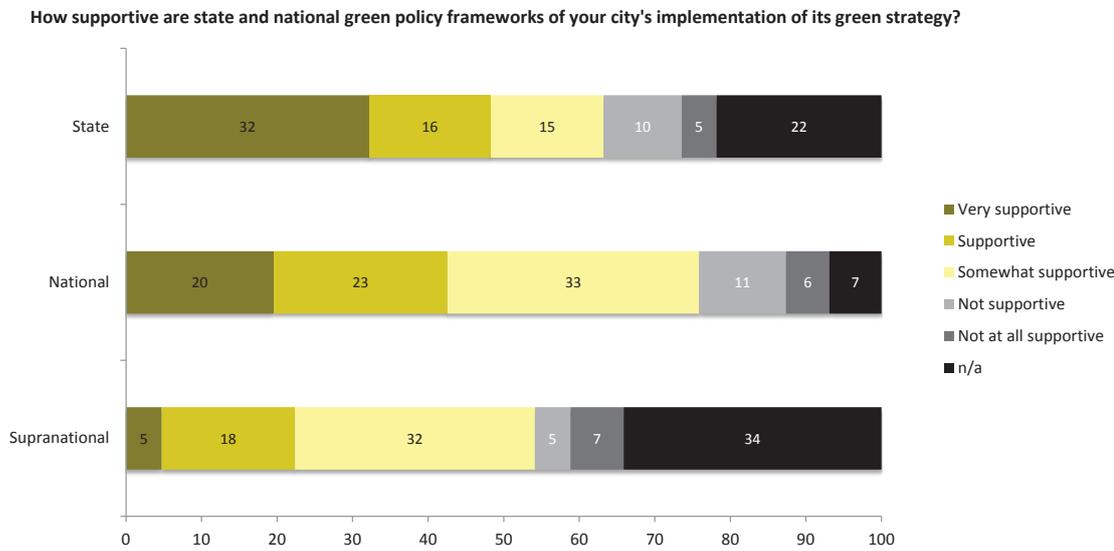
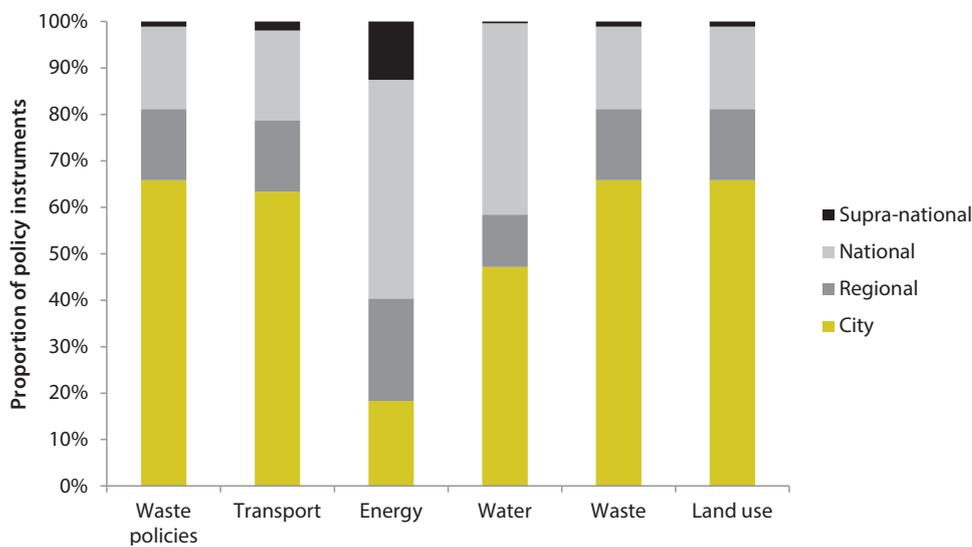


Figure 3

Proportion of policy instruments for delivering urban development at different levels of government

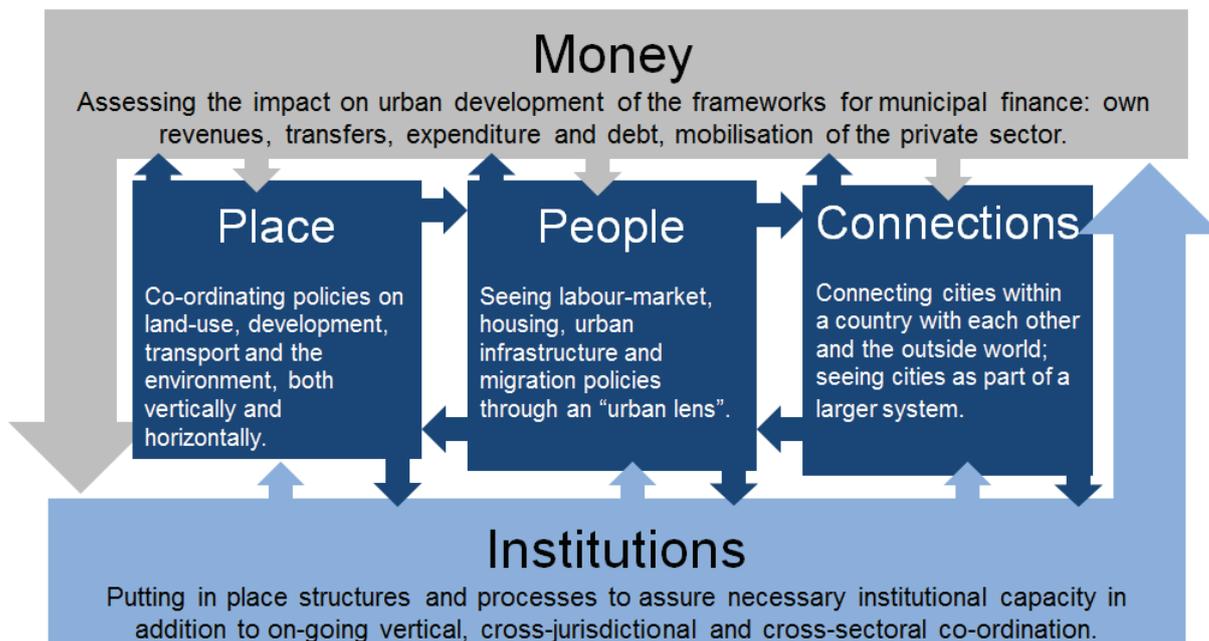


3.1.1 National policy impact on urban development

Depending on how they are designed, national policies can enable or constrain the ability of cities to pursue compact growth, improve connectivity and increase co-ordination. For this reason, policy coherence between national and local levels of government is critical, as is taking a holistic approach at the national level in order to anticipate the potential distributional consequences of policies for compact urban growth or improving infrastructure (OECD, 2013a).

However, taking a holistic approach is challenging given the range of ministries that may influence urban development. For example, as of 2013, in the average OECD government 6.7 ministries or national-level departments had urban policy functions, and several countries had more than eight (OECD 2014b forthcoming). To improve coordination and policy coherence, national governments should review key national policies that can have a strong impact on urban development, even if the impact is unintentional, and then identify potential areas of incoherence and synergy (OECD 2014b forthcoming). Key national policies to review generally fit into the categories of ‘money,’ ‘institutions,’ ‘place,’ ‘people’ and ‘connections,’ (further explained in Figure 4). Steps towards improving national-local coordination also include central government recognition of the statutory importance of local authorities in constitution and legislation and maintaining open channels of communication (Dodman, Dalal-Clayton et al. 2013).

Figure 4
Five broad categories for assessing national influence on urban policy



Source: OECD (2014b forthcoming). “Chapter 5. A National Strategy for Cities: Taking Ownership of Urban Policy”, *Regional Outlook 2014*, OECD Publishing, Paris.

One holistic approach is for national governments to adopt a ‘systems of cities’ attitude to underpin the identification of corridors for development, potential growth areas for economic activity or locations for major infrastructure (Brown 2014; Clark and Clark 2014). For example, South Africa has used national legislation to create an Integrated Development Plan that coordinates national, provincial and local government policy (Rode, Wagner et al. 2008). In France, both local and regional governments have used climate action planning as a tool of coordination, with strategies being developed in consultation with stakeholders and citizen participation processes (Cochran 2012; de Charentenay, Leseur et al. 2012).

National governments can also play a critical role in bolstering capacity at the local level to deliver integrated socio-economic and environmental policy programmes. The trend towards decentralisation has at times resulted in fragmented governance and a transfer of responsibilities to the local level without sufficient funding or training (Cochran 2012). For example, in China, one obstacle to implementing environmental targets in small and medium-sized cities has been a lack of capacity to integrate environmental and economic development objectives (OECD 2013a).

National governments can help build capacity by fostering learning across cities and providing technical assistance to local efforts to integrate land-use and transportation planning (OECD 2010). They can also scale up successful local-level approaches to policy integration, such as in Kitakyushu in Japan, where the metropolitan authority transfers staff between departments focussed on environmental and economic objectives in order to inculcate institutional learning and foster understanding of inter-sectoral linkages (OECD 2013c).

3.1.2 Metropolitan coordination and authorities

Nearly all urban areas, whether Emerging Cities, Global Megacities, or Mature Large Cities, are composed of multiple municipalities, but how these municipalities coordinate on the activities that affect economic growth and climate change can vary widely. To complicate matters further, the largest urban areas may also cross regional or provincial boundaries, requiring coordination not only among municipalities but also among regional governments, and between regional and municipal governments.

For urban areas to develop and address climate change more effectively, coordination across municipalities (and regions, if applicable) is needed, particularly on land-use and urban expansion decisions, on transport planning and service delivery, and on the planning and delivery of basic services such as drinking water, sanitation and solid waste collection. Failure to coordinate land-use planning and transport investments effectively across metropolitan regions can lead to inefficient use of land, gaps or duplications in infrastructure investment, and increased traffic congestion (OECD 2014; OECD 2014a forthcoming). Metropolitan governance structures can deliver services with greater efficiency by sharing costs, exploiting economies of scale and reducing negative externalities that can spill across municipal boundaries (World Bank 2013c). Furthermore, they can provide a higher degree of transparency and accountability, with clear channels of communication both with the public and executive governance bodies.

Metropolitan areas have pursued a range of governance approaches, which generally fall into four categories: (1) informal/soft co-ordination; (2) inter-municipal authorities; (3) supra-municipal authorities; and (4) special status of 'metropolitan cities' (Kim, Schumann et al. 2014). A survey of metropolitan governance bodies in the OECD (mainly Mature Cities but also some Global Megacities) found that 81% are active in the field of regional development, 78% in transportation, and 67% of such organisations work in spatial planning. More than half work on all three fields (OECD 2014).

Fragmented authority over road, rail, metro and other modes of transport is a particularly important barrier to more cost effective and equitable accessibility in cities (UN HABITAT 2013). This has direct implications for efforts to mitigate climate change, given the role that emissions from transport play in cities' overall levels of greenhouse gas emissions. Urban transport brings with it a level of complexity not found in other transport sectors such as railways, roads or inland waterways, given the number of possible modes in the city (Government of India 2014). An effective solution is to create an integrated, multi-modal transport authority. Transport authorities can put in place the coordinated planning and management necessary to transfer people and goods across metropolitan regions. Evidence shows that the initiation of city-wide transport authorities can bring with them a number of co-benefits, including a positive effect on reported levels of particulate matter and higher levels of public satisfaction with transport systems (OECD 2014).

Metro regions such as Marseille – the most congested city in France – show that reform can be slow, particularly in the context of urban population growth. Ten different public transport authorities operate in the city, and while there has been some progress in sharing information related to transport investments and pricing, fares have yet to be harmonised across the city as a first step (OECD 2014c). Some cities like Berlin and Paris have benefited from well-established multi-modal transport authorities, with the BVG and RATP initiated in 1928 and 1948 respectively. In contrast Lagos, a rapidly growing Nigerian city, developed its Metropolitan Area Transport Authority as recently as 2003. It is responsible for overseeing the planning of all aspects of metropolitan transport, both private vehicle traffic management and public transport, with associated power to direct investment (Government of India 2014).

In creating an organisation such as a multi-modal transport authority, it can be crucial to obtain buy-in from all levels of government (including national and municipal), as well as private operators. London has succeeded in reforming its system. Transport for London was formed in 2000 and oversees all urban transport modes, including non-motorised transport, public transport and road traffic, and has the authority to take decisions across local administrative boundaries. However, it still lacks the direct link with land-use and an ability to leverage dedicated funding sources for urban investments.

By contrast, Curitiba first pioneered the establishment of integrated transport and land-use planning authorities through the Instituto de Pesquisa e Planejamento Urbano de Curitiba (IPPUC), which aimed to integrate all elements of urban growth (Cervero 2013). IPPUC fostered mixed development and dedicated high capacity bus lanes that formed the backbone of the successful BRT system – an approach that has been replicated globally. Key factors contributing to the IPPUC's success have been dedicated funding sources and a long-term vision pursued by a succession of leaders (IPCC 2014). Other Latin American

cities have followed a similar pathway, which allowed them to explore innovative options such as the cable car (Metrocable) transit system in Medellin and Caracas.

National or regional/provincial governments often need to encourage or require metropolitan coordination, as municipal governments often do not have sufficient capacity or incentive to coordinate across a metropolitan area on long-term planning and on expansion plans (OECD 2014b forthcoming). Indeed, many metropolitan coordination mechanisms arising from city initiatives focus on service delivery (such as waste collection or public transport) rather than on long-term strategic decisions about urban form or affordable housing provision (Kim, Schumann et al. 2014).

National governments can provide incentives for metropolitan governance, which often take the form of contractual arrangements and financial transfers. With contractual arrangements, national governments typically confer special benefits on metropolitan areas in exchange for stronger co-operation among the municipalities in those areas. In the case of financial transfers, national governments may provide grants to inter-municipal bodies or directly to municipalities to encourage the adoption of similar policies across the metropolitan area or to facilitate co-ordination on planning or service provision (Kim, Schumann et al. 2014). In the United States, urban areas are required to designate a Metropolitan Planning Organization (MPOs) to receive and manage federal transportation funds (AMPO 2013). Some MPOs have expanded their activities to include inter-municipal coordination of spatial planning, as in the case of the Chicago Metropolitan Agency for Planning, although these plans are not legally binding (OECD 2012b). Metropolitan governance can also be initiated from national legislation (as in the case of the Paris or Madrid metropolitan region) or by state law (as in the case of the Berlin or Vancouver metropolitan region).

3.2 City leadership and financial authority

While national and regional policies are critical for steering urban growth, cities also need strong municipal leadership, as well as a sufficient level of autonomy and financial authority to deliver infrastructure and services effectively. City-level governance is a critical scale for collective decision-making and action, particularly for the visioning, strategic planning and integrated policy intervention needed for infrastructure development and spatial planning (World Bank 2010; OECD 2012a; UN HABITAT 2013).

Greater fiscal autonomy is already a trend in higher income cities, with expenditure at the sub-national level in OECD countries reaching an average of 33% in 2005 (IPCC 2014). On average in European OECD countries, local government capital expenditure on environmental protection represents 75% of total government spending on the environment, but this varies widely. In some countries (e.g. France, Netherlands, Norway and Sweden), nearly all spending on environmental protection is done by the local government, in the United Kingdom and Iceland, local government accounts for less than a third of total government spending on the environment (Kamal-Chaoui and Robert 2009; Merk, Slack et al. 2012). Additional sources of revenue – including those from higher levels of government – will be needed to cover the costs of new public transit solutions, retrofitting buildings and investment in resilience measures in cities.

Despite the trend towards decentralisation, many municipal governments continue to lack the capacity or expertise required to run through each management stage of a project, from its identification to project budgeting and financing, project supervision and implementation (Lindfield and Steinberg 2012; UN HABITAT 2013). This has hampered the decentralisation of responsibilities from national to local government, particularly in the management of urban infrastructure programmes in countries such as Indonesia (Cervero 2013). Furthermore, a lack of technical expertise, from the management level down, can stymie planning authorities in addressing relevant climate change issues in both middle-income cities such as Johannesburg (Holgate 2007) and Mexico City (Molina and Molina 2004) and in higher income megacities such as London (Bulkeley and Schroeder 2008). This is in addition to deficiencies in the use of ICT systems, whether in transport and traffic systems, energy generation and distribution or building design and land-use planning (Villa and Mitchell 2009). Given that rapidly urbanizing cities in middle income countries have the most potential to reduce future greenhouse gas (GHG) emissions, such institutional shortcomings are important barriers to tackle (IPCC 2014).

Greater financial independence at the city level could be achieved by gaining a credit-rating, in order to reduce the cost of borrowing but also to aid the development of municipal bond financing. Only 4% of the 500 largest developing country cities are seen as creditworthy in international financial markets, increasing to 20% in local markets (World Bank 2013a). Estimates from the World Bank indicate that approximately 80% of the municipalities taking part in its programme consistently run an operating

deficit (World Bank 2013a). Building city creditworthiness can be highly effective for raising finance. The World Bank has estimated that a dollar invested in raising the credit-rating of a city in a developing country could leverage more than 100 dollars in finance from the private sector for low-carbon and climate-resilient infrastructure (World Bank 2013a).

Efforts at developing a mechanism that could assist a range of city types to gain a credit-rating have already begun, with the World Bank initiating a City Creditworthiness Academy whose objective is to share best practice in building city creditworthiness. The programme is helping cities to build multi-year action plans that identify 'own source' revenues, manage debt and develop multi-year capital investment plans. The World Bank aims to reach 300 of the largest developing country cities in the next four years. As well as focusing on the improvement of expenditure controls and the maintenance of assets, the World Bank is promoting the use of 'Climate Smart Capital Investment Planning' to help cities plan, structure and implement low-carbon projects (World Bank 2014a).

Strengthening coordination between national, regional and local governments should be a focus of global efforts to improve creditworthiness, including examination of how legislative and regulatory frameworks can enable city governments to source their own revenue and manage debt (World Bank 2013a). Middle-income cities and smaller cities may require assistance, for instance in the form of grants, from national government actors in order to gain credit ratings. For example, the national governments of Mexico and India have legislated to ensure that sub-national authorities are rated on a national level, with India mandating rating processes for those municipalities bidding for central government grants (PPIAF 2012).

Achieving a credit rating is a long-term process, taking up to five years. The Public Private Infrastructure Advisory Facility (PPIAF) is working within the Creditworthiness Academy process. This builds on its recent work in assisting sub-national governments to access private finance. It recently helped the Peruvian capital Lima on its pathway to creditworthiness, a process that took around five years. It provided funding that assisted the municipality to gain a credit rating from an international rating agency, and helped build capacity within the administration to develop long-term investment plans for infrastructure and move away from short-term debt financing. The success of this programme aided Lima in its development of a Bus Rapid Transit project, which also gained funding from the World Bank and the Inter-American Development Bank (PPIAF 2011).

3.3 Transparency and accountability

3.3.1 Building transparency and trust

A lack of transparency and accountability is a major barrier not only for strengthening the fiscal authority of cities but also for engaging with the private sector and civil society stakeholders who are critical for delivering the 3C model of urban development. While many megacities have skills and resources to envision, build and maintain effective policy programmes and financial mechanisms, many other cities lack capacity. Institutional strengthening is particularly important in small and medium sized developing cities, where transparency, democratic decision making and corruption-free infrastructure procurement are often lacking (UN HABITAT 2013). The scale of this challenge should not be underestimated and for certain cities may remain a barrier into the longer term. However, a number of countries and cities are beginning to use innovative technologies to increase transparency and accountability.

Building the trust of citizens is important for governing effectively. Given that many local governments have only begun to gain greater financial autonomy and legitimacy, they need to work even harder to build and maintain trust with citizens. This means ensuring that the government has institutional frameworks for citizen and stakeholder consultation. As in Kitakyushu, Japan, this could mean fora that include local officials, business leaders, local policy and academic experts, and representatives from non-profit organisations (OECD 2013c). Furthermore, many city governments can use new ICT systems and e-governance to empower citizens to provide feedback to the municipal administration, strengthening their interface with the local government (see Box 2).

Box 2

Strengthening Municipal Transparency and Accountability in India

In order to deal with the challenges of rapid urbanisation, India is addressing both deficiencies within key institutions and inefficiencies and corrupt practices in the planning system and land market. Such corruption often stems from the fact that there is a great deal of value in converting land from an undeveloped state to use for industrial or residential construction (Brown 2014). Furthermore, the land market is stymied by perverse incentives such as urban land ceilings, which restrict density and result in many potential sites of development being withheld. When changes are made to land-use or floor space index, they are often done in an ad-hoc manner with little regard for spatial planning, often following the development of transport infrastructure. This further encourages rampant speculation and insider trading (Ahluwalia and Mohanty 2014).

The land acquisition process is undergoing reform in order to make it easier and fairer to acquire areas of land that are most suitable for development. Key changes still required include clarity over property rights and methodologies for land and property valuation (World Bank 2013c). According to Ahluwalia and Mohanty, this should be accompanied by an expansion of clear, regulated property rights that allow for easy transactions on the land market, enforcement of contracts, and transparency in development and planning approvals (Ahluwalia and Mohanty 2014). There are deficits in the capacity of local governing bodies tasked with putting together proper city development, master and financial plans (Ahluwalia and Mohanty 2014). Reform of the judicial system is required in order to adequately safeguard property rights, and provide methods of redress in relation to land-use changes or acquisition (World Bank 2013c). Local governments in India are starting to use GIS mapping systems, which can develop spatial planning strategies and also ensure more effective collection of revenues by identifying individual properties. By using more transparent methods of property assessment, municipal governments can also enhance the accuracy of the collection system and build the trust of residents.

A number of Indian States such as Karnataka, Kerala and Rajasthan are working to create unified municipal standards across their respective jurisdictions (Abraham 2013). National leadership on municipal accounting reform has been implemented as part of the Jawaharlal Nehru National Urban Renewal Mission, but standards have yet to be agreed upon and implemented. According to analysis by the Asian Development Bank (Abraham 2013), fewer than 10% of Indian towns have undertaken meaningful accounting reforms.

Cities are increasingly using e-governance for citizen consultation. For example, in negotiating changes to an already compact city, Singapore has engaged both citizens and business stakeholders in its Land Transport Masterplan through online portals and accessible public forums (Siemens and C40 2013). The Brazilian city of Bahia has developed a series of Citizen Service centres, offering e-government services at convenient locations to residents, such as in transport hubs or shopping malls (Bhatnagar 2004; Ndou 2004). At the same time, the Indian State of Andhra Pradesh is now using ICT to deliver services in the form of billing, certificates and other record keeping (Ahluwalia 2014).

However, despite recent progress, a deep digital divide still remains in many countries. For example, only 7% of Africa's inhabitants are currently online, and while mobile phone usage has grown to 72%, it remains at only 5% in Eritrea (GSMA and AT Kearney 2013; International Telecommunications Union 2013). While such statistics show the depth of the challenge, national and local governments could nonetheless develop better metrics in collaboration with civil society, the private sector and telecoms companies.

3.3.2 Developing accounting frameworks and metrics

A key barrier preventing governments from assuming greater leadership to manage cities more effectively is the lack of capacity to measure and monitor the vast amounts of data that are central to planning and implementing city-based policies. For example, recent analysis by World Bank staff suggests that currently only around 20% of the world's 150 largest cities have the basic analytics required for low-carbon planning (World Bank 2013a). Two areas of reform stand out: the development of frameworks

for municipal financial accounting and building a better understanding of carbon emissions.

A standard accounting framework, similar to those used by national governments, would provide municipal governments with a stronger basis for short-term and long-term decision making. It would also allow greater transparency, trust and accountability for local governments, giving civil society a clearer insight into government affairs and contributing to national efforts to track the flows of climate finance.

In moving to an 'integrated accounts' model, an important first step for cities would be to develop a framework similar to the Standard National Accounting system (UN Statistics Division 2009; Severinson 2010). This means a clear, reliable and integrated set of macroeconomic accounts based on common standards. As an example of greater consistency in city-based accounting, the US Governmental Accounting Standards Board has been working with state and local governments on common principles. In a 2008 survey, they found that 67–72% of state and local governmental authorities included in the study followed the 'generally accepted accounting principles' (GASB 2008). The development of common standard accounts should be complemented by municipal capacity building, particularly the introduction of accounting software that can provide adequate feedback to municipal administrations (Abraham 2013).

The development of an internationally recognised system of municipal accounts would form an important part of establishing a municipal credit rating system. Having a standard baseline against which to measure the financial management of municipalities enables potential investors to differentiate between more and less creditworthy local actors. It would also provide administrations with a tool to improve their credit rating, by understanding how their accounts affect their rating. Cities could then build on this by introducing into their accounting practices some of the core principles of the 'integrated reporting model', such as the recognition of environmental or social capital. Reform could take the shape of developing accounting methods that can adequately value the benefits of green infrastructure, on cost-benefit scales, compared to grey infrastructure (Pickle 2014 forthcoming).

Metrics for cities to measure and monitor carbon emissions are also inconsistent. This is a challenge for all cities – even higher income cities with relatively high levels of technical capacity. In a survey of over 100 cities worldwide for this paper, only 60 had published carbon emissions, and only 40 had published recent carbon emissions between 2010 and 2013. Of these, only 29 cities had a breakdown by scope and sectors for these emissions and most of these breakdowns were not comparable. For example, some cities include Scope 3 emissions from aviation, marine transport or shipping, while others do not report these emissions. A common challenge is emissions double counting, where several institutions are sometimes credited with overlapping emissions activities. The level of detail in reporting is also highly variable, providing further challenges to benchmarking and comparability. Overall, only 12 cities included a clear breakdown of carbon emissions from industry, transport, buildings and electricity consumption, four of the main sources of emissions from energy use in most cities.

The lack of a commonly agreed methodology on measuring emissions is one challenge, with differing perspectives on which sectors to include and whether methodologies should be focused on production or consumption (McCarney, Blanco et al. 2011). As a result, many cities are unable to set out evidence-based plans for mitigating carbon emissions or to collaborate regionally and globally with other municipalities on reduction efforts. Encouragingly, more sub-national governments are utilising platforms such as the Carbon Climate Registry and the Carbon Disclosure Project (CDP). The Global Protocol for Community Scale Emissions project currently being developed by ICLEI, IEAP, WRI and C40, and supported by the World Bank, UN-Habitat and UNEP, aims to produce a new comprehensive methodology for accounting for greenhouse gas emissions associated with city-based economic activity and consumption (Greenhouse Gas Protocol 2012). A complementary programme will be developed to help city officials and private sector actors build greenhouse gas emissions inventories using the new methodology.

3.4 Policy integration at the local level

Designing and implementing complementary policies simultaneously is an important means of achieving compact urban growth, connected infrastructure and coordinated governance. Pursuing these goals will require building support from a broad constituency of public and private stakeholders. Implementing a set of policies together will in some cases be necessary to make them politically acceptable and achieve overall policy goals. For example, part of the success of the congestion charge in London can be attributed to the use of the receipts to improve public transport (OECD 2010a). Another example is combining policies to limit outward urban expansion with policies to increase accessibility through public transport and to set aside public green spaces in inner urban areas.

Recent modelling demonstrates how policy packages can achieve a mix of objectives that would otherwise not be attainable by pursuing each policy separately. Vigiú and Hallegatte (2012) modelled three policies – a greenbelt policy prohibiting development in areas not already densely inhabited; a public transport subsidy; and a policy prohibiting new building in flood-prone areas – to determine how they affected a number of policy objectives. These objectives included climate change mitigation, adaptation to climate change, housing affordability, protection of natural areas, and distributional impacts (policy neutrality). When applied separately, each policy achieved one to three of the objectives, but had a more negative impact on one or more of the other objectives compared to a ‘do-nothing’ scenario. In contrast, applying public transport subsidies, a green belt policy and flood-zone building restrictions simultaneously resulted in a more positive impact on each of the five objectives than in the do-nothing scenario (Vigiú and Hallegatte 2012).

Policy integration faces a number of challenges and limitations. For example, the lines of leadership or accountability potentially become less clear, and measuring the effectiveness or impact of certain administrative functions can be more difficult. There are programmatic concerns that the development of cross-cutting mechanisms represents an opportunity cost in terms of planning time (Rode, Wagner et al. 2008). Other considerations include the fact that integration requires a degree of informal coordination, thus making it impossible to prescribe pro-forma guidelines. Ultimately, integration should be aimed not so much at the process of an organisation but at better project delivery. Lastly, integration is often dependent on political leadership and whether it is practised at the highest levels of governance (Rode, Wagner et al. 2008).

While city governments have many of the skills needed for delivering the green economy, expertise in innovation-based economic development could be improved – particularly for cities in middle- and low-income countries. In a survey by LSE Cities, over 80% of cities viewed their skills base in urban planning as ‘good’ or ‘excellent’, with 74% holding that same view with respect to legislative drafting. In contrast, 42% of cities regarded their capabilities in innovation-based economic development as ‘very limited’ to ‘moderate’. Monitoring and enforcement of policies is another area where capabilities could be strengthened (Rode, Floater et al. 2013).

When considering the policy tools in Part II of this paper, attention should be paid to the set of objectives the policy mix is intended to meet, such as climate change mitigation, congestion reduction or housing affordability. This should serve as the basis for designing the set of policies that can best meet those goals within a city’s specific political and administrative context.

3.5 City networks: sharing best practice

City governments can benefit from current international networks such as the C40 Cities Climate Leadership Group, and the International Council for Local Environmental Initiatives (ICLEI) (see Box 3). They provide peer learning and dissemination of best practice and clear channels that both national city networks and national governments can liaise with (Matsumoto and Nuttall 2014 forthcoming). They enfranchise city governments, enabling them to be part of international discussions on global environmental challenges, both through direct city-to-city cooperation and by bringing action down to a local level, accessible for citizens (Matsumoto and Nuttall 2014 forthcoming). These formal networking mechanisms can also lead to greater cooperation on the measurement and management of emissions at a city level. There has been a significant increase in cities signing up to voluntary frameworks for carbon emissions reductions, from fewer than fifty in the early 1990s to several thousand by 2012 (Bulkeley and Betsill 2005; Kern and Bulkeley 2009; Pitt 2010; Krause 2011).

Furthermore, inter-municipal networking is increasingly being pursued, with Rotterdam and Ho Chi Minh – two cities both vulnerable to the risk of coastal flooding – sharing best practice through the initiation of a Climate Adaptation Partnership (Siemens and C40 2013). City governments can build international connections through the design of their institutions. For instance, the Japanese city of Kitakyushu has an International Office in its Environmental Bureau (OECD 2013c). This helps not only to share technical know-how with new international partners, but also to unlock new markets for innovative local companies. Furthermore, through agreements such as the Nantes Declaration of Mayors and Subnational Leaders on Climate Change, city governments can maintain pressure on national governments to commit to ambitious legislative frameworks that are embedded with multi-level governance principles.

One new initiative is the World Business Council for Sustainable Development through its Urban Infrastructure Initiative (UII). This brought together 14 world-leading companies in partnership with ICLEI and the Urban Land Institute to support 12 developed and developing world cities with new urban solutions. In Yixing (China), for example, UII recommended approaches for tackling urban sprawl and the development of a citywide tram network is now being fast-tracked.

Box 3

C40 Cities and ICLEI: the value of city networks

International city networks can play an important role in knowledge sharing and spreading of best practice from one city to another. Two global networks that act to disseminate knowledge and ideas on low carbon development in cities are C40 Cities and ICLEI.

C40 Cities

Founded in 2005, the C40 Cities Climate Leadership Group is a network of global cities committed to identifying specific policies and programmes that can be introduced at the city level to combat climate change. The network's aim is to speed up the global adoption of climate mitigation and adaptation strategies by sharing best practice and programmes that have been shown to work in one or more of the member cities.

Currently, the C40 network has 69 member cities, comprising 40 large cities and an additional number of smaller cities considered to be leaders in addressing climate change. Together they represent some 18% of global GDP, with members drawn from across the developing and the developed world. Using collaboration, knowledge sharing and metrics, C40 initiates sustainable action through a range of networks that cover seven key themes: adaptation and water; energy; finance and economic development; measurement and planning; sustainable communities; transportation; and solid waste management.

A number of transformative ideas have been disseminated among C40 cities in recent years. For example, while only six cities in the C40 had implemented cycle-hire schemes in 2011, this grew to 36 cities with schemes being initiated or in place. Over the same period, Bus Rapid Transit schemes grew from nine C40 cities in 2011 to 29 cities in 2013. Meanwhile, only a handful of member cities in C40 had LED street lighting programmes in 2007, compared to half of C40 members today (C40 and Arup 2014).

ICLEI- Local Governments for Sustainability

ICLEI was established in the 1990s and is an association of cities and local and metropolitan governments that are leading the way in sustainable development. Currently ICLEI comprises 12 megacities, 100 super-cities and urban regions, 450 large cities, 450 small and medium-sized cities and towns in 86 countries around the world. The aim of the network is to support cities to become sustainable, resilient, resource efficient, bio-diverse and low carbon; to build smart infrastructure; and to develop a green economy.

ICLEI's global networks allow innovative cities and local governments to share experience and expertise in sustainable development and to accelerate action at all levels. For example, EcoProcura is a series of European conferences that provide information on the latest solutions for sustainable procurement for purchasers from all levels of government, suppliers and policy makers, whilst the World Mayors Council on Climate Change is a group of 80 local government leaders advocating greater engagement of local governments in multilateral efforts to tackle climate change.

PART II POLICY INSTRUMENTS: PLANNING, PRICING AND FINANCE

Delivering the integrated policy programmes set out in Part I will require a mutually reinforcing package of policies and investments tailored to the specific political, economic and social contexts of each city, as well as capacity for implementation. In Part II of this paper, we explore some of the most promising policy instruments that could be used to underpin the integrated policy approach. These instruments can be grouped into three main areas (see Table 2):

1. Planning urban growth: strengthening the role of strategic spatial planning and land-use regulation at the national and city level to provide the strategic and regulatory framework for more efficient and effective planning of land-use, transport and urban infrastructure.
2. Pricing congestion, sprawl and pollution: reforming subsidies and pricing the negative externalities associated with poorly managed urban expansion to reduce and reverse the perverse incentives related to inappropriate pricing of land, new development and conventional motorisation
3. Financing infrastructure: unlocking financing for innovative, connected urban infrastructure to allow cities to redirect and invest capital in infrastructure that raises economic efficiency while reducing carbon emissions and increasing the quality of life for citizens.

Table 2

Policy instruments for delivering compact, connected and coordinated urban pathways

1. Planning urban growth	2. Pricing congestion, sprawl and pollution	3. Financing infrastructure
<p>Strategic spatial planning</p> <p>Infrastructure planning</p> <p>Codes, standards, regulations</p>	<p>Transport</p> <p>Congestion charging and parking fees</p> <p>Fuel pricing and other fiscal incentives</p> <p>User fees and charges</p> <p>Land, property, development</p> <p>Land and property taxation</p> <p>Development charges and fees</p> <p>Industrial</p> <p>Emissions trading systems</p>	<p>Land value capture (LVC)</p> <p>Development-based LVC</p> <p>Tax-based LVC</p> <p>Raising private finance</p> <p>Municipal bonds</p> <p>Investment platforms</p> <p>Public private partnerships (PPPs)</p> <p>International funding</p> <p>Multilateral Development Banks</p> <p>Carbon credits</p>

4 PLANNING URBAN GROWTH

Effective urban planning will be critical to the success of cities in developing a new growth model, given its central role in the coordination of actors that shape and control land-use, urban form, and infrastructure and service delivery. Spatial planning can play a vital role in managing urban growth more effectively, whether that expansion is supply or demand led (see Rode, Floater et al. 2014 for a discussion of this). In pursuing compact and coordinated urban form, spatial planning provides a way to engage with the flows of the city in pursuing the optimal sequencing, coordination and integration of infrastructure investments. In particular it is the interlinked character of spatial planning that can facilitate synergetic effects, strengthening overall policy impacts (IPCC 2014). Reforms to national and city-level planning systems need to go hand in hand with regulatory reform. This section discusses three key areas of policy instruments for planning urban growth: (1) strategic spatial planning; (2) infrastructure planning; and (3) codes, standards and regulations.

4.1 Strategic spatial planning

Spatial planning is used to shape the strategic growth patterns of a city and set the legal guidelines for new development. It can also be a key tool for meeting future environmental and social objectives (Brown 2014). Effective spatial planning requires sequencing, coordination and integration of infrastructure investments with land development. A metropolitan spatial plan can provide an important link between national-level and municipal spatial planning, but only if it succeeds in delivering policies that are aligned with other plans rather than providing a competing vision of a city system (OECD 2014a forthcoming).

An example of effective, coordinated spatial planning is the London Plan, developed by the Greater London Authority. The Plan operates as a 'living document' that can adjust according to changing needs and the latest evidence. This strategy was developed in consultation with the London Development Agency and Transport for London to ensure that a holistic view of the city and its challenges was obtained (Rode, Wagner et al. 2008). In line with the objective of integration and consultation at the municipal level (OECD 2014a forthcoming), individual borough councils within London must have regard to the plan when developing their own strategies.

Spatial planning is particularly effective when used as a broad tool of economic development. While integrated spatial planning is gaining traction, in practice metropolitan spatial plans often focus solely on physical infrastructure (OECD 2014a forthcoming). However by considering broader economic development goals, spatial planning can provide the basis not only for spatial infrastructure development, but also for housing, transport, technology hubs and industrial zones (Rode, Wagner et al. 2008; Dodman, Dalal-Clayton et al. 2013). This holistic approach lies behind the 'City Development Strategy' method championed by UNEP and the Cities Alliance which is currently being used in a range of developing country cities such as Jinja in Uganda, Manila in the Philippines and Ha Long in Vietnam (Dodman, Dalal-Clayton et al. 2013). The approach encourages cities to analyse not only spatial form and infrastructure, but citizen livelihoods, service delivery, energy efficiency improvements and environmental quality, as well as good governance, financial capacity and poverty reduction.

National governments are key partners in strategic spatial and transport planning, in terms of providing an overarching vision of urban expansion that may also include key regulatory interventions. For example, Denmark's Planning Act on the 'Station Proximity Principle' requires new offices over 1,500m² to be located within 600m of a rail station (Floater, Rode et al. 2014a). This has been instrumental in the development of Copenhagen's efficient, compact urban form (Rode, Floater et al. 2013). Berlin's Land Use Plan – the main strategy for spatial development decisions in the city – is another example of coordinated planning. The legal requirement for instituting a Land Use Plan is defined within Germany's Federal Building Code. In following the general zoning framework of the Land Use Plan, Local Development Plans (Bebauungspläne) have to align regulations regarding the development of individual sites (Rode, Wagner et al. 2008).

Urban containment instruments are commonly used to foster urban compaction and incentivise the development of brownfield over greenfield land. They attempt to delineate built-up areas from rural areas and green space. Examples include the green wedges of Copenhagen's finger plan, and the Portland growth boundary. These instruments can serve both to limit sprawl and to conserve peri-urban areas which may have conservation or agricultural value (UN HABITAT 2012a). A study on the effect of urban growth boundaries set out in the Swiss Land Use plan showed that the boundaries increased building density (Gennaio, Hersperger et al. 2009).

However, if not designed appropriately, urban containment can lead to perverse outcomes by incentivising development to ‘jump the greenbelt’ (OECD 2012a). In London and Seoul, commuter towns have developed on the urban periphery, with workers travelling long distances into the city (Cheshire and Sheppard 2005; OECD 2012a). However, this may be partly explained by the dominant place of such cities in the British and Korean economies. The Korean government is attempting to diversify economic activity in urban centres other than Seoul through support for higher education and technology clusters (UNEP 2010).

It should be recognised that planning of urban spatial expansion is complex and requires strong coordination of policies across many sectors. For this reason, spatial planning objectives will need to be tailored to the realities and capacities of Emerging Cities and other cities in less developed countries. As such, governments with weak capacity will be more effective by using a narrow approach - focusing on a small number of policy areas and implementing them well, rather than attempting extensive policy programmes that may fail (Fuller and Romer 2014c forthcoming).

As a priority, these governments can focus on preventing undesirable developments and land uses that can be hard to reverse, with fairly modest prescriptive planning. Furthermore, these governments will increase their effectiveness by focusing on large scale urban infrastructure that will be locked in over the longer term and cannot easily be corrected. If governments act early, before development begins and land values rise, public space can be designated and protected more cheaply, and used partly for future urban growth (Angel, De Groot et al. 2013).

A narrow approach should not impose significant constraints on how the private sector develops the blocks defined by the transport network and the public land retained. Blocks can be removed and redeveloped relatively cheaply. In contrast, correcting a failure to lay out a compact, connected transport network or to acquire land needed for public uses can be prohibitively expensive to correct in the future (Fuller and Romer 2014c forthcoming).

4.2 Infrastructure planning

Infrastructure planning is one of the most important elements of strategic planning, shaping a city’s character and footprint (Hall 1993; Müller and Siedentop 2004). The design, construction and use of transport, energy, water and other infrastructure can play a key role in a city’s development – in particular its low-carbon and climate resilient development. For example, transport infrastructure and facilities centrally determine urban mobility patterns in relation to both motorised and non-motorised modes, and whether there is preference given to low-carbon forms of travel (Pucher and Buehler 2006; Andrade, Woods et al 2011). As such, infrastructure planning is vital for managing, projecting and planning for city growth, identifying where gaps may lie including the need to climate proof infrastructure versus developing climate resilient infrastructure from the start, and where efficiencies can be made.

The Growth Management Strategy (GMS) process used by Johannesburg City Council is an example of how infrastructure planning can fit within broader integrated strategic planning. The GMS focused on six key issues: spatial integration; integrated public transport network and walkability; environmental sustainability in terms of enhancing natural resources and protecting sensitive areas; infrastructure services and social amenities; mixed-housing typologies; and safety and security. The infrastructure planning sector has to define itself in relation to the other key issues, and show how it is meeting the broader aims of the GMS. In the case of Johannesburg, the aim of the GMS was to drive more compact urban form, social integration, environmental sustainability and economic competitiveness (City of Johannesburg 2008; City of Johannesburg 2009; Rode and Burdett 2011).

Different cities face different infrastructure challenges, depending on their stage of development. In rapidly growing Emerging Cities, large scale, transformative infrastructure planning is key for shaping urban expansion. Codes and standards that are effective in higher income cities and Global Megacities are challenging to implement and enforce in Emerging Cities and lower income urban areas, due to informal growth, weak government control and minimal public engagement with development and planning processes (Rode, Wagner et al. 2008; Rode and Burdett 2011; Brown 2014). In contrast, large transport, energy and other large infrastructure projects not only provide essential services to citizens but also act to define the shape of the city itself. In Global Megacities and Mature Cities, infrastructure plans need to address ageing assets, identifying whether to retrofit or retire certain infrastructure (Rode and Burdett 2011).

Funding strategies as part of infrastructure planning are key to overcoming barriers to high quality infrastructure - including low carbon and climate resilient infrastructure. In rapidly growing Emerging Cities, a strong incentive exists to provide new infrastructure as quickly as possible to meet the growth in population. Consequently, these cities often procure the cheapest urban infrastructure solutions that are often carbon intensive and of low quality and not climate resilient.

National, regional and urban infrastructure frameworks can provide strategic direction, funding and guidelines for private investors to support infrastructure planning for individual cities. For example, India's National Urban Transport Policy aims to integrate infrastructure planning with land-use planning and provides funding for cities to prepare their own integrated transport and land-use plans (Gakenheimer 2011). This is similar to Brazil's urban transport strategy, which for the past 25 years has supported the development of sustainable urban transport (IPCC 2014). Furthermore, providing clear national and regional guidelines over infrastructure planning can help to raise confidence amongst private sector investors over the longer term.

Infrastructure plans are most effective when coordinated at the metropolitan level. Plans which have been agreed across a metropolitan region and which bring together a range of government actors can help reduce bureaucracy and complexity in larger infrastructure projects; and reduce the unnecessary conflicts between jurisdictions that can hold up approval processes or licensing arrangements (Berliner, Gruning et al. 2013; Barysch, Hewitt et al. 2014).

4.3 Codes, standards and regulations

Urban codes, standards and regulations can be effective policy instruments for shaping compact urban growth and connected, efficient infrastructure including new and existing buildings, transport systems and other forms of infrastructure such as energy, water and waste.

Shifting from maximum density standards to more sophisticated policy programmes can support more compact urban form (Glaeser 2011; Suzuki, Cervero et al. 2013). For example, according to World Bank calculations, maximum density standards in Bangalore have resulted in urban sprawl and caused welfare losses of around 2 to 3% of household income (World Bank 2013). In contrast, cities such as Hong Kong have redensified over time by using guidelines and regulations for residential development plot ratios that set parameters not only for density, but also for community facilities and open space, local retail and industry, public transport, conservation value and environmental protection (Rode, Keim et al. 2013; Brown 2014; GoHK 2014).

Building codes can be used to increase the energy efficiency of buildings and reduce associated carbon emissions. Building codes can mandate minimum standards for new or existing development, for example through participating in energy labelling programmes such as LEED in the United States. National and regional governments and city administrations that run utilities can roll out smart meters and information programmes to reduce energy use further (IPCC 2014).

Mixed-use developments and the use of zoning as part of spatial planning can be a key determinant of land-use. Traditional zoning as used in the United States, with the segregation of residential from commercial or business districts, has contributed to sprawl and car dependency (Brown 2014). Cities such as Miami are moving to 'criteria' or 'form' based zoning, which focuses on urban form rather than use. Through this zoning code, Miami aims to encourage both mixed-use development and increased public transit use, as well as ensure that new buildings relate to existing developments and pedestrian areas (City of Miami 2012).

Shifting from minimum to maximum parking requirements for urban development would also support more compact urban growth. Parked cars are an inefficient use of land, with aggregate parking space in the central business district of Los Angeles occupying more than 80% of the land area (Manville and Shoup 2004). Case studies in the United States show that minimum parking requirements have typically led to reductions in site densities of between 30% and 40% (Willson 1995; Talen 2011). In contrast, the introduction of maximum to replace minimum parking requirements in London has reduced parking supply by 40% (Guo and Ren 2013), and cities like San Francisco and Zurich have used maximum requirements to promote efficient land-use and reduce the costs of development (Kodransky and Hermann 2011). Private motor vehicle use is incentivised by minimum parking requirements which make driving cheaper. When combined with public transport infrastructure, maximum parking requirements can help to reduce car use and its associated negative externalities.

5 PRICING CONGESTION, SPRAWL AND POLLUTION

Pricing instruments such as taxation and carbon markets are potentially powerful policy instruments that can either hinder or support well-managed urban growth, depending on their application. National, regional and local governments can reduce and reverse the perverse incentives supporting poorly managed urban growth and conventional motorisation through subsidy reform and new pricing mechanisms. Furthermore, well designed property taxes and development fees can incentivise compact urban growth and effectively raise investment for connected infrastructure.

In this section, we examine some of the main pricing instruments available for the transport sector and for land markets. In addition, a few cities have set up carbon markets for capping and trading industrial emissions. While a detailed discussion of carbon markets is beyond the scope of this paper, Box 4 provides examples of emissions trading systems in Tokyo and Rio de Janeiro.

Box 4

Municipal Emissions Trading Systems

Tokyo Emissions Trading System

The Tokyo Municipal Government has set carbon emission reduction targets of 25% relative to 2000 levels by 2020, and 50% by 2050. The city's Emissions Trading System (ETS), developed in 2002, is central to achieving those goals and has been recognised internationally in the City Climate Leadership Awards for 2013 (Siemens and C40 2013). The ETS covers 40% of industrial and commercial sectors, representing around 1,400 facilities, of which 80% are office buildings. Large scale facilities that produce emissions equivalent to over 1500 kl in crude oil are covered (IETA 2013). In total, around 20% of Tokyo's GHG emissions are included under this scheme, and there are plans to extend the ETS to other gases. A limited number of allowances to produce emissions (the cap) are provided to facilities. If they emit less than their quota, they can trade their unused allowances to other facilities that have exceeded their cap. Facilities can use offset credits both from uncapped SMEs within Tokyo and from renewable energy providers in Japan, including the Japanese Solar Energy Bank. This provides support to a fledgling renewable energy industry. The system is linked with other programmes in neighbouring prefectures. Reports must be made annually to the Governor, as well as public disclosure of emissions data which are independently verified. Companies that fail to meet their Phase I obligations must cut Phase II emissions by 1.3 times the Phase I shortfall. If they fail to achieve this added indemnity, they face penalties of up to JP¥500,000 (IETA 2013). Reports show that Tokyo's 2010 emissions were reduced by 13% compared to the base year (Bureau of the Environment 2012).

Rio de Janeiro BVRio Green Credit system

The BVRio Green Credit system was developed in collaboration with both the Rio de Janeiro State and Municipal Governments and their respective finance and environmental secretariats. BVRio provides a platform for developing market mechanisms for environmental services and assets, with a view to trading these on an electronic exchange. With the Rio ETS system still in development, BVRio has not yet fulfilled its potential, but it is currently undertaking a cap and trade simulation based on real data with a group of blue-chip corporations in Brazil. It aims to put in place trading and auction platforms and a registry of allowances that will be tailored to a range of participants, companies, government and market regulators. 20 participating companies recently took part in an auction to acquire part of their allowances to meet their targets, followed by the development of a secondary market in which companies can negotiate their allowances and offsets. The organisers of the simulation believe it can develop a model for future GHG trading for both state and federal governments (BVRio 2013; Teixeira 2014).

5.1 Transport pricing

5.1.1 Congestion charging and parking fees

Congestion charging and parking fees can shift commuters to public transport if alternatives exist. One study in Paris showed that congestion charging would reduce the radius of the metro-area by 34% and average travel distance by 15% (De Lara, De Palma et al. 2013). Stockholm's congestion tax was followed by a 33% decrease in traffic delays and a 22% decrease in overall traffic (Baradaran and Firth 2008). Meanwhile, the congestion tax runs at an annual surplus of an estimated US\$90 million (Eliasson 2008). Box 5 provides a discussion of the Stockholm congestion tax.

While the benefits of congestion charging are potentially great, its introduction is often politically challenging. Although charging has the capacity to generate revenue – with London raising £132 million in 2012 (Conroy 2013) – and other co-benefits (health improvements, lower carbon emissions), its primary goal should be to reduce congestion (OECD 2010a). A public perception that charges are designed solely to raise revenue could reduce public acceptance of the scheme. Some cities have promised revenue neutrality with the introduction of charging schemes. In other cities, the revenues are ring-fenced for upgrading public transport. In all cases, charging schemes require a certain level of expenditure on installation and operational costs; in Singapore and Stockholm these are estimated at 15-30% of gross revenue from the scheme (OECD 2010a).

Box 5

Congestion charging in Stockholm

The congestion charge came into force in Stockholm in August 2007, following a public referendum and a six-month trial of the charge. The revenue generated through the charge is used to fund road improvement and public transport projects in the city. It has significantly reduced the city's traffic congestion, with an average reduction of 20% in overall traffic to and from the city centre and an associated increase in public transport use (around 7%). Recent cost-benefit analyses have shown tangible benefits in time savings from reduced congestion, along with reductions in air pollution. Reduced traffic volumes have led to a 10-15% decline in motor vehicle CO₂ emissions in the city. This is despite the population growing by 40,000 people each year (Floater, Rode et al. 2013)

Parking fees that vary according to time, parking location or vehicle size can be used to reduce car trips, increase public transport use and consequently may reduce congestion, air pollution and carbon emissions (OECD 2012a). For example, New York and Los Angeles charge variable parking fees according to the time of the day or the length of time that the vehicle has been parked (OECD 2010). Evidence suggests that variable fees, particularly when used in residential areas, can reduce car trips substantially. One study of 8 workplaces in Southern California showed a 12% decrease in commuter vehicle miles resulting from charges (Shoup 1997), while another study of 5 British cities showed a 13% reduction in car modal share as a result of parking charges (Dasgupta, Oldfield et al. 1994). However, if they are not well designed, parking fees can simply displace car trips to the urban periphery, where fees are not implemented.

Coordinated action between national, regional and local governments can be taken to eliminate the practice of companies providing subsidies for private motor vehicle use or free parking. This may involve changes to taxation systems. Policies could instead be employed to incentivise employees to take public transport, while local governments could offer discounted parking fees for electric vehicles, as is in done in Paris (OECD 2010).

5.1.2 Fuel pricing and other fiscal incentives

Fuel pricing policy and other fiscal incentives that promote urban sprawl should be avoided. The under-pricing of transport fuels and motorised travel has produced a series of negative feedback loops and artificially high levels of vehicle use – see the New Climate Economy cities paper on 'Accessibility in Cities: Transport and Urban Form' for a discussion (Rode, Floater et al. 2014). Hidden or direct subsidies can also have a perverse incentive. For example, the German commuter tax allowance scheme is estimated to cost €6 billion per year while incentivising commuters to travel longer distances (Müller, Liu et al. 2013). Many

national governments in developing countries are distorting domestic resource markets by subsidising fuels such as diesel, with the added impact of supporting the use of fuels that are polluting urban areas. For example, the Indian national budget has included US\$ 18 billion for fuel subsidies, including US\$ 7.6 billion for diesel (OECD 2007).

5.1.3 Transport user fees and charges

User fees have been deployed to price the external costs of personal car travel, or provide disincentives to inefficient private car use. High Occupancy Lanes and High Occupancy Toll (HOT) lanes both operate on a similar principle; to encourage more efficient use of cars by incentivising multiple occupancy in vehicles, for instance via carpooling. However, evidence suggests that such schemes are expensive to implement, with operational costs for the Los Angeles HOT lanes reaching 27% of total revenue (Dachis 2011). Putting in place restrictions on the number of licence plates distributed is a low-cost demand management scheme that has been applied in Latin American and Asian cities. Singapore employs a vehicle licence quota on top of its congestion charge; which aims to align vehicle numbers with present and future road capacity (OECD 2010a).

5.2 Pricing land, property and development

5.2.1 Land and property taxation

Conventional property tax is a common and relatively stable source of revenue for municipal authorities in many countries. Many countries have a property tax system that focuses on 'improvements' to the land rather than the land per se, although in many cases the land value is taken into account (Sietchiping 2011). These conventional types of property tax form the largest source of revenue for many cities, with 100% of revenues often passing directly to the local government. Property tax represents the largest revenue source in high income countries such as France, Germany, Japan and Denmark, as well as middle and low income countries such as Argentina, Colombia, Egypt and Guatemala (Norregaard 2013). In 2006, local administrations in the United States raised almost 72% of tax receipts through property tax (Dye and England 2010). Some of India's largest cities have property taxes as the prime revenue source. In Hyderabad, for example, property tax represents 39% of total revenue receipts (Sietchiping 2011).

Perverse incentives that favour single-family homes over multi-household developments should be eliminated. For example, in the United States, lower tax rates are offered to single-family residences compared to higher-density developments of the same value (Haveman and Sexton 2008; Sietchiping 2011; Merk, Slack et al. 2012). This provides an incentive for lower density development and can encourage sprawl.

Split-rate taxes could be a more effective instrument for promoting compact urban form (Merk, Slack et al. 2012; IPCC 2014). Split-rate taxes tend to levy higher rates on the value of the land, and lower or zero rates on the value of properties. In theory, as the value of the land is taxed more highly than the property, it should increase the capital to land ratio and so incentivise a higher intensity of development. In practice, evidence on the relative benefits of split-rate tax is equivocal, and few empirical studies have been undertaken on their practical application (see for example, Banzhaf and Lavery 2010).

Land and split-rate taxes are currently used by cities less commonly than property tax. However, countries where these taxes are used include Poland, Brazil, UK, the United States, Australia and New Zealand (Sietchiping 2011). For example, a form of land tax is used in all states of Australia, with exclusions mostly for primary places of residence or land used for primary production (Treasury Department 2009). A survey of Asian countries (Franszen 2013) found that only Japan, Korea and Taiwan employed taxes solely based on land value, with the Philippines deploying a version on land and buildings. In South America, land or split-rate taxes are rarely used, with only Chile having a sole land-value system and Guyana utilising a land and property system (Franszen 2013).

Despite the benefits of land and split-rate taxes, they are potentially challenging to administer. Property tax is relatively predictable and the cost is borne solely by local residents, with minimal spill-over effects (Norregaard 2013). In contrast, it has been argued that an increased emphasis on land value may cause challenges in assessment, as site valuation can potentially be more complex (Norregaard 2013). Some argue that it is preferable to subtract the value of improvement from the property as a whole in order to assess the land value (Merk, Slack et al. 2012) or to assess site value from sales or accounts resulting from demolition (Netzer 1998), which is potentially easier.

Local governments need the legislative and technical capacity to administer their tax regimes effectively. This includes the need to strengthen property registries and consistent processes for effective valuation methods. The ability of local governments to have a close knowledge and understanding of local property markets, sales and valuation rolls provides some justification for greater responsibility to operate at the city level (Norregaard 2013). Administrative costs may represent a major barrier to greater local government involvement. However, the use of self-assessments and indexation between valuation periods could help to reduce costs (Bahl 2007). Technology can also play a key role in assessment, collection and record keeping, particularly in developing countries.

5.2.2 Development charges and fees

Development charges can reduce the negative impacts of housing and other developments on citizens and the environment. These charges (also known as levies, fees, taxes and impact fees) are a direct method of pricing the negative externalities (for example pollution, waste and carbon emissions) associated with new urban development. Development charges can include requirements for additional infrastructure and services, or reductions in open spaces (Brueckner 2000; Bento, Franco et al. 2006). Research suggests that they can curb urban sprawl more effectively than growth boundaries (Brueckner 2000; Bento, Franco et al. 2006). Development charges are used by an estimated 1,000 local governments in the United States, where they are often called impact fees (Nelson, Bowles et al. 2008). Charges can also be used to finance area-specific infrastructure projects. For example, fees arising from the development of the Ørestad area in Copenhagen were used to extend a metro-line in the city (Floater, Rode et al. 2014a).

Development charges require local authorities to have a degree of technical capacity, including analytical tools to estimate the impact of building size, land-use type and location on wider infrastructure requirements. In addition to the need for an infrastructure investment plan, this could test the capacity of many developing country cities. Area-specific development charges could be used by cities to incentivise development around public infrastructure. One method would be to charge developments in areas that are further away from existing infrastructure in order to pay for new investments in public transport (Peterson 2009).

6 FINANCING INFRASTRUCTURE

The OECD estimates that around US\$50 trillion will be required for investment in infrastructure over the next 15 years (OECD 2007). This includes investments in road, rail, and basic energy and water infrastructure, much of this in cities. Capital requirements for buildings are as high as US\$7 trillion over the next 20 years (World Economic Forum 2013). Under current projections, many cities will not be able to raise the finance required to meet this demand for infrastructure. According to some estimates, the deficit in investment for global infrastructure is estimated at around US\$1 trillion annually (Boston Consulting Group 2013).

This investment gap is particularly acute in developing countries and emerging economies, where the urban infrastructure deficit is estimated at US\$6.3 trillion to 2030 (Parry 2009). In India alone, the gap in urban infrastructure investment is estimated at US\$827bn over the next 20 years (Ahluwalia 2014). If this infrastructure gap is not closed, millions of urban dwellers will face living in informal settlements without basic sanitation, clean drinking water, energy provision and waste collection. And without adequate public transport systems and general accessibility, mobility for employment, livelihood and quality of life will be inhibited.

As a first principle of financial policy, existing funding should be redirected away from inadequate, inefficient urban infrastructure development. For example, the Bogotá Bus Rapid Transit was funded as result of a decision by the city administration to redirect funding away from urban motorway programmes. The mayor at the time took a political risk to re-orientate transport policy away from private automobiles towards public transport and the creation of a walkable and cycle-friendly city (Pardo, Jiemian et al. 2012).

In the remainder of this section, we examine three key areas of policy instruments that, if well designed, can improve access to finance for compact urban growth and connected infrastructure. First we examine land value capture which has been used in a range of cities both to finance new infrastructure while shaping a more compact urban form at the same time. Second, we examine a range of additional mechanisms for raising private finance, including municipal bonds, investment platforms and public private partnerships. Finally, we explore the financing that multilateral development banks and other international funding systems can provide for compact, connected, coordinated cities in developing countries. Although these instruments are designed partly to raise finance from the private sector, city leadership is still key to the successful delivery of public infrastructure projects.

6.1 Land value capture

Land value capture (LVC) can be used both as a revenue-raising instrument and for directing the shape of urban form and infrastructure. Under LVC, city authorities capture the uplift in land and property values as a result of new public infrastructure such as public transport, energy networks and public spaces (Deweese 1976; Batt 2001; Fensham and Gleeson 2003; Smith and Gihring 2006; Smolka 2013). Not only can governments raise finance using this method, they can also shape more compact urban form by incentivising higher density development around transport routes and other types of infrastructure (see the example of Hong Kong in Box 6).

Variations of LVC include rail plus property models, betterment contributions, special assessment or business improvement districts, tax increment financing, public land leasing and development right sales, land readjustment programmes, connection fees, joint developments and cost/benefit sharing (Landis, Cervero et al. 1991; Bahl and Linn 1992; Enoch, Potter et al. 2005; Smith and Gihring 2006). Overall, LVC instruments can be grouped broadly into either tax-based or development-based land value capture (see Boxes 6 and 7).

A number of factors can influence the effectiveness of different land value capture instruments. For example, macro-economic factors such as rapid urbanisation or strong economic growth can aid LVC models situated around mixed-used or transport-oriented development (Ingram and Hong 2012; Suzuki, Murakami et al. 2014 forthcoming). The effectiveness of LVC will also depend partly on overarching national legal frameworks such as property rights. For instance, the São Paulo CEPAC scheme was underpinned by Brazilian law. However, in other countries, where landowners have stronger individual property rights, this more interventionist form of land value capture might be challenged (Serva 2014).

Collaboration between national, regional and municipal governments is often needed for the implementation of large scale developments that require substantial financing. For example, a steer from a metropolitan body with a clear master plan can provide the regulatory certainty needed for large, transformative regeneration projects. Regulatory certainty is key to gaining private sector input, particularly when land-use changes are part of the project, as land values can be influenced by a range of factors, from environmental regulations to monetary policy at a federal level (Sandroni 2010). Furthermore, open channels of communication between developers and governance bodies are required to provide any relevant information regarding changes in law or to master plans (Sandroni 2010; Suzuki, Murakami et al. 2014 forthcoming).

Box 6

Development-based Land Value Capture

There are a number of development-based land value capture instruments based on the ownership of land by the municipal or other government. By providing development rights to the private sector, governments can capture the uplift in value of land and properties due to their proximity to new public infrastructure and zones such as metro and rail lines or public parks.

Hong Kong 'Rail plus Property'

In Hong Kong, the government's 'Rail plus Property' model captures the uplift in property values along new transit routes. It has led to more compact urban development and delivered a US\$940m profit in 2009 for the Mass Transit Railway Corporation (MTRC) (Rode, Floater et al. 2013). The initiative is a joint venture between the government (with a 76% stake), the Mass Transit Railway Corporation and property developers. By building property developments around stations, the model both increases public transport use and enhances land values (Hale 2011). MTRC receives over half (52%) of its revenues from such property development, with the rest split between the railway (28%), property investment and management (10%) and non-fare revenue sources (10%) (Cervero and Murakami 2009). Benefits accrue to all actors: private developers are able to embark on new projects opened up as a result of the rail siting; government transfers the commercial risks to the railway operator; and passengers have access to efficient railway services at more affordable prices (Rode, Floater et al. 2013).

Hyderabad Metro Rail public private partnership

The Indian city of Hyderabad is implementing the world's largest Metro Rail PPP, through a 'Design, Build, Finance, Operate and Transfer' agreement between a private contractor and Hyderabad Metro Rail Ltd. The private company will fund all costs associated with the metro development (US\$2.7 billion) and anticipate recovering their investment costs over a 35-year concessionary period through fare revenues (50% of total revenue) and revenues from the property development (45% of total revenue from 109ha of leased land). The agreement between the two parties clearly defines the rights and responsibilities of each, and includes a mechanism for financial remedy in case of undelivered obligations on either side (Suzuki, Murakami et al. 2014 forthcoming).

CEPACs in Brazil

São Paulo in Brazil has used CEPACs (certificates of additional construction potential bonds) to generate finance for urban regeneration and infrastructure investment in various parts of the city. Through CEPACs, the municipality has sold building rights exceeding US\$1.2 billion in the last six years based on the sale of additional floor space (Merk, Slack et al. 2012). CEPACs allow administrations, who have already developed master plans for an area's regeneration, to finance the construction of infrastructure regardless of when developer projects begin and without going into debt or splitting funds from other lines of municipal budgets.

Box 7

Tax-based Land Value Capture

A number of tax-based land value capture instruments have been used in different cities. Two of the most well known are betterment contributions and tax increment financing.

Betterment contributions

Betterment contributions (also known as betterment levies, taxes or fees and special assessment districts) are used to fund new localised public infrastructure or services by charging owners of certain properties located nearby who stand to benefit. They have been used widely in Latin American countries, with most having some legal basis for their use (Smolka 2013). In Bogotá, Colombia, betterment contributions have been used to fund about US\$1 billion of public works between 1993 and 2013 (Smolka 2013). Betterment contributions can face challenges, and their effectiveness and efficiency depend on city-specific circumstances. For example, while California's special assessment district regime raised up to US\$3.5 billion per year to invest in parks, open spaces and rail transit, the system has also faced a range of legal challenges relating to the quantification, definition and distribution of 'benefits' (Misczynski 2012). In lower income cities and districts most in need of basic infrastructure, many property owners are unable to pay contributions. In other cities, betterment contributions can be an effective method of land-value capture. For example, a form of betterment contribution was used to raise approximately £3.5 billion for the London Crossrail project (out of total budget of £16 billion) from businesses across the Greater London area, with exemptions for those with a rateable value of £50,000 or less (Sietchiping 2011).

Tax Increment Financing (TIF)

TIF allows public bodies to borrow money against expected increases in business rates that result from new developments. Investments in projects are generally funded through government borrowing or by the issuance of bonds against the expected increases in incremental tax revenue (Merk, Slack et al. 2012). Allocated 'TIF funds' are used to pay back issued bonds. TIF schemes are widely used in the United States. For example, the Atlanta BeltLine project is a sustainable development project that connects neighbourhoods in the city with a 22-mile rail network, parks and multi-use trails (Mancini Nichols 2012). Local funding for this project comes in the form of TIF and is expected to generate around US\$1.7 billion - the majority of the total project cost of US\$2.8 billion (Atlanta BeltLine 2014).

6.2 Raising private finance

In addition to land value capture, a range of financing instruments could be used by municipal governments for raising finance to fund large projects for connected, low carbon and climate resilient infrastructure. In this section we examine three broad types of revenue raising instruments that can be used independently or integrated together. First, we examine municipal bonds, both as a general revenue-raising instrument, and more specifically for funding low carbon (or 'green') infrastructure projects. Second, we examine the potential of investment platforms that can operate at the national or international level to aggregate and scale up municipal infrastructure projects to make them more attractive to large investors. And third, we discuss the importance of public private partnerships, both for leveraging private finance and ensuring effective delivery of infrastructure projects.

6.2.1 Municipal bonds

Municipal bonds can be used to raise capital for long-term infrastructure projects. Bonds provide institutional investors with longer term maturities, lower risk and steady yields. In their traditional form, bonds currently make up half of the total assets in OECD pension funds, and the global bond market was valued at US\$100 trillion in 2013 (Bank for International Settlements 2013). Of this, public debt securities were listed at US\$43 trillion. While municipal bonds are relatively unknown in some countries, cities in the United States regularly use this form of revenue raising, with the US municipal bond market estimated to be worth US\$3.7 trillion in 2013 (Black, Paris et al. 2013).

As discussed in Part I of this paper, lack of municipal creditworthiness can be a major barrier to raising finance in developing countries (see also the discussion on recent progress to increase creditworthiness in these countries through World Bank and other initiatives). Nonetheless, municipal bonds are already being used in some developing countries. According to a UN DESA survey, municipalities in India have accumulated US\$285.5 million through both taxable and tax-free bonds and pooled financing arrangements, mainly for financing water and sewerage systems (Platz 2009). Since the city of Aguascalientes launched the first Mexican municipal bond in 2001 for the sum of US\$69 million, a further 3 municipalities, along with 12 state counterparts, have issued bonds totalling US\$1.9 billion (Platz 2009). In Indonesia, Jakarta's municipal government recently issued municipal bonds worth US\$141 million (Roswendi 2012).

Municipal green bonds are an emerging market for financing low carbon infrastructure (see Box 8). Green bonds – like their conventional counterparts – can be issued by a range of actors including governments, banks and other corporate bodies. The climate-related bond market is currently estimated at US\$503 billion (Boulle, Kidney et al. 2014). Of this, municipal green bonds represent a small proportion, estimated at US\$1.5 billion in 2013 (Oliver, Boulle et al. 2013). However, this is growing. Most examples of green municipal bonds come from the developed world, although a number of middle-income cities are beginning to enter the market. The metropolitan government of Johannesburg has led Africa in initiating municipal bonds, recently issuing a green municipal bond with a target value of US\$136 million. The bond was oversubscribed and will earn investors a 185 basis points return above sovereign bonds. The bond will provide revenue for renewable energy, modification of waste-water plants for electricity generation, waste to energy from landfill and 152 hybrid fuel buses (Boulle, Kidney et al. 2014; Kidney 2014).

Box 8

Municipal Green Bonds - an Emerging Market

Green bonds finance low carbon, energy efficiency and other projects that reduce environmental impacts. The municipal green bond market is emerging and continues to grow, with multilateral development banks and investment banks the dominant investors in this market. Of the World Bank's green bonds portfolio, urban green investment projects make up an estimated 20-25% (Merk, Slack et al. 2012). The European Investment Bank meanwhile has created Climate Awareness Bonds that finance projects in a number of cities, such as a district heating scheme in Paris.

United States

The US has the largest municipal bond market. The federal government supports municipal bonds through subsidies and tax exemptions, for example through the Qualified Energy Conservation Bond and Clean Renewable Energy Bonds, which collectively raised US\$5.6 billion between 2006 and 2011 (Morel and Bordier 2012). Other support includes partial credit-risk guarantees, which may help to attract investors to municipal projects. Cities such as Chicago and states such as Delaware have developed green bond programmes that are particularly focused on energy efficiency improvements and the promotion of renewable energy (Merk, Slack et al. 2012). Under the Delaware Energy Efficiency Bonds scheme, bonds are issued to provide capital for energy retrofits and renewable energy projects in municipal buildings, universities, schools and hospitals.

France

Ile-de-France issued a municipal green bond for €350 million in 2012 for a 12 year period. They have recently built on that with another 12 year bond for €600 million, which received a rating of AA/AA+ (Morel and Bordier 2012; Kidney 2014a).

Sweden

The City of Gothenburg recently issued a SEK 1.8bn (US\$273 million) six year bond, with the funds directed towards public transport, water and waste management and energy projects (Kaminker 2014 forthcoming).

6.2.2 Investment platforms

Investment platforms are a mechanism for attracting private investment at scale. Larger cities can set up exchanges that match infrastructure projects with financial backers. For example, the Chicago Infrastructure Trust attracts private investors to energy efficiency and climate resilient infrastructure projects (see Box 9).

Smaller cities can benefit from national platforms, which provide both independent technical advice and aggregate smaller infrastructure projects which may be of a similar nature, to enable larger investors such as pension funds to invest at greater scale (Barysch, Hewitt et al. 2014). Markets, particularly in urban infrastructure projects, have tended to be highly fragmented and this is potentially a major barrier to private investment. Very large investors, such as pension funds, may regard urban projects that are too small and fragmented to be unprofitable or less profitable than other large investments. In particular, the transaction costs for due diligence and retention of institutional knowledge for smaller projects may outweigh the returns (Berliner, Gruning et al. 2013). If designed appropriately, infrastructure platforms could help to reduce transaction costs and potentially provide standardised funding and implementation models for urban infrastructure projects.

Box 9

Investment Platforms: Scaling Up Finance for Urban Infrastructure

Chicago Infrastructure Trust

The Chicago Infrastructure Trust (CIT) is an infrastructure exchange that matches public infrastructure projects to private investors. Many of the targeted programmes focus on resource efficiency and climate resilient infrastructure (Siemens and C40 2013). The city administration is paying for the CIT's US\$2.5 million running costs, while financial institutions, including Macquarie Infrastructure and Real Assets, Ullico, Citibank and JPMorgan, have committed to investing a total of US\$1.7 billion in the scheme. In order to leverage further private sector investment, the CIT will also provide finance via bonds, capital or equity funding in addition to tax-exempt debt. Chicago City Government hopes to raise about US\$7 billion in total. The private sector will receive returns on their investment from tolls, user fees, premium pricing or tax breaks. The CIT's first project – Retrofit Chicago – is an energy efficiency scheme covering more than 3,500 public buildings in the city. The project aims to reduce annual energy costs by US\$20 million, and the savings from the project will be used to pay back investors (Chicago Infrastructure Trust 2013; Siemens and C40 2013).

UK Green Investment Bank

The UK's Green Investment Bank (GIB), the first of its kind, aims to address some of the market failures relating to low-carbon investments, including the issue of small, risky or fragmented projects (Merk, Slack et al. 2012). Through direct investments, fund-led transactions and funding for technical assistance, the GIB is supporting a number of key priority areas; 80% of its capital (from initial Government support of £3 billion) is mandated for offshore wind, waste recycling, waste-to-energy and energy efficiency (Merk, Slack et al. 2012; UK Green Investment Bank 2014). Waste-to-energy and energy efficiency projects will be particularly relevant for cities, with the GIB unifying previously disparate local government funding for waste infrastructure projects (ranging from £15-25 million) and aiming to leverage matching private capital. The GIB has also assisted the roll-out of the UK Government's energy efficiency Green Deal programme, underpinned by £125m of debt funding for the Green Deal Finance Company (UK Green Investment Bank 2013a). Some notable investments include £20 million towards the Merseyside waste-to-energy plant, which has brought in £250 million in private capital; £30.4 million of debt funding for a similar plant in Wakefield, with a PFI agreement raising an additional £122 million in private finance; and £47.8 million invested in the UK's first wood-to-electricity biofuel plant in Birmingham (Shankleman 2013; UK Green Investment Bank 2013; UK Green Investment Bank 2014).

6.2.3 Public private partnerships

Public private partnerships (PPPs) of cities, national governments, businesses and research institutes are key mechanisms to exploit the natural advantages of cities as test-beds of innovation. PPPs incorporate investments in projects or government services funded and operated through a formal agreement between government actors and one or more private companies. For some PPPs, the cost of using a service is borne through user charges or fees (as in the case of tolls); in others, for example when Private Finance Initiatives (PFI) are used, the cost of providing an agreed service by the private sector is borne solely or partly by the government.

The effectiveness of PPPs depends on particular sub-sectors of infrastructure. For example, access roads that are in the interests of the private sector should be financed by the private capital, rather than crowded out with public funds. On the other hand, private investment in low carbon infrastructure may be leveraged more effectively when access to public funds is available. Cooperation between business and local and national levels of government can ensure that new innovative technologies are supported along each stage of their development by building the necessary research facilities and encouraging commercialisation through the introduction of incentives and regulatory structures. PPPs can also help increase the effectiveness of the city's management of operations. For example, through a partnership with IBM, the Operations Centre of Rio de Janeiro uses the latest smart technology to collate real-time data and information from 30 agencies, substantially improving coordination and reaction times (IBM 2011).

The city of Stockholm was able to leverage 85% of investment from the private sector for one of its eco-districts, benefitting from PPPs between the city, the private sector and research institutes (Floater, Rode et al. 2013). While the city government has been the main driver, support has been provided at the national level in the form of finance for innovation and R&D. Joint funding came from the City of Stockholm, Stockholm Transport, the National Road Administration and private investment, as well as the Swedish Government's Local Investment Programme (LIP). This resulted in funding from the national R&D funding agency being matched with private investment from various R&D projects (Floater, Rode et al. 2013).

6.3 International funds

6.3.1 Multilateral Development Banks

Multilateral Development Banks (MDBs) play an important role in financing infrastructure projects in developing countries where raising finance is particularly challenging. Traditionally, MDB funding has focused on highway construction and other non-urban infrastructure. However, at the Rio+20 summit in 2012, the eight largest MDBs committed to a broad target of investing US\$175 billion in sustainable transport over the next decade to 2022 (Multinational Development Banks 2013).

Within this broad pledge, the institutions committed to integrating sustainable transport into their existing policy frameworks. In making their commitment, the MDBs signed up to a definition of sustainable transport as "transport that is accessible, affordable, efficient, financially sustainable, environment-friendly and safe" (Multinational Development Banks 2012). This commitment is significant because the funding has potential to leverage substantial private sector investment for sustainable transport projects.

In a progress report published in December 2013, the MDBs collectively reported that they had approved more than US\$20 billion in financing in 2012 and that they were on track to meet their commitments on sustainable transport (Multinational Development Banks 2013). However, of the 186 transport projects funded, only 41 (22%) were unambiguously urban projects, while 16 of these were focused on roads or urban highways (see Table 3). This suggests that, for the foreseeable future, MDB financing will continue to provide incentives for business as usual urban growth rather than compact urban growth and connected infrastructure.

Table 3
Transport projects funded by the eight largest Multilateral Development Banks as reported for the year 2012 - (Multinational Development Banks 2013)

	Multilateral Development Banks (MDBs)								
	AfDB	ADB	CAF	EBRD	EIB	IADB	IsDB	WB	All MDBs
No. transport projects	9	27	15	31	41	16	11	36	186
No. urban* transport projects	0	5	4	8	13	6	1	4	41
Value of transport projects (US\$ millions)	940	3,939	1,486	2,038	5,341	1,544	472	4,249	20,009
Value of urban transport projects (US\$ millions)	0	900	496	689	2381	506	8.50	824	5,804
Proportion of MDB transport projects that are urban	0%	18.5%	27%	26%	32%	37%	9%	11%	22%

* Urban projects are defined as those that are specifically targeted at ‘urban’, ‘metro’, or ‘city’ infrastructure. Other MDB transport projects may include some urban components.

6.3.2 Carbon credits

In 2008, the carbon offset market was valued at €5.2 billion (Clapp, Leseur et al. 2010). Two offset mechanisms are currently operating under the Kyoto Protocol: the Joint Implementation (JI) and the Clean Development Mechanism (CDM). Together, they form the compliance market. Both mechanisms provide a means of ‘converting’ emission reductions projects into ‘Certified Emissions Reduction’ units which can then be traded. For cities in developing countries, the Clean Development Mechanism may not be optimal or effective. Urban mitigation projects play a small role in the compliance market (less than 10%), with urban-based projects largely focused on waste management, energy efficiency and energy distribution (Clapp, Leseur et al. 2010; Li 2011). Some analysts argue that reform of the CDM is needed, and that it should move from a project basis to having a sectoral focus in areas such as sustainable transport or urban energy efficiency.

Although not on the scale of the compliance market, voluntary offsetting could potentially offer municipal authorities with an alternative source of finance. However, Kebe, Bellassen et al (2011) calculated that local government represented only 3% of the suppliers of credits to the offset market from current projects, with US municipalities making up the highest percentage of sellers, partly due to the US Federal Government’s non-ratification of the Kyoto Protocol and consequent barring from JI and CDM funding processes. In determining the role of local authorities, analysis indicates that in order to source funding from voluntary offsetting, municipal authorities prefer to target local projects and utilise a variety of financing tools and incentive mechanisms (Kebe, Bellassen et al. 2011).

7 CONCLUSIONS

Coordinated governance is a crucial pillar of the 3C model of urban development. Effective governance is required to address the market failures of business as usual urban growth. Institutional and governance failures can result in ineffective and inefficient policy programmes that fail to maximise the benefits of urban growth and/or fail to minimise the costs. In other cases, the failure is a lack of policy intervention altogether. For many cities, the challenge of developing a more coordinated governance framework, at different levels of government and across different sectors of the urban economy, will be highly challenging. The barriers to institutional strengthening and capacity building, even in higher income cities should not be underestimated. Nonetheless, the results of our review suggest that change is possible, and is already happening, in different cities at different levels of development.

Four elements of urban governance will be important: (1) multi-level governance, (2) city leadership and financial authority, (3) transparency and accountability, and (4) horizontal policy integration at the local level. Municipal governments can also use international and regional networks of cities to transfer best practice.

A number of policy instruments for delivering the 3C model are available to cities, including planning, pricing and finance instruments (Tables 4, 5 and 6). No one-size-fits-all blueprint exists for the most effective combination of instruments. Each city has a specific suite of characteristics and a particular starting position. Most policy instruments will provide opportunities and challenges, the balance of which will depend on city-specific circumstances. Whilst this paper provides a guide to some of the most promising instruments available, national, regional and city governments themselves will need to determine the appropriate balance as part of a tailored strategy for compact, connected and coordinated urban growth.

Table 4
Planning instruments

Policy Instrument	Opportunity (example)	Challenge (example)	City (example)
Strategic spatial planning	Steering principal urban form over the longer term, and shaping spatial economic development	Consistency of implementing urban development across sectors and geographic scales	Berlin
Infrastructure planning	Determining large scale patterns of urban growth	Fostering agreement across municipalities for city-wide infrastructure	Johannesburg
Codes, standards, regulations	Driving greater energy efficiency in buildings	Enforcement – particularly for emerging cities	Boston

Table 5
Pricing instruments

Policy Instrument	Opportunity (example)	Challenge (example)	City (example)
Carbon markets			
City-based emissions trading schemes	Pricing externalities associated with city-based pollution and carbon emissions	Challenging to administer; requires effective monitoring, carbon accounting	Tokyo
Transport pricing			
Congestion charging and parking fees	Shifting commuters to public transport if these alternatives exist	High operational costs at start of project	Stockholm
Fuel pricing and other fiscal incentives	Removing perverse incentive to motorisation and sprawl	Overcoming vested interests	Cities in Norway
Transport user fees and charges	Pricing the external costs of private car use	High operational costs at start of project	Singapore
Land, property and development pricing			
Land and property taxation	Incentivising more compact urban growth	Challenging to administer, e.g. up to date land and property registries required	Hyderabad
Development charges and fees	Pricing the negative externalities associated with new urban development directly	Requiring a degree of technical capacity, including analytical tools	Copenhagen

Table 6
Finance instruments

Policy Instrument	Opportunity (example)	Challenge (example)	City (example)
Land value capture			
Land value capture policies	Both raising revenues and directing the shape of urban form and infrastructure	Requiring collaboration between all levels of government; i.e. in enabling legislation	Hong Kong
Raising private finance			
Municipal bonds	Raising capital for long-term infrastructure projects	Requiring a high city credit rating	Paris
Investment platforms	Leveraging funds from private sector by bundling smaller projects	Possibly requiring national government assistance to initiate platforms particularly for smaller cities	Chicago
Public private partnerships	Introducing the latest technical innovations from private sector	Partnerships requiring strong and clear legal and clear contractual agreements between partners	Rio de Janeiro
International Funds			
Multilateral Development Banks	Providing substantial funding for transformative connected infrastructure projects	Moving away from business as usual infrastructure funding	Nanchang
Carbon Credits	Providing international funding for urban projects that reduce emissions	Market is currently small for urban-based projects	Durban

8 BIBLIOGRAPHY

- Abraham, C. T. (2013). *Municipal Accounting Reforms in India*. ADB South Asia Working Paper Series. Manila Asian Development Bank.
- Ahluwalia, I. (2014). *Transforming Our Cities: Postcards of Change*. London, Harper Collins.
- Ahluwalia, I. (2014). *Urban Infrastructure and Service Delivery*. Urbanisation in India. I. Ahluwalia, R. Kanbur and P. Mohanty. New Delhi, Sage Publications.
- Ahluwalia, I. and P. Mohanty (2014). *Planning and Markets for Urban Development in India*. Urbanisation in India. I. Ahluwalia, R. Kanbur and P. Mohanty. New Delhi, Sage Publications.
- AMPO (2013). "Association of Metropolitan Planning Organisations- About MPOs." Retrieved April 20, 2014, from <http://www.ampo.org/about-us/about-mpos/>.
- Andrade, K., L. Woods, et al. (2011). *Cycling within urban areas: the cases of England and Japan*. European Transport Conference 2011.
- Angel, S., D. De Groot, et al. (2013). *The Ethiopia Urban Expansion Initiative: Interim Report 2*. NYU-Stern Urban Expansion Project Working Paper. New York.
- Arrington, G. and R. Cervero (2008). *Effects of TOD on Housing, Parking, and Travel*. TCRP Report 128. Washington, DC, Transportation Research Board of the National Academies.
- Atlanta BeltLine (2014). "How the Atlanta BeltLine is Funded." Retrieved March 20, 2014, from <http://beltline.org/about/the-atlanta-beltline-project/funding/>.
- Bahl, R. W. and J. F. Linn (1992). *Urban public finance in developing countries*. Washington D.C., World Bank.
- Bahl, R.W. and J. Martinez-Vazquez (2007) *The Property Tax in Developing Countries: Current Practice and Prospects*, Lincoln Institute of Land Policy Working Paper, Cambridge MA, Lincoln Institute
- Bank for International Settlements (2013). *BIS Quarterly Review- June 2013 -International banking and financial market developments*. BIS. Basel.
- Banzhaf, H. S. and N. Lavery (2010). "Can the land tax help curb urban sprawl? Evidence from growth patterns in Pennsylvania." *Journal of Urban Economics* 67(2): 169-179.
- Baradaran, S. and D. Firth (2008). *Congestion tax in Stockholm: An analysis of traffic before, during and after the trial and since start of the permanent scheme*. Ecocity World Summit 2008 Proceedings.
- Barth, B. (2014). *Curitiba: The Greenest City on Earth*. Ecologist. London.
- Barysch, K., R. Hewitt, et al. (2014). *Investment in Green Cities: Mind the Gap*. Allianz Group Public Policy and Economic Research. Munich, Allianz Group.
- Batt, H. W. (2001). "Value capture as a policy tool in transportation economics: an exploration in public finance in the tradition of Henry George." *American Journal of Economics and Sociology* 60(1): 195-228.
- Bento, A. M., S. F. Franco, et al. (2006). "The efficiency and distributional impacts of alternative anti-sprawl policies." *Journal of Urban Economics* 59(1): 121-141.

- Berliner, J., C. Gruning, et al. (2013). Addressing the barriers to climate investment. Climate and Development Knowledge Network. Frankfurt, Climate and Development Knowledge Network.
- Bhatnagar, S. (2004). E-government: From Vision to Implementation: A Practical Guide with Case Studies. Delhi, Sage- India.
- Black, W., M. Paris, et al. (2013). Municipal Bond Market Outlook- Investment Insights. London, Invesco.
- Boston Consulting Group (2013). Bridging the gap: Meeting the Infrastructure Challenge with Public-Private Partnerships. Boston, Boston Consulting Group.
- Boulle, B., S. Kidney, et al. (2014). Bonds and Climate Change: The State of the Market in 2014. London, Climate Bonds Initiative.
- Bourdic, L. and S. Salat (2012). "Building energy models and assessment systems at the district and city scales: a review." Building Research & Information 40(4): 518-526.
- Breheny, M. (2001). "Densities and sustainable cities: the UK experience." Cities for the New Millennium. London: Spon: 39-51.
- Brown, A. (2014). City Futures- Planning Sustainable and Inclusive Cities. DFID. London, DFID.
- Brueckner, J. K. (2000). "Urban sprawl: diagnosis and remedies." International Regional Science Review 23(2): 160-171.
- Bulkeley, H. and M. M. Betsill (2005). Cities and climate change: urban sustainability and global environmental governance. Hove, East Sussex Psychology Press.
- Bulkeley, H. and H. Schroeder (2008). Governing Climate Change post-2012: The Role of Global Cities- London. Oxford.
- Bureau of the Environment (2012). The Tokyo Cap and Trade Program Results of the First Fiscal Year of Operation (Provisional results). Tokyo Metropolitan Government. Tokyo.
- Burgess, R. (2000). The Compact City Debate: A Global Perspective. Compact Cities: Sustainable Urban Forms for Developing Countries. M. Jenks and R. Burgess. London, Routledge: 9-24.
- Burton, E. (2002). "Measuring urban compactness in UK towns and cities." Environment and Planning B 29(2): 219-250.
- Burton, E., M. Jenks, et al. (2003). The Compact City: A Sustainable Urban Form? London, Routledge.
- BVRio (2013). Rio de Janeiro Environmental Exchange- Operational Report 2011-2013. Rio de Janeiro, BV Rio.
- C40 and Arup (2014). Climate Action in Megacities: C40 Cities Baseline and Opportunities. London, C40 and Arup, . II.
- Calthorpe, P. (1993). The Next American Metropolis: Ecology, Community, and the American Dream. Princeton, Princeton Architectural Press.
- Cervero, R. (2003). "Growing Smart by Linking Transportation and Land Use: Perspectives from California." Built Environment 29(1): 66-78.
- Cervero, R. (2013). "Linking urban transport and land use in developing countries." Journal of Transport and Land Use 6: 7-24.
- Cervero, R. and J. Murakami (2009). "Rail and property development in Hong Kong: Experiences and extensions." Urban Studies 46(10): 2019-2043.
- Charbit, C. (2011). Governance of Public Policies in Decentralised Contexts: The Multi-level Approach. OECD Regional Development Working Papers. Paris, OECD.
- Charbit, C. and M. V. Michalun (2009). Mind the gaps: Managing mutual dependence in relations among levels of government. OECD Working Papers on Public Governance., Paris, OECD.

Cheshire, P. and S. Sheppard (2005). "The introduction of price signals into land use planning decision-making: a proposal." *Urban Studies* 42(4): 647-663.

Chicago Infrastructure Trust (2013). Board Meeting: Retrofit One Discussion. CIT Board. Chicago.

City of Copenhagen (2012). CPH 2025 Climate Plan- A Green, Smart and Carbon Neutral City. Copenhagen, City of Copenhagen

City of Johannesburg (2008). Growth management strategy: Growth trends and development indicators report. Johannesburg, COJ.

City of Johannesburg (2009). Sustainable Human Settlements Development Indices- Unpublished report. Johannesburg, COJ.

City of Miami (2012). Types of Zoning Codes. Miami 21: Your city, your plan, City of Miami

Clapp, Leseur, et al. (2010). Cities and Carbon Market Finance: Taking Stock of Cities Experience with Clean Development Mechanism (CDM) and Joint Implementation (JI). OECD Environmental Working Paper No. 29, OECD.

Clark and Clark (2014). Nations and the Wealth of Cities: A New Phase in Public Policy. London, Centre for London.

Cochran, I. (2012). The Local-Level Management of Climate Change: the Case of Urban Passenger Transportation in France, Université Paris-Dauphine et Mines Paris-Tech. Docteur de l'Université Paris-Dauphine Sciences Economiques.

Conroy, S. (2013). Congestion Charging and Traffic Enforcement. London, Transport for London.

Dachis, B. (2011). Congestive Traffic Failure: The Case for High-Occupancy and Express Toll Lanes in Canadian Cities, CD Howe Institute.

Dasgupta, M., R. Oldfield, et al. (1994). "Impact of transport policies in five cities." TRL Project Report(PR 107).

Davis, S. J., K. Caldeira, et al. (2010). "Future CO₂ emissions and climate change from existing energy infrastructure." *Science* 329(5997): 1330-1333.

de Charentenay, J., A. Leseur, et al. (2012). Regional Climate- Air-Energy Plans:A tool for guiding the energy and climate transition in French Regions Climate Report Paris, CDC Climat. 36

De Lara, M., A. De Palma, et al. (2013). "Congestion pricing and long term urban form: Application to Paris region." *Regional Science and Urban Economics* 43(2): 282-295.

Deweese, D. N. (1976). "The effect of a subway on residential property values in Toronto." *Journal of Urban Economics* 3(4): 357-369.

Dobbs, R., J. Oppenheim, et al. (2011). Resource Revolution: Meeting the world's energy, materials, food and water needs. London, McKinsey Global Institute.

Dodman, D., B. Dalal-Clayton, et al. (2013). Integrating the Environment in Urban Planning and Management. UNEP. Nairobi, UNEP.

Dye, R. F. and R. W. England (2010). Assessing the theory and practice of land value taxation. Cambridge MA, Lincoln Institute of Land Policy.

Eliasson, J. (2008). "Lessons from the Stockholm congestion charging trial." *Transport Policy* 15(6): 395-404.

- EMBARQ. (2013). "166 cities worldwide adopt bus rapid transit – a key tipping point." Retrieved March 20, 2014, from <http://www.embarq.org/en/news/13/10/30/160-cities-worldwide-adopt-bus-rapid-transit-%E2%80%93-a-key-tipping-point>.
- EMBARQ (2013a). Financing Needs for Sustainable Transport Systems for the 21st Century. World Resources Institute (WRI) Center for Sustainable Transport. Background paper presented at the 7th Regional Environmentally Sustainable Transport Forum in Asia, 23- 25 April 2013. Bali, Indonesia.
- EMBARQ (2014) Bogota, Global BRT Data, EMBARQ. Retrieved 30 July , 2014, from http://brtdata.org/#/location/latin_america/colombia/bogota
- Energy Foundation (2014). Building Livable Cities in China. Submitted as part of New Climate Economy Call for Evidence.
- Enoch, M., S. Potter, et al. (2005). "A strategic approach to financing public transport through property values." *Public Money and Management* 25(3): 147-154.
- Ewing, R. and F. Rong (2008). "The impact of urban form on US residential energy use." *Housing Policy Debate* 19(1): 1-30.
- Ewing, R. H. (2008). Characteristics, causes, and effects of sprawl: A literature review. *Urban Ecology*, Springer: 519-535.
- Fensham, P. and B. Gleeson (2003). "Capturing value for urban management: a new agenda for betterment." *Urban Policy and Research* 21(1): 93-112.
- Floater, G., Rode, P., Robert, A., Kennedy, C., Hoornweg, D., Slavcheva, R., Godfrey, N. (2014). Cities and the New Climate Economy: the Transformative Role of Global Urban Growth. NCE Cities Paper 01. LSE Cities. London School of Economics and Political Science.
- Floater, G., P. Rode, et al. (2013). Stockholm: Green Economy Leader Report. London, LSE Cities, London School of Economics and Political Science.
- Floater, G., P. Rode, et al. (2014a). Copenhagen: Green Economy Leader Report. London, LSE Cities, London School of Economics and Political Science.
- Franszen, R. (2013). Property Taxation in Developing Countries. 8th Mass Appraisal Valuation Symposium Durban, South Africa.
- Fuller, B. and P. Romer (2014c forthcoming). OECD Regional Outlook 2014 Paris, OECD.
- Gakenheimer, R. (2011). "Land Use and Transport in Rapidly Motorizing Cities: Contexts of Controversy." *Urban Transport in The Developing World: A Handbook of Policy and Practice*.
- GASB (2008). Research Brief: State and Local Government Use of Generally Accepted Accounting Principles for General Purpose External Financial reports. Norwalk, GASB.
- Gehl, J. (2011). *Life between buildings: using public space*, Island Press.
- Gennaio, M.-P., A. M. Hersperger, et al. (2009). "Containing urban sprawl—Evaluating effectiveness of urban growth boundaries set by the Swiss Land Use Plan." *Land Use Policy* 26(2): 224-232.
- Gertz, C. (1998). *Umsetzungsprozesse in der Stadt-und Verkehrsplanung: Die Strategie der kurzen Wege*. Berlin, TU, Univ.-Bibliothek.
- Gillingham, K., R. G. Newell, et al. (2009). *Energy Efficiency Economics and Policy*. Discussion Paper. Washington D.C, National Bureau of Economic Research.

Glaeser, E. (2011). *Triumph of the City: How Our Greatest Invention Makes us Richer, Smarter, Greener, Healthier and Happier*. New York, Penguin Press.

GoHK (2014). *Hong Kong planning standards and guidelines*. Hong Kong, Government of the Hong Kong Special Administrative Region.

Government of India (2014). *India Transport Report: Moving India to 2032*. New Delhi, Government of India. Vol 3.

Greenhouse Gas Protocol. (2012). "The Greenhouse Gas Protocol Initiative." Retrieved 20 March, 2014, from <http://www.ghgprotocol.org/about-ghgp>.

GSMA and AT Kearney (2013). *The Mobile Economy 2013*. London.

Guo, Z. and S. Ren (2013). "From Minimum to Maximum: Impact of the London Parking Reform on Residential Parking Supply from 2004 to 2010?" *Urban Studies* 50(6): 1183-1200.

Hale, C. (2011). *Evolving futures for Australian and international passenger rail*. Australasian Transport Research Forum. Adelaide, Australia.

Hall, P. (1993). "Forces shaping urban Europe." *Urban Studies* 30(6): 883-898.

Haveman, M. and T. A. Sexton (2008). *Property tax assessment limits: Lessons from thirty years of experience*, Lincoln Institute of Land Policy Cambridge, MA.

Holgate, C. (2007). "Factors and actors in climate change mitigation: a tale of two South African cities." *Local Environment* 12(5): 471-484.

IBM. (2011). "City of Rio de Janeiro and IBM Collaborate to Advance Emergency Response System; Access to Real-Time Information Empowers Citizens." Retrieved 5 March, 2014, from <http://www-03.ibm.com/press/us/en/pressrelease/35945.wss>.

IETA (2013). *Tokyo- The World's Carbon Markets: A Case Study Guide to Emissions Trading*. Geneva, International Emissions Trading Association.

Ingram, G. and Y. Hong (2012). *Land Value Capture: Types and Outcomes. Value Capture and Land Policies*. G. Ingram and Y. Hong. Cambridge MA, Lincoln Institute of Land Policy.

International Telecommunications Union (2013). *ICT Facts and Figures: The World in 2013*. Geneva, ITU.

IPCC (2014). *Climate Change 2014: Mitigation of Climate Change - Human Settlements*. Potsdam, IPCC - Working Group III.

Kamal-Chaoui, L. and A. Robert (2009). *Competitive Cities and Climate Change*. OECD Regional Development Working Papers No. 2. Paris, OECD.

Kaminker, C. (2014 forthcoming). *Mobilising Institutional Investment for Sustainable Energy Infrastructure: Defining Channels and Approaches*. Paris, OECD Publishing.

Kebe, Bellassen, et al. (2011). *Voluntary Carbon Offsetting by Local Authorities: Practices and Lessons*. Paris, CDC.

Kelbaugh, D. (1989). *The Pedestrian Pocket Book: A New Suburban Design Strategy*. Princeton, Princeton Architectural Press.

Kern, K. and H. Bulkeley (2009). "Cities, Europeanization and Multi-level Governance: Governing Climate Change through Transnational Municipal Networks*" *JCMS: Journal of Common Market Studies* 47(2): 309-332.

- Kidney, S. (2014). "Just Out: First emerging market green city bond... City of Johannesburg Green Bond, approx R1.5bn (\$139m), 1.5x oversubscribed!" Retrieved June 6, 2014, from <http://www.climatebonds.net/2014/06/just-out-first-emerging-market-green-city-bond-city-johannesburg-green-bond-approx-r15bn#sthash.RIZcgEDR.dpuf>.
- Kidney, S. (2014a). "Île-de-France issues EUR600m (\$830m), 12yr, AA+ Green Muni. They had so many orders in one hour they upped it from 350m to 600m." Retrieved 20 May 2014.
- Kim, S., A. Schumann, et al. (2014). What Governance for Metropolitan Areas. OECD Regional Development Working Papers. Paris, OECD.
- Kodransky, M. and G. Hermann (2011). Europe's Parking U-Turn: From Accomodation to Regulation, Institute for Transportation and Development Policy New York, NY.
- Krause, R. M. (2011). "Symbolic or substantive policy? Measuring the extent of local commitment to climate protection." *Environment and Planning C: Government and Policy* 29(1): 46-62.
- Landis, J., R. Cervero, et al. (1991). "Transit joint development in the USA: an inventory and policy assessment." *Environment and Planning C: Government and Policy* 9(4): 431-452.
- Lee, C. and P. Erickson (2014). Competitive cities = Low carbon cities? Assessing the evidence. Submitted as part of New Climate Economy Call for Evidence, SEI-US.
- Li, J. (2011). "Supporting greenhouse gas mitigation in developing cities: a synthesis of financial instruments" *Mitig Adapt Strateg Glob Change*, 16: 677-698.
- Lindfield, M. and F. Steinberg (2012). Green Cities. Urban Development Series. Manila, Asian Development Bank.
- Litman, T. (2014). Analysis of public policies that unintentionally encourage and subsidize urban sprawl. New Climate Economy Cities. Supporting paper commissioned by LSE Cities, Victoria Transport Policy Institute.
- Mancini Nichols, C. (2012). "Value Capture Case Studies: Atlanta Beltline." Value Capture Case Studies Retrieved March 2012, 2014, from <http://www.metroplanning.org/news/article/6357>.
- Manville, M. and D. Shoup (2004). "People, parking and cities." *ACCESS Magazine* 1(25).
- Matsumoto, T. and C. Nuttall (2014 forthcoming). National and Subnational Integration. Green Growth in Practice: Lessons from Country Experiences. Seoul, Green Growth Best Practice Initiative.
- McCarney, P., H. Blanco, et al. (2011). Cities and climate change. Climate Change and Cities: First Assessment report of the Urban Climate Change Research Network. C. Rosenzweig, W. Solecki, S. Hammer and S. Mehrotra. Cambridge, Cambridge University Press: 249-269.
- Menckhoff, G. (2005). Latin American experience with bus rapid transit Annual Meeting of the Institute of Transportation Engineers. Melbourne.
- Merk, O., E. Slack, et al. (2012). Financing Green Urban Infrastructure. Regional Development Working Papers 2012/10. OECD. Paris
- Misczynski, D. (2012). Special Assessments in California: 35 Years of Expansion and Restriction. Value Capture and Land Policies. G. Ingram and Y. Hong. Cambridge MA, Lincoln Institute of Land Policy.
- Molina, M. J. and L. T. Molina (2004). "Megacities and atmospheric pollution." *Journal of the Air & Waste Management Association* 54(6): 644-680.

Morel, R. and C. Bordier (2012). Financing the transition to a green economy: their word is their (green) bond? Climate Brief. Paris, CDC Climate Research. No. 14 May 2012.

Müller, B. and S. Siedentop (2004). "Growth and shrinkage in Germany—Trends, perspectives and challenges for spatial planning and development." *German Journal of Urban Studies* 44(1): 14-32.

Müller, D. B., G. Liu, et al. (2013). "Carbon Emissions of Infrastructure Development." *Environmental Science and Technology* 47(20): 11739–11746.

Multinational Development Banks (2012). Joint Statement on Commitment to Sustainable Transport. Joint Statement to the Rio+20 United Nations Conference on Sustainable Development by the African Development Bank, Asian Development Bank, CAF-Development Bank of Latin America, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, Islamic Development Bank, and World Bank. .

Multinational Development Banks (2013). Progress Report 2012-2013 of the MDB Working Group on Sustainable Transport.

Ndou, V. (2004). "E-government for developing countries: opportunities and challenges." *The Electronic Journal of Information Systems in Developing Countries* 18(1): 1-24.

Nelson, A. C., L. K. Bowles, et al. (2008). *A guide to impact fees and housing affordability*. Washington D.C, Island Press.

Netzer, D. (1998). *Land value taxation: Can it and will it work today?* Cambridge MA, Lincoln Institute of Land Policy.

Norregaard, J. (2013). *Taxing Immovable Property: Revenue Potential and Implementation Challenges*. IMF Working Paper. Washington, IMF.

OECD (2007). *Infrastructure to 2030: Mapping Policy for Electricity, Water and Transport (Volume 2)*. Paris, OECD.

OECD (2010). *Cities and Climate Change*. Paris, OECD Publishing.

OECD (2010a). *Implementing Congestion Charges*. Round Table 147. OECD. Paris, OECD.

OECD (2012). *Environmental Outlook to 2050: The Consequences of Inaction*. Paris, OECD.

OECD (2012a). *Compact City Policies: A Comparative Assessment*. OECD Green Growth Studies. Paris, OECD Publishing.

OECD (2012b). *OECD Territorial Reviews: The Chicago Tri-State Metropolitan Area, United States*. Paris OECD Publishing.

OECD (2013). *Green Growth in Stockholm, Sweden*. Paris, OECD

OECD (2013a). *Urbanisation and Green Growth in China*. OECD Regional Development Working Papers. Paris, OECD.

OECD (2013b). *Green Growth in Cities*. OECD Green Growth Studies. Paris, OECD

OECD (2013c). *Green Growth in Kitakyushu*. OECD. OECD Green Growth Studies. Paris, OECD.

OECD (2014). *What Makes Cities more Productive? Evidence on the Role of Urban Governance from 5 OECD Countries*. Paris, OECD.

OECD (2014a forthcoming). *The Metropolitan Century*. Paris OECD.

OECD (2014b forthcoming). Chapter 5, *A National Strategy for Cities: Taking Ownership of Urban Policy*. Regional Outlook 2014. Paris, OECD

OECD (2014c forthcoming). *Urban Trends and Governance*. Paris OECD.

Oliver, P., B. Boulle, et al. (2013). *Bonds and Climate Change: The State of the Market in 2013*. London, Climate Bonds Initiative.

Pardo, C. F., Y. Jieman, et al. (2012). *Sustainable Urban Transport. Shanghai Manual: A Guide for Sustainable Urban Development in the 21st Century*. New York, UNDESA.

Parry, M. L. (2009). *Assessing the costs of adaptation to climate change: a review of the UNFCCC and other recent estimates*. London, IIED.

Peterson, G. (2009). *Unlocking Land Values to Finance Urban Infrastructure*. Washington DC, World Bank.

Pickle, A. (2014 forthcoming). *21st Century Water Asset Accounting: Case Studies Report*. London, International Water Association Publishing.

Pitt, D. (2010). "The impact of internal and external characteristics on the adoption of climate mitigation policies by US municipalities." *Environment and planning. C, Government & policy* 28(5): 851.

Platz, D. (2009). *Infrastructure finance in developing countries— the potential of sub-sovereign bonds*. DESA Working Paper No. 76. New York, UN Department of Economic and Social Affairs.

Power, A. and R. Burdett (1999). *Towards an Urban Renaissance*. London, E and F N Spon.

PPIAF (2011). *PPIAF Helps Peruvian Sub-Nationals Tap Financial Markets*. Washington DC, PPIAF.

PPIAF (2012). *Importance of a National Scale Credit Ratings for Sub-National Authorities that Borrow Long term*. Washington D.C, PPIAF.

Pucher, J. and R. Buehler (2006). "Why Canadians cycle more than Americans: a comparative analysis of bicycling trends and policies." *Transport Policy* 13(3): 265-279.

Ricardo AEA (2011). *Cities and low carbon development. Low Carbon Development: Summary Sheets*. London, Ricardo AEA

Rode, P. (2014). *The Politics and Planning of Urban Compaction: The Case of the London Metropolitan Region. The Economy of Sustainable Construction*. N. J. Ilka and Andreas Ruby. Berlin, Ruby Press.

Rode, P. and R. Burdett (2011). *Cities. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Nairobi, UNEP.

Rode, P., G. Floater, et al. (2013). *Going Green: How cities are leading the next economy*. London, LSE Cities, London School of Economics and Political Science.

Rode, P., Floater, G., Thomopoulos, N., Docherty, J., Schwinger, P., Mahendra, A., and Fang, W. (2014): *Accessibility in Cities: Transport and Urban Form*. NCE Cities Paper 03. LSE Cities. London School of Economics and Political Science.

Rode, P., C. Keim, et al. (2013). "Cities and energy: urban morphology and residential heat energy demand." *Environment and Planning B: Planning and Design* 40(1): 138 – 162.

Rode, P., J. Wagner, et al. (2008). *Integrated city making: Governance, planning and transport*. London, LSE Cities, London School of Economics and Political Science.

Rogat, J., M. Hinojosa, et al. (2008). "Promoting sustainable transport in Latin America through mass transit technologies." *Ghardaïa, Algeria 16-18 February 2009*: 83.

Rogers, R. G. and A. Power (2000). *Cities for a Small Country*. London, Faber.

- Roswendi, E. (2012). *The Role of Municipal Bond in Regional Development*. Jakarta, Pefindo.
- Sandroni, P. (2010). *A New Financial Instrument of Value Capture in São Paulo : Certificates of Additional Construction Potential. Municipal Revenues and Land Policies*. G. Ingram and Y. Hong. Cambridge MA, Lincoln Institute of Land Policy.
- Serva, L. (2014). How São Paulo uses “value capture” to raise billions for infrastructure - Citiscope. Washington DC, Citiscope Global News. May 22 2014.
- Severinson, C. (2010). *The New IAS 19 Exposure Draft*. Paris, OECD Publishing.
- Shankleman, J. (2013). *Green Investment Bank backs Merseyside waste to energy plant*. Business Green. London, Incisive Financial Publishing Limited.
- Shoup, D. C. (1997). “The high cost of free parking.” *Journal of Planning Education and Research* 17(1): 3-20.
- Siemens and C40 (2013). *Leadership Awards 2013 Cities leading the way to a sustainable future: Summary and profile of winners*. London Siemens and C40.
- Sietchiping (2011). *Innovative Land and Property Taxation*. Nairobi, UN-HABITAT.
- Smith, J. J. and T. A. Gihring (2006). “Financing transit systems through value capture.” *American Journal of Economics and Sociology* 65(3): 751-786.
- Smolka, M. (2013). *Implementing Value Capture in Latin America: Policies and Tools for Urban Development*. Cambridge, MA, Lincoln Institute.
- Suzuki, H., R. Cervero, et al. (2013). *Transforming cities with transit: Transit and land-use integration for sustainable urban development*. Washington D.C, World Bank Publications.
- Suzuki, H., J. Murakami, et al. (2014 forthcoming). *Financing Transit with Land Values: Adapting Development-based Land Value Capture in Developing Countries*. Washington D.C, World Bank.
- Talen, E. (2011). *City rules: How Regulations Affect Urban Form*. Washington D.C, Island Press.
- Teixeira, M. (2014). *BVRio Environmental Exchange and Getúlio Vargas Foundation start emissions trading simulation with blue chip companies in Brazil*. BV Rio Newsletter. Rio de Janeiro, BV Rio.
- Thomas, L. and W. Cousins (1996). *A new compact city form: concepts in practice. The Compact City: a sustainable urban form*. E. Burton, M. Jenks and K. Williams. London, Routledge.
- Treasury Department (2009). *Australia’s Future Tax System*. Canberra, Government of Australia.
- UK Green Investment Bank. (2013). “GIB and Foresight Group forge consortium to construct £47.8m renewable energy plant in Birmingham.” Retrieved March 20, 2014, from <http://www.greeninvestmentbank.com/news-and-insight/2013/gib-and-foresight-group-forge-consortium-to-construct-478m-renewable-energy-plant-in-birmingham/>.
- UK Green Investment Bank (2013a). *Green Investment Bank- Case Study: The Green Deal Finance Company*. Green Investment Bank- case studies. London, Green Investment Bank.
- UK Green Investment Bank (2014). *Our Investments - to date*. Edinburgh, UK Green Investment Bank.
- UK Green Investment Bank. (2014). “What we do” Retrieved April 20, 2014 from <http://www.greeninvestmentbank.com/what-we-do/>.
- UN DESA (2014). *World Urbanization Prospects: The 2014 Revision, Highlights*. Geneva, UN DESA.

- UN HABITAT (2012). *Leveraging Density : Urban Patterns for a Green Economy*. Nairobi, UN Habitat.
- UN HABITAT (2012a). *Leveraging Density- Urban Patterns for a Green Economy*. Nairobi, UN Habitat.
- UN HABITAT (2013). *Planning and design for sustainable urban mobility: Global report on human settlements 2013*. United Nations Human Settlements Programme. New York, United Nations.
- UN Statistics Division (2009). *System of National Accounts 2008*. New York, United Nations.
- UNEP (2010). *Overview of the Republic of Korea's National Strategy for Green Growth*. UNEP Green Economic Initiative. Nairobi, UNEP.
- Viguié, V. and S. Hallegatte (2012). "Trade-offs and synergies in urban climate policies." *Nature Climate Change* 2(5): 334-337.
- Villa, N. and S. Mitchell (2009). *Connecting cities: achieving sustainability through innovation*. Fifth Urban Research Symposium, Marseille.
- Whitelegg, J. and G. Haq (2003). "The global transport problem: same issues but a different place." *The Earthscan reader on world transport, policy and practice*. London, Earthscan Publications 1: 28.
- WHO (2014). *Air pollution estimates: World Health Organisation*. Geneva, WHO.
- Williams, K., E. Burton, et al. (2000). *Achieving sustainable urban form: an introduction*. Achieving sustainable urban form. E. Burton, M. Jenks and K. Williams. London, Routledge: 1-5.
- Willson, R. W. (1995). "Suburban parking requirements: a tacit policy for automobile use and sprawl." *Journal of the American Planning Association* 61(1): 29-42.
- World Bank (2010). *Cities and Climate Change Mitigation: Case Study on Tokyo's Emissions Trading System*. Washington DC, World Bank.
- World Bank (2013). *Planning, Connecting, and Financing Cities Now: Priorities for City Leaders*. Washington D.C, World Bank.
- World Bank (2013a). "Financing Sustainable Cities: How We're Helping Africa's Cities Raise Their Credit Ratings." Retrieved March 20, 2014, from <http://www.worldbank.org/en/news/feature/2013/10/24/financing-sustainable-cities-africa-creditworthy>.
- World Bank (2013c). *Urbanization beyond municipal boundaries: Nurturing metropolitan economies and connecting peri-urban areas in India*. Washington DC, International Bank for Reconstruction and Development: xvi+ 106pp.
- World Bank (2014a). "Asian Cities: Climate Focus Needed in Capital Investment Planning." Retrieved May 15, 2014, from <http://www.worldbank.org/en/news/feature/2014/05/15/asian-cities-climate-focus-needed-capital-investment-planning>.
- World Bank (2014). *Urban China: Toward Efficient, Inclusive and Sustainable Urbanisation*. Washington D.C, World Bank.
- World Economic Forum (2013). *The Green Investment Report: The ways and means to unlock private finance for green growth*. Geneva, World Economic Forum.