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Article

Politics and Space C

Environment and Planning C: Politics and Space
2019, Vol. 37(1) 137–156
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DOI: 10.1177/2399654418778596
journals.sagepub.com/home/epc
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Governance for green urbanisation: Lessons from Singapore's green building certification scheme

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Abstract

As more and more Asian countries join the global urbanisation trend, numerous negative environmental consequences loom larger than ever, rendering green urbanisation an urgent public policy agenda. This study addresses how Singapore has met this challenge and established itself as one of the world's greenest urban centres through the implementation of the Green Mark Scheme since 2005. Drawing on the new urban governance literature, this study argues that several conditions have enabled this result. First, the government has steered the design and promotion of the Green Mark Scheme, introducing various legal and regulatory mechanisms to undergird the Green Mark Scheme regime. Second, various financial incentive schemes, risk-sharing programmes and rewards have made the government's commitment credible, lowering entry barriers for new participants. While these policy instruments and measures echo Singapore's top–down policy-making tradition and developmental state legacy, the government has increasingly relied on collaborative partnerships with multiple stakeholders to generate positive environmental impacts throughout buildings' entire life cycles. These elements have created an effective mode of new green urban governance. This study illustrates how policy-makers can facilitate sustainable urbanisation by adopting green initiatives tailored to their local conditions. Moreover, this study argues that green urbanisation entails not just technical aspects but also governance elements.

Keywords

Singapore, green building, Green Mark Scheme, new urban governance, urbanisation

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Introduction

Urbanisation and environment

Urbanisation has been an accelerating global trend. More than 50% of the world's population live in cities now, and by 2100, about 85% will be urbanised, making cities spheres of governance for meeting social, economic and environmental concerns (Douglass, 2016: 1). Cities' roles as the main sites and sources of environmental problems have been widely researched (Astleithner and Hamedinger, 2003; Betsill and Bulkeley, 2007; DiGaetano and Strom, 2003; Hardoy et al., 2001; Low et al., 2000; Rees and Wackernagel, 1996). For instance, cities account for two-thirds of global energy consumption and 70% of greenhouse gas emissions (Ostojic et al., 2013), rendering them important players in global climate change governance (Schroeder et al., 2013).

A parallel story applies to Asia, in which countries have undergone urbanisation at an unprecedented pace and scale. Since the end of Second World War, Asian governments have promoted rapid urbanisation as a strategy for national development and regime legitimacy (Douglass, 2016). Moreover, increasing mobility, pro-urban policy for economic growth and growing inter-city competition for investment and productivity (Lo and Yeung, 1996) have accelerated urbanisation. Around half a billion people moved into cities in the last four decades in Asia (South China Morning Post, 2014a), and the Asian urban population will soar from 1.9 bn in 2011 to 3.3 bn by 2050 (South China Morning Post, 2014b). Cities in Asia, however, have increasingly confronted hazardous environmental conditions, such as air and water pollution, solid waste and toxic gases, which have generated public health problems and financial costs (Wescott and Jones, 2007: 337).

How to govern cities' living and functional spaces so that they serve sustainable development and human flourishing has become one of the most urgent challenges in this context (Douglass, 2016; Ng, 2007a: 325). Asian cities need to develop policies to reduce demand for fossil fuel-based energy through efficient public transport and cleaner fuels, stop the degradation of water and air pollution and promote recycling and reprocessing of waste (United Nations Economic and Social Commission for Asia and the Pacific, 2013). Some Asian megacities have improved the local and global environment through new urban designs, technologies and products (Fujita and Hill, 2007). However, the tension between urban expansion and environmental sustainability remains unresolved as many rising cities lag behind the advanced countries in green urbanisation practices (Van der Heijden, 2016).

Thus, a major policy challenge has become how to achieve green urbanism – which has several features, such as increasing the use of renewable energy, carbon neutrality and being distributed, biophilic, eco-efficient and place-based (Newman and Matan, 2013). However, achieving environmental sustainability in urbanisation requires not just sound policy and institutions but also innovative governance structure that helps organise the relationships between governments and a wide range of stakeholders (Fraser-Moleketi, 2003; Joss, 2015; Smith and Wiek, 2012; Torfing et al., 2012).

Singapore and new green urban governance

Against this backdrop, this research addresses how urbanisation and green development can be coupled by establishing a governance model that is conducive for effective green urbanisation. It examines the case of Singapore, a city-state located off the southern tip of the Malay Peninsula. This country has a densely built-up urban environment with limited land space and few natural resources. While environmental protection has been pursued by the

Singaporean government since the late 1960s, greening buildings began to receive the attention of policy-makers only in the early 2000s as an effective green urbanisation initiative (BCA, n.d.: 5). Since the Singaporean government adopted a green building certification system, called the Green Mark Scheme (GMS), in 2005, there has been rapid expansion of the country's green certified buildings. This study examines what kind of urban governance Singapore has created to undergird the effective implementation of the GMS. A case study method is adopted to help reveal the process through which Singapore's green urban governance model has generated positive policy outcomes in rich detail. This case study also helps develop a theoretical concept and derive specific policy lessons, while large-N studies or comparative case studies would be more suitable for unearthing generalisable patterns across cases.

To address the aforementioned research goals, this study borrows from the new urban governance literature to identify several factors that have contributed to positive outcomes in Singapore's GMS implementation. Governance suggests an arrangement governing beyond the state through horizontal associational networks of private entities, civil society and state actors (Swyngedouw, 1992, 2005). Urban governance has several features, such as partnerships between public institutions and non-public institutions in (re)developing urban areas, a reorganisation of the rights and responsibilities of the national state, changing relationships between the state and citizens and the rise of entrepreneurial governance (McCann, 2017).

'New' urban governance (Van der Heijden, 2016: 2) shares similar characteristics: a shift away from the government as the sole authority in managing urban problems toward the involvement of public and private sector stakeholders; a shift toward networks and collaboration with stakeholders; an interest in governance instruments that encourage self-organisation, market solutions or both as substitutes for or complements to mandatory command-and-control style instruments and a shift toward instruments that reward voluntary compliance as opposed to enforcing mandatory behaviour. However, new urban governance highlights the notion of the 'shadow of hierarchy' as conditions that help the aforementioned features coalesce into a functioning governance structure (Héritier and Eckert, 2008; Van der Heijden, 2016: 9). The shadow of hierarchy suggests that while the horizontal incorporation of diverse stakeholders and multiple instruments is integral, the government should play a central role in establishing a sound institutional foundation by installing adequate regulatory systems and by providing incentives to facilitate effective new urban governance. Thus, rather paradoxically, the new governance model reasserts the centrality of the government in catalysing an effective governance system.

Given the dearth of empirical studies that concretise and exemplify these arguments, this study demonstrates how Singapore has achieved new green urban governance, leading to effective implementation of the GMS. This study illustrates how the shadow of hierarchy has been mustered by the Singaporean government, facilitating a functioning new urban governance structure. This study reveals that the implementation of the GMS has been planned and led by the Singaporean government through a lead agency, echoing the country's traditional mode of governance under the developmental state legacy. However, rather than applying a purely top–down approach to the GMS, the government has engaged multiple stakeholders and adopted diverse policy instruments, including market incentives, ensuring its roles do not eclipse those of other stakeholders in society.

Buildings and green urbanisation

Before turning to the case study, a brief discussion on green buildings is in order, to establish the linkages between buildings and sustainable urbanisation. Although often unnoticed

owing to their permanent and static nature, buildings have significant environmental impact, accounting for 40% of global energy consumption and resources, 25% of global water consumption and one-third of greenhouse gas emissions (Building and Construction Authority, BCA, n.d.: 5). The built environment, then, should be an important consideration in sustainable urban governance.

Green buildings incorporate various features, such as solar panels, energy-saving elevators and escalators, highly efficient air-conditioning units and software that monitors buildings' carbon dioxide emissions (Ives, 2013). Green buildings generate several benefits. For instance, commercially available green technologies can reduce green buildings' energy consumption by 30–80% (BCA, n.d.: 5). Furthermore, they allow reduced consumption of materials, less waste production and reduction of traffic throughout their life cycle. Moreover, they incorporate aesthetically pleasing designs, generating positive effects on physical and mental health of city dwellers (Lee and Koski, 2012). Various studies demonstrate diverse economic benefits of green buildings (Deng et al., 2012; Eichholtz et al., 2012; Heinzle et al., 2013).

These benefits have led to growing attention toward various mandatory and voluntary initiatives for green buildings since the early 1990s. For instance, advanced economies have adopted systems to certify green buildings to make their resource consumption and carbon intensity visible and transparent as well as to measure their performance objectively (Van der Heijden, 2016: 7). Such certification systems apply specified sets of standardised criteria covering sites, water, material, energy and indoor environment quality as well as other attributes of sustainable design (Gou and Lau, 2014: 282). These certification tools then rank environmental performance relative to business-as-usual practices, design codes and engineering standards, providing evidence for judging buildings' sustainability and preventing arbitrary decisions (Gou and Lau, 2014: 282).

Various green building certification systems exist at local, national and international levels, reflecting diverse lifestyles, preferences, urban morphology and climate variations (Gou and Lau, 2014; Koski, 2010; Laitner et al., 2007). Many countries have introduced green building certification as an alternative to mandatory government instruments to promote green buildings, as such instruments remain ineffective and slow (Van der Heijden, 2014, 2017). Interest in green buildings and their certification schemes has grown in Asia too as countries strive to achieve sustainability of the built environment (Gou and Lau, 2014; Ye et al., 2015). For instance, Malaysia introduced the Green Building Index in May 2009 on a voluntary basis (Yiing et al., 2013). In China, dozens of green building standards have been initiated by the central and local governments since green buildings were incorporated into the 12th Five-Year Plan (2011–2015).

However, green buildings have remained an issue of low saliency (Koski, 2010: 101) because they are often indistinguishable from conventional buildings. Moreover, the environmental harm caused by conventional buildings remains diffuse and invisible compared to such visible externalities as air pollution, dampening efforts to promote green buildings. Multiple economic, political, institutional and social factors serve as barriers to entry (Allouhi et al., 2015). Potential participants might not have access to knowledge available or might feel that their actions alone would not help resolve urban sustainability challenges when others do not take similar actions and free ride on their efforts (Van der Heijden, 2017: 26). As these factors lead to market failures, the public sector seems better positioned to lead green urbanisation via buildings, as this study shows in the case of Singapore.

The rest of this article proceeds as follows. The following section describes the broad policy context where the green building agenda emerged in Singapore. The section thereafter examines the process of GMS execution since 2005 and discusses the policy outcomes

achieved thus far. The penultimate section provides a detailed account of the factors that have enabled the effective implementation of the GMS. The concluding section discusses the implications and policy lessons that the findings of this study generate for green urbanisation in Asia and beyond.

Green buildings in Singapore

Singapore obtained independence from British colonial rule in 1959 and briefly joined the Malaysian Federation in 1963 until it departed the federation in 1965. Singapore's small landmass and lack of natural resources heightened this young nation's sense of vulnerability, leading to the emergence of a developmental state where power is highly concentrated around the central government (Doner et al., 2005; Low, 2001; Pereira, 2008; Perry et al., 1997). For decades, the central government equipped with technocratic bureaucrats has adopted a meticulous planning and management approach to lead Singapore's rapid economic growth through the optimal use of its limited resources and land (Perry et al., 1997; Wong, 2011). Throughout this transition, the government has orchestrated the development of its urban landscape by controlling the design and construction of buildings (Lee, 2010). Through central planning and technocratic management, the developmental state aimed to promote the country's transition to an advanced economy.

However, what differentiated Singapore from many of its Asian neighbours was that environmental protection goals were incorporated into its urban planning as early as the 1960s. The founding Prime Minister, Lee Kuan Yew, declared Singapore's vision of building a green and clean garden city (National Parks Board, n.d.) and set institutional and legal foundations for further environmental reform (Heng, 2008). Singapore adopted the Clean Air Act in 1971 and established its environmental ministry in 1972, one of the world's first environmental ministries, with broad mandates ranging from public health to pollution monitoring (Goh, 2001: 11). Over time, green urban spaces, such as parks and corridors, have been expanded dramatically (Han, 2017; Tan et al., 2013). These measures have given Singapore the accolade of the most sustainable city in Asia (Khoo, 2016).

This transition to a garden city has exhibited the top–down and managerial aspects of the developmental state. According to recent studies (Han, 2017), the Singaporean government has empowered the central planning agency to apply a technocratic approach to environmental governance, while its environmental agency and civil society remain at the margin of the policy process. Moreover, the Singaporean government has exhibited a highly instrumental perspective toward environmental governance, considering it a means to achieve national advancement and competitiveness (Wong, 2012). That the environment can be most effectively managed by the government and its market-oriented and technocratic approaches reflects the ecological modernisation thinking that has shaped this developmental state and its leaders' perspectives (Neo, 2013).

Throughout this transition to a garden city, the nexus between buildings and environmental sustainability has become clearer. Considered the symbols of the country's economic rise and seen as a policy domain to which the government's technocratic and managerial approaches can be easily applied, modern and technically advanced green buildings have begun to receive the attention of the policy-makers.

Buildings are one of the main consumers of energy in Singapore. As of 2012, commercial buildings accounted for 38% of national electricity consumption (Figure 1), making buildings a crucial component of achieving the national goal of 35% reduction in energy intensity by 2030 (Ives, 2013).

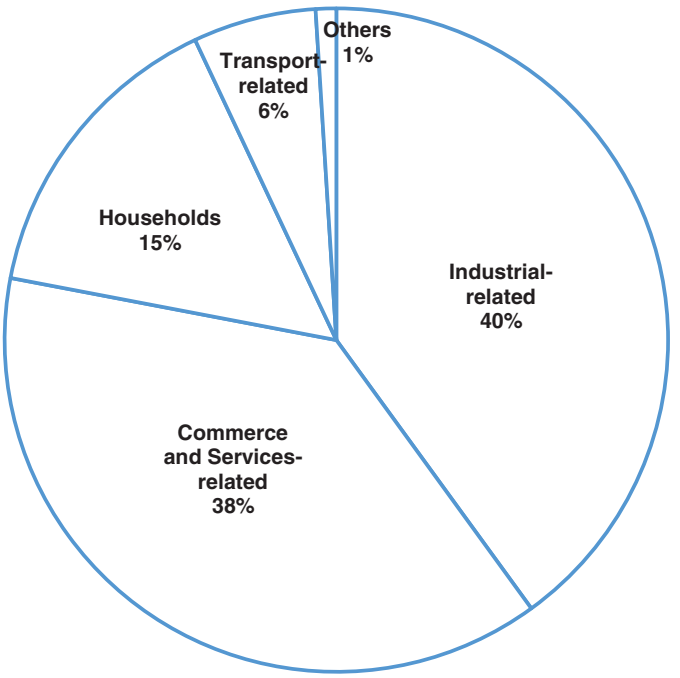

Figure 1. Electricity consumption in Singapore in 2012.
Source: BCA (2014b: 15).

Moreover, Singapore's urbanisation has led to a rising carbon footprint. According to the National Climate Change Secretariat (NCCS, n.d.), Singapore is responsible for about 0.11% of global greenhouse gas emissions, but its contribution has been rising (Figure 2). The NCCS (n.d.) predicted in 2005 that emissions under a business-as-usual scenario would reach 77.2 million tonnes by 2020 and buildings would account for 13.8% of the total emissions, making them the third largest source of emissions after industry (60.3%) and transport (14.5%). Moreover, International Energy Agency data ranked Singapore the 26th in the world in terms of emissions per capita, mainly due to its small size and density. This projection has alerted the government to the necessity for emission mitigation to retain its reputation as a garden city. Buildings, as the third largest sources of emissions, have naturally become one of the focal areas for abatement efforts. The mounting international pressure to develop actions for climate change mitigation and the government's aspiration to expand its leadership in energy efficiency in the Southeast Asian region and beyond have also prompted the adoption of the green building standardisation measures (Van der Heijden, 2017: 172–173).

Sustainable urbanisation through the GMS

As outlined in the previous section, green buildings have been integrated into Singapore's urban planning and governance for the past two decades. Prior to the early 2000s, guidelines for sustainable buildings suitable for Singapore were scarce as the existing green building standardisation schemes of the US and Europe did not apply to Singapore's local climate and conditions (BCA, n.d.: 8). Thus, the BCA decided to launch the GMS as its own green

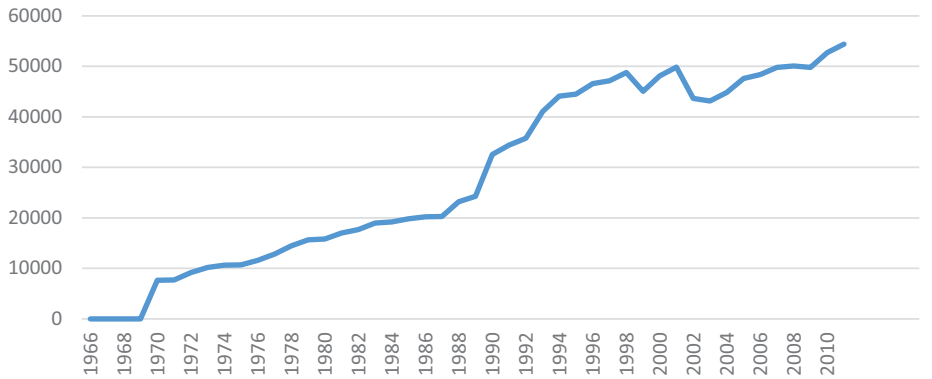

Figure 2. Singapore's total greenhouse gas emissions (kt of CO2 equivalent).
Source: World Bank (2016).

building certification tool in 2005 to promote safe, high-quality, sustainable and environment-friendly buildings. This GMS ranks the greenness of buildings by four categories – Certified, Gold, Gold Plus and Platinum – based on total points obtained.

The GMS has provided a standard benchmark and guidelines for the industry to follow when constructing new buildings and retrofitting existing ones (BCA, n.d.: 9). Over time, the standards have expanded to encompass a greater variety of building types, incorporating such elements as passive design, the use of sustainable construction materials and the development of performance-based design and systems (BCA, n.d.: 6). The most recent version of the GMS announced in 2015 measures the greenness of buildings based on five criteria and associated indicators that encompass the entire value chain (Table 1). The GMS uses these indicators to identify and reward the owners and property developers of buildings equipped with sustainable design features and help them integrate more environmental features into construction and management practices.

Since 2005, the GMS regime has been reinforced by a series of legal and institutional measures (BCA, n.d.). In 2006, the BCA introduced the first Green Building Masterplan to announce the government's plan to green new buildings by using financial incentives, legislation and industrial training programmes, and to raise public awareness on green buildings. The second masterplan released in 2009 aimed to incorporate existing buildings into the GMS and expressed the government's ambition to bolster itself as a trendsetter in green buildings (BCA, n.d.: 6). The third masterplan reaffirmed the country's ambition to mark itself as the leader in global green building movement with special expertise in the tropics and sub-tropics (BCA, 2014a). The plan also aimed to promote the concept of total building energy consumption, addressing such issues as internal environment quality and health, life cycle and environmental impact and the behaviour of building occupants (BCA, 2014a).

The GMS implementation has been quite effective, especially when compared to the rather lacklustre accomplishment record of various countries that have adopted similar green building standards (Van der Heijden, 2017). While there were only 17 green buildings in 2005 in Singapore when the GMS was launched, this figure grew to about 1700 in 2013 (Figure 3). Performance data have also indicated positive uptake beyond compliance as 21% of certificates issued in 2014 were Gold Plus and 35% were Platinum (Van der Heijden, 2017: 180). To date, there are more than 2500 green building projects, covering approximately 20% of the gross floor area (GFA) of buildings (BCA, 2015: 9). While green

Table 1. Green Mark 2015 criteria and indicators.

Criteria	Indicators
Climatic responsive design	Leadership
	Urban harmony
	Tropicality
Building energy performance	Energy efficiency
	Energy effectiveness
	Renewable energy
Advanced green efforts	Cost effective design
	Complementary certifications
	Social benefits
	Innovation
Resources stewardship	Water
	Materials
	Waste
Smart and healthy building	Smart operations and control strategies
	Spatial quality
	Indoor air quality

Source: BCA (2015: 10–11).

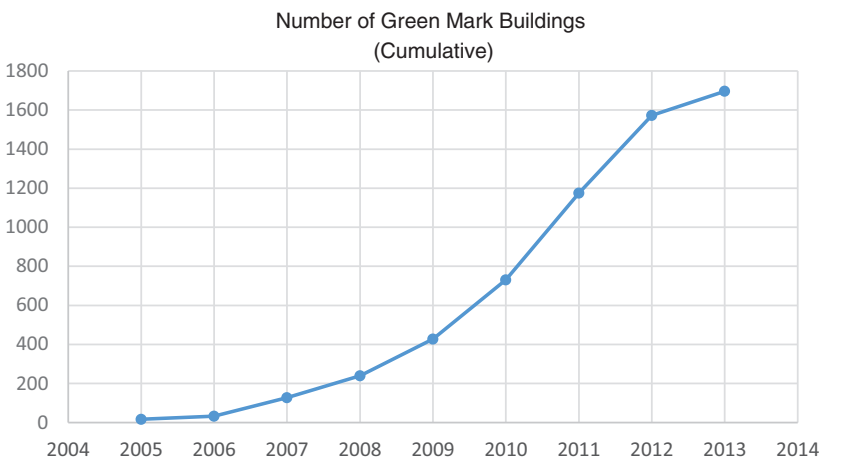

Figure 3. Growth of Green Buildings.
Source: BCA (n.d.: 15).

buildings accounted for only 0.5% of all buildings when the GMS was introduced, this figure increased to 10% in 2010 and 29% in September 2015. Following this trajectory, Singapore's Inter-Ministerial Committee on Sustainable Development, which charts national sustainability strategies, set a goal to increase the ratio of GMS certified buildings to 80% by 2030 (BCA, 2015).

In addition to this growth, the GMS has generated tangible environmental benefits for participants. For instance, Singapore-based CapitaLand, Southeast Asia's largest developer, says investments in green-building technologies have helped the company reduce 11.7% and

16.1% of its energy and water consumption, respectively, since 2008. Moreover, the company reported a 16% reduction in carbon emissions (Ives, 2013). The 2014 Green Mark Champion, Mapletree Investments Pte Ltd, recorded annual electricity savings of more than 53 million kWh, a figure that is equivalent to the electricity needs of more than 9500 households for a year (BCA, 2015).

These achievements accompanied the government's deliberate efforts to promote GMS as its brand in global green building markets. For instance, BCA's Center for Sustainable Buildings has run various capacity-building projects for developing countries since 2009 and has hosted their delegations on study missions about sustainable and energy-efficient buildings (BCA, 2015). Between 2008 and 2013, about 800 delegates participated in the BCA Academy's green building training programmes (BCA, n.d.: 24). Moreover, in August 2015, the Singaporean government hosted the seventh Singapore Green Building Week, at which more than 20 countries participated in a series of 24 events, including the International Green Building Conference (BCA, 2015).

As a result of these efforts, more than 250 projects in 71 cities in 15 countries had adopted the GMS by July 2014 (BCA, 2014a: 8). Currently, there are more than 400 GMS buildings around the world (Ives, 2013). Furthermore, Singapore's development of a local green certification scheme has prompted neighbouring governments to develop rating schemes tailored to their own local conditions (Ives, 2013). This achievement has brought the BCA international prestige as the first government agency outside North America and Europe to receive the Alliance to Save Energy's International Star Award in 2013. Moreover, the Singaporean government obtained the World Green Building Council's Government Leadership Award for its commitment and leadership in green building development (BCA, n.d.: 7).

These achievements, however, should be seen in light of several challenges in the GMS implementation. First, the vast majority of the existing buildings remain non-green in Singapore. The uptake rate among existing buildings remains low, as only 18% of certificates issued in 2014 were awarded to them (Van der Heijden, 2017: 181). The general lack of awareness among homeowners and the hesitance to pay for sustainable improvements is another challenge. Moreover, as Van der Heijden (2017) argues, the predominant focus on several big building owners and their achievements might have created a false impression that the GMS has produced spectacular results. Despite these limitations, this study evaluates Singapore's performance positively given several factors. First, the country has recorded dramatic upward trends in the number of green buildings and in terms of the GFA covered by them. Second, the government has achieved these outcomes within less than two decades. Third, the government has expanded its soft power by marketing the GMS as an alternative green certification scheme and facilitating its diffusion internationally.

Keys to success: Establishing new green urban governance

Drawing on the earlier discussion on new urban governance, this section discusses in detail what factors have contributed to the effective implementation of the GMS in Singapore.

Government taking the lead and steering

In line with the new urban governance literature, Singapore's successful implementation of the GMS can be attributed to the role that the government has played by retaining the shadow of hierarchy. This centrality of the government in designing and implementing the

GMS imbues the developmental state tradition in this city-state. Since Singapore's independence, its economic development and planning agencies have dominated the authority to use and develop land, applying a meticulous technocratic approach to urban policy. Reflecting this tradition, the BCA has been designated and empowered as the lead agency in charge of developing and promoting the GMS.

At the outset, the BCA set the agenda for green buildings and developed the GMS as a certification tool that is different from existing standards by focusing on energy efficiency and suitability for Singapore's local climate. Moreover, unlike other standardisation systems administered voluntarily by non-government entities or private actors, the BCA has remained the central authority, while maintaining a close relationship with building developers and owners to coordinate green urbanisation efforts. In addition, the BCA has supervised the implementation of the GMS by conducting regular evaluations of the greenness of buildings and post-occupation verification to ensure participants' compliance with GMS standards (BCA, n.d.: 9). For instance, the agency has urged Green Mark-certified buildings to undergo re-assessment every three years to encourage building owners and tenants to develop a long-term perspective toward environmental sustainability and to ensure their continuous commitment (BCA, n.d.: 11).

Moreover, the government has adopted various legal instruments to provide adequate statutory support for the GMS, creating a functioning GMS regime. In 2008, the government amended the Building Control Act to make the GMS certification mandatory for new buildings and mandate the Gold rating for those larger than 2000 m^2 (BCA, n.d.: 15). This act required building owners that retrofit their buildings to (1) achieve the minimum Green Mark rating for existing buildings when replacing or upgrading their chiller systems, (2) submit periodic energy efficiency audits of building cooling systems every three years and comply with cooling plant efficiency standards and (3) submit annual energy consumption data and other relevant information (BCA, n.d.: 24). These legal measures allowed the government to incorporate a number of existing green buildings into the GMS (BCA, n. d.: 10), making Singapore one of the first countries to implement mandatory minimum environmental standards for existing buildings (BCA, n.d.: 24).

The government, however, has not simply relied on such a draconian measure, as it has applied the GMS standards to public buildings and government-linked businesses. For instance, Green Mark award recipients include public institutions, such as the Housing and Development Board (HDB), the largest developer and main provider of residential buildings in Singapore. The HDB has promoted eco-friendly solutions in public housing and has applied GMS certification to new public housing development since 2007 (BCA, n. d.: 27). Given more than 80% of Singaporeans live in public housing and households consume about 90% of the nation's energy (Wong, 2011: 117, 123), HDB's participation has contributed to the success of the GMS.

Moreover, since 2009, the government has made it mandatory for all new public sector buildings with air-conditioned floor areas of more than 5000 m^2 to achieve the Green Mark Platinum rating, the highest GMS level. For existing public buildings with more than 10,000 m^2, retrofitting should be undertaken to achieve Green Mark Gold by 2020 (BCA, n.d.: 16). To facilitate this mandate, the government has encouraged these public agencies to enter Guaranteed Energy Savings Performance contracts with accredited energy services companies to adopt energy-savings measures and conduct regular energy audits (BCA, n.d.: 15). These measures represent the government's commitment to achieve green urbanisation through leading by example to urge non-governmental actors to emulate some of its own best practices.

Furthermore, the government has initiated various supplementary programmes for effective implementation of the GMS. For instance, the Singapore Green Building Product Certification was introduced to assess building products and materials and set benchmarks for their environmental sustainability level. This programme has complemented the GMS by helping the industry identify and select more environmentally friendly materials to achieve comprehensive sustainability (BCA, 2015). Similarly, Singapore Green Building Services Certification was introduced to enhance green building performance throughout the delivery of services among service firms and agencies (BCA, 2015). These programmes have reinforced the GMS by enhancing the greenness of the country's built environment holistically.

Finally, at the time of the top–down initiation of the GMS, Singapore did not have sufficient human resources in the green building arena. To tackle this challenge, the government has turned its attention to human capacity building in the green building industry. Together with various research and development (R&D) initiatives to advance relevant knowledge and expertise, the BCA established the BCA Academy to cultivate a green workforce, offering a wide range of learning opportunities for professionals and citizens (BCA, n. d.: 23). The BCA has set a target of training 20,000 green building specialists by 2020 (BCA, n.d.: 23).

Generating incentives to participate

At the initial stage of the green building journey, the BCA needed to persuade various stakeholders to buy into the GMS owing to their lack of interest and incentives. Industry, one of the most crucial partners in green urbanisation, had to be persuaded to believe that going green is viable (BCA, n.d.: 15). Thus, the government's first green building masterplan utilised a mix of legislation and incentive schemes to induce business participation. For instance, the government launched a $20m Green Mark Incentive Scheme for New Buildings in 2006, offering cash incentives for developers, building owners and project engineers who have earned at least a Green Mark Gold rating or higher in design and construction. In 2007, the Sustainable Construction Masterplan established a framework for sustainable methods of construction and the Ministry of National Development initiated a $50m Research Fund for the Built Environment to provide financial support for applied R&D in the building industry (BCA, n.d.: 15). In 2009, the government allocated $100m to help property owners pay for efficiency audits and install energy-efficient cooling units, motion sensors and shading devices over five years (Ives, 2013).

Examples of such financial programmes abound (Table 2). These programmes have generated financial incentives for various actors to participate in the GMS. In some cases, the government has shared financial risks with participants by partially underwriting loans. These measures have lowered the financial and psychological entry barriers for building developers, owners and tenants to adopt sustainable practices and techniques.

In addition, the government has demonstrated the economic soundness of green buildings through various studies. Its recent study conducted with the National University of Singapore found that a sample of office buildings designed to meet GMS standards saved about 11.6% of the total operating expenses while boosting buildings' value by 2.3% (Ives, 2013). Moreover, the BCA showed how most developers recoup their initial investment within seven years through energy savings, although new green buildings could cost up to 5% more to construct (Ives, 2013). Another study by the BCA demonstrated that retrofitting can result in up to 13.5% average savings in operating expenses and an increase in capital value of up to 2.5%, with an average payback period of about 6.3 years (BCA, n.d.: 17). Yet another study of 40 commercial buildings that achieved GM Gold or Platinum

Table 2. Financial schemes supporting the GMS (2009–2013).

$100m Green Mark Incentive Scheme for existing buildings	Provided cash incentives for the purchase of energy-efficient equipment and energy audits that determine the efficiency of air-conditioning chiller plants. The scope was expanded in 2012 to include the cost of installing energy-efficient equipment and engaging professional services.
Green Mark Gross Floor Area Incentive Scheme	Allowed building owners of new private developments to apply for additional floor area if their developments achieve Green Mark Platinum or Gold ratings.
$5m Green Mark Incentive Scheme for design prototype	Provided funding for engaging environmentally sustainable design consultants to conduct collaborative design workshops and assist in simulation studies for the design of green buildings.
Building retrofit energy efficiency financing scheme	Provided credit facilities for commercial building owners, management corporations and energy service companies to conduct energy-efficiency retrofits under an energy performance contract arrangement. Participating financial institutions issued loans for the purchase and installation of energy-efficient equipment (with BCA co-sharing half the risk of the loan default).

Source: BCA (n.d.: 17).

suggested that green retrofitting saved 90 GWh of energy or S$24m in costs a year (Reyes, 2013). These studies have demonstrated various monetary and environmental benefits of green buildings, presenting strong cases for green buildings and wooing new entrants into the GMS.

Together with these inducement measures, the government has granted a number of awards for green buildings. In 2014, a new Green Mark Pearl Award was launched (BCA, 2015) to reward developers, building owners and lessors who have obtained Green Mark Gold or higher and have a substantial number of GMS-certified tenants under the Green Mark occupant-centric schemes. By rewarding building owners that make efforts to shape their tenants' behaviour and operational practices, this award aims to promote total green building performance. For instance, City Development Limited, a Singapore-based real estate operating company, won the first BCA Green Mark Pearl Prestige Award for its effort to promote tenants' green certification. At least 70% of the building's interior offices met the environmental standards of the GMS and, as of April 2015, close to 80% of this building's commercial tenants had signed a green lease memorandum of understanding with the firm (BCA, 2015). As of May 2015, a year that marked the 10th anniversary of the scheme, the BCA (2015) had granted 221 awards, including 70 Green Mark Platinum and 58 Green Mark Gold awards. These awards have appealed to those businesses that aim to nurture a positive corporate image and tap into a niche market (Van der Heijden, 2017).

Engaging multiple stakeholders

While the BCA has remained a major actor representing the government's commitment to green urbanisation, diverse stakeholders have become another important pillar supporting the GMS regime. At the beginning of GMS implementation, the lack of information and public disclosure regarding the GMS and its performance-measurement criteria undermined the expansion of the programme (Cheam, 2013). The BCA soon realised the necessity to engage a broad range of stakeholders populating the entire value chain of green buildings (BCA, n.d.: 26). Since the government aimed to make green buildings a norm rather than a

luxury, it became crucial to engage the owners of non-commercial buildings and historic houses as well as tenants and the public. Moreover, given that the design and construction phases comprise only 10–20% of a building's entire life cycle costs while that of operation and management make up 80–90%, raising the environmental awareness of building occupants and tenants, and enlisting them in effective green building operation should be part of green urbanisation campaigns (Lim, 2013).

For these reasons, the Singaporean government has paid increasing attention to reducing the information asymmetry among various stakeholders and engaging them. The third Green Building Master Plan explicitly stated the government's goal to encourage diverse groups of tenants, building owners and corporations, to sustain and accelerate the green building drive (Reyes, 2013). The government has made continuous efforts to educate tenants on green building operations through green fit-out guides, green tips and energy-efficient mock-ups. Furthermore, it has reached out to the public through the Singapore Green Building Council, a non-governmental organisation that the BCA helped establish in 2009. This council shared the BCA's goal of advocating green building design, practices and technologies. Together, they organised the Big Day Out Carnival, a public outreach programme designed to raise public awareness about green buildings and green lifestyle (BCA, 2015).

Furthermore, the Singaporean government, industry and academic community have deepened their collaboration over time. The government has promoted R&D to help develop new sustainable products and quantify their performance through several initiatives, such as collaboration with industry, academic and other relevant agencies in the form of grant calls, inter-agency collaboration and memoranda of understanding (BCA, n.d.: 18). Between 2007 and 2013, the BCA launched six R&D grant calls that adopted a public–private partnership approach to develop innovative green building solutions. In 2013, 61 R&D projects were awarded funding support, of which 39 projects worth $28m were allocated to green buildings and associated industries (BCA, n.d.: 19). As the government promotes public–private partnerships, industrial actors and universities have participated in the refinement and expansion of the GMS as co-designers of policy and its detailed programmes. The Green Mark 2015, for instance, was developed by 12 specialist technical workforces co-chaired by industry experts from more than 102 industry members. These teams partnered with the National University of Singapore and Eindhoven University of Technology (BCA, 2015). The importance of this public–private partnership was highlighted by John Keung, CEO of the BCA, in a 2016 interview (Khoo, 2016).

We are heartened that Singapore's green building movement and green building masterplans have played a pivotal role in placing Singapore on the world map as the most sustainable city in Asia…. *It was not just a conscious, top–down approach but also the commitment and close collaboration of the public, private and people sectors that made such an achievement possible for Singapore*…. We will continue to push the boundaries with more focus on research and innovation, as well as more engagement with building users to initiate ground-up action for the green building movement (the emphasised italics are the author's own).

Conclusion

This study discussed how the Singaporean government has furthered its efforts to achieve environmental sustainability of its urban setting through the GMS, a green building certification scheme. Since its launch in 2005, the GMS has led to a dramatic increase in the number of green buildings and has been exported to other countries and cities as an

alternative to existing green building accreditation tools. This case study unpacked what factors have contributed to this policy implementation and outcomes.

Drawing from the new urban governance literature, this study suggested that the Singaporean government has established a working model of governance that is conducive for the effective implementation of a green urban initiative. Existing studies on urban governance have emphasised broad participation of diverse stakeholders and utilisation of multiple policy instruments that go beyond the traditional command-and-control style policy measures. To these, the new urban governance literature has added the importance of the 'shadow of hierarchy' as a term that suggests a proactive but nuanced role for government in establishing sound regulatory regimes, providing relevant institutional assistance and facilitating the usage of diverse policy instruments and multi-party collaboration.

The case of Singapore's green urbanisation trajectory via the GMS demonstrates how such new green urban governance has materialised. The government, through the BCA, has steered the process of policy design, promotion and implementation by providing adequate legal frameworks and reinforcing the GMS regime with supplementary policy programmes. Moreover, the government has applied the GMS to the public sector to lead the green building movement by example. Furthermore, the lead agency, the BCA, has acted as a policy entrepreneur to promote the domestic and international diffusion of the GMS. These measures suggest that the government has maintained the shadow of hierarchy throughout the implementation of the GMS.

The Singaporean government, however, has not simply relied on top–down legal instruments, as it has employed various policy instruments to incentivise the participation of multiple stakeholders. The government has used various financial programmes to induce building developers, owners and tenants to adopt the GMS. The government has shared risk to encourage hesitant participants to adopt long-term perspectives and demonstrated the economic and environmental benefits of green buildings through research. These measures have effectively lowered the entry barrier for new participants.

This green building movement led by the state reflects the Singaporean government's continuous application of a technocratic and managerial approach to environmental governance (Han, 2017; Ng, 2007b). The government has assumed that green urbanisation can contribute not just to the country's sustainable development but also to its economic progress as a smart nation at the forefront of technological innovation. Therefore, the government took the initiative to develop the GMS as its global brand. The government's centrality in agenda setting, implementation and regulation of the GMS and its proactive roles exhibit top–down features of Singapore's governance, as a lingering legacy from the developmental state era. Using a term coined in studies on Singapore's public policy-making, 'disciplined governance' (Francesch-Huidobro, 2007) might have been invoked by the country's strong and resourceful government to implement the GMS.

While such developmental state features might have been integral to the effective implementation of the GMS, this study argues that the government has not simply relied on disciplining multiple stakeholders on its own terms. Rather, the government's successful implementation of the GMS has been increasingly upheld through engagement and collaboration with multiple stakeholders in society. While the government has introduced the GMS and relevant legal and financial institutions, it has recognised that the generation of positive environmental outcomes has depended on those who build, manage, run and use green buildings throughout the entire life cycle of buildings. Therefore, the BCA has accelerated its efforts to involve a broader range of actors via public education and outreach programmes. The government has also expanded and fine-tuned the GMS regime over time by consulting industrial and academic communities. These factors demonstrate that the

government has engaged various actors in society and used diverse policy instruments rather than simply adopting a top–down approach to green urbanisation.

In summary, the effective implementation of the GMS has hinged on new green urban governance, which has been conjured up under the shadow of hierarchy. The Singaporean government has remained the central authority in the implementation of the scheme by providing legal frameworks and various types of policy assistance. However, the government supervision has not been so outright, given that the state has also depended on the expertise and partnerships of various industrial and professional actors. The relationship between the government and these societal actors has become interdependent as the implementation of the GMS has proceeded. Thus, the shadow of hierarchy has been in place in Singapore's green urban governance, but it has not depleted the healthy space for non-governmental actors to contribute to this networked governance.

This study generates insights into and lessons for environmentally sustainable urban development. Instead of making a sweeping generalisation that Singapore's experience is transferrable globally, this study argues that the experience can be replicated among Asian countries that share strong statist tradition and top–down policy-making (Gilley, 2014; Ng, 2007a, 2007b). Singapore's new green urban governance model can be emulated among those Asian countries whose governments are capable of serving active roles in promoting green buildings through certification systems and supporting instruments, particularly when the private sector lacks technical expertise, financial incentives or simply the willingness to adopt environmentally friendly measures. In addition, governments in Asia are in a favourable position to mobilise various non-governmental and private sector stakeholders by employing a mix of legal and regulatory measures and incentives. Governments, particularly those with quite sizable public sectors, as in the case of Singapore, can adopt various green urban measures as pilot projects before market-wide diffusion. Already, some Asian governments have joined the green building trend (Gou and Lau, 2014; Ye et al., 2015; Yiing et al., 2013) and they can draw policy lessons from Singapore's implementation of the GMS, particularly regarding how to create a healthy shadow of hierarchy to achieve new green urban governance.

Despite these policy implications and lessons, the findings of this research should be read with caution. First, the Singaporean government's experience with green buildings and the mode of governance it has created might be less applicable to countries with different political systems, environmental conditions and economic development given that the GMS was designed mainly for a relatively prosperous urban metropolis (Ives, 2013). The Singapore case also demonstrates that state capacity is integral in developing green urbanisation policy and implementing it through the mobilisation of resources and appropriate policy instruments. Furthermore, it shows the importance of the public administration system that allows the inter-agency cooperation and broad policy compliance of non-state actors. These features might vary across countries. As demonstrated in a recent systematic analysis of various green urban initiatives across multiple countries (Van der Heijden, 2017), contextual factors of each country can determine the effectiveness of such initiatives.

Second, while this study illustrated how a functioning new urban governance structure was created for sustainable urban development under the shadow of hierarchy in Singapore, it does not offer a definitive answer to the question of how such a facilitative shadow of hierarchy can be created and retained. The question of what an adequate level or ideal composition of the shadow of hierarchy is that upholds an effective new urban governance model requires contextual information about local conditions, such as state capacity and state–society relations. Therefore, more empirical studies should be conducted to illuminate the shadow of hierarchy concept and make it more operationally useful.

Third, the finding in this study that the Singaporean government has maintained collaborative relationships with various non-governmental actors under the shadow of hierarchy does not mean that the country's traditional top–down model of governance has become obsolete. Even in the case of the GMS implementation, the Singaporean government's steering role and paternalistic position vis-à-vis the private sector and society writ large has continued. However, the predominance of the government might lose its appeal for an increasingly pluralised and dynamic society or might have a lock-in effect, stymieing the growth of vibrant society and bottom–up introduction of policy measures. Some argue that the government's dominant involvement in the GMS has resulted in the adoption of a passive stance by the construction and property industries (Chan et al., 2009; Van der Heijden, 2017: 223). Therefore, maintaining the right balance in the degree of the shadow of hierarchy is an art requiring political skills for the proper distribution of power and authority between state and society.

Finally, applying the policy lessons from Singapore to urban governance at the sub-national government level might be challenging. Cities, for instance, face obstacles to implementing ambitious public policy, such as green buildings, owing to the lack of expertise, cost of implementation and uncertain outcomes (Zia and Koliba, 2011). High capital requirements and the regulatory nature of policy implementation might cause a backlash from nascent business communities (Lee and Koski, 2012: 609). Moreover, sub-national governments might not have the proper legal authority to introduce green urbanisation initiatives and to enact enforcement mechanisms even if they are ambitious. Such measures as mainstreaming energy efficiency on a city-wide scale and introducing low-carbon policies require cities to reform existing institutions, build capacity and strengthen energy planning and governance (Ostojic et al., 2013: 1), which remain daunting tasks. These constraints suggest that such reforms might generate better outcomes when nested within national green urbanisation policy and multi-layered governance (Bulkeley and Betsill, 2005).

Despite these challenges, successful green urbanisation cases, like the one examined in this study, can generate boomerang effects (Fisher, 2013), triggering competitive diffusion or learning across cities and countries. Moreover, cities can serve as building blocks to drive national-level green urban governance if they could strengthen their institutional and technical capacity and succeed in mobilising societal support to establish collaborative governance (Schroeder et al., 2013). For a continuous exploration of the nexus between urbanisation and sustainable development, this case of Singapore serves as a heuristic model that generates empirical knowledge about how an effective mode of governance can be forged to promote green urbanisation.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Allouhi A, Fouih YEI, Kousksou T, et al. (2015) Energy consumption and efficiency in buildings: Current status and future trends. *Journal of Cleaner Production* 109: 118–130.

Astleithner F and Hamedinger A (2003) Urban sustainability as a new form of governance: Obstacles and potentials in the case of Vienna. *Innovation* 16(1): 51–75.

Betsill M and Bulkeley H (2007) Looking back and thinking ahead: A decade of cities and climate change research. *Local Environment* 12(5): 447–456.

Building and Construction Authority (BCA) (2014a) 3rd Green Building Masterplan. Available at: www.bca.gov.sg/GreenMark/others/3rd_Green_Building_Masterplan.pdf (accessed 11 February 2017).

Building and Construction Authority (BCA) (2014b) BCA Building Energy Benchmarking Report 2014. Available at: www.bca.gov.sg/GreenMark/others/BCA_BEBR_Abridged_FA.pdf (accessed 11 February 2017).

Building and Construction Authority (BCA) (2015) *Building Green Magazine* 8. Available online at https://www.bca.gov.sg/Publications/BuildGreen/others/BGreen_8_2015.pdf (accessed 17 May 2018).

Building and Construction Authority (BCA) (n.d.) Singapore: Leading the way for green buildings in the tropics. Available at: https://www.bca.gov.sg/greenmark/others/sg_green_buildings_tropics.pdf (accessed 17 May 2018).

Bulkeley H and Betsill M (2005) Rethinking sustainable cities: Multilevel governance and the 'urban' politics of climate change. *Environmental Politics* 14(1): 42–63.

Chan E, Qian Q and Lam P (2009) The market for green building in developed Asian cities. *Energy Policy* 37(8): 3061–3070.

Cheam J (2013) Increased transparency a boost to green building movement. *Eco-Business,* 16 September. Available at: www.eco-business.com/opinion/increased-transparency-boost-green-building-movement/ (accessed 2 April 2016).

Deng Y, Li Z and Quigley JM (2012) Economic returns to energy-efficient investments in the housing market: Evidence from Singapore. *Regional Science and Urban Economics* 42: 506–515.

DiGaetano A and Strom E (2003) Comparative urban governance: An integrated approach. *Urban Affairs Review* 38(3): 356–395.

Doner RF, Ritchie BK and Slater D (2005) Systemic vulnerability and the origins of developmental states: Northeast and Southeast Asia in comparative perspective. *International Organization* 56: 321–361.

Douglass M (2016) *The rise of progressive cities in Asia: Toward human flourishing in Asia's urban transition*. Asia Research Institute (National University of Singapore). Working Paper Series. No. 248. Available at: https://ari.nus.edu.sg/Assets/repository/files/publications/wps16_248.pdf (accessed 15 May 2016).

Eichholtz P, Kok N and Yonder E (2012) Portfolio greenness and the financial performance of REITs. *Journal of International Money and Finance* 31: 1911–1929.

Fisher DR (2013) Understanding the relationship between subnational and national climate change politics in the United States: Toward a theory of boomerang federalism. *Environment and Planning C: Government and Policy* 31(5): 769–784.

Francesch-Huidobro M (2007) Impact of government–NGO relations on sustainable air quality in Singapore and Hong Kong compared. *Journal of Comparative Policy Analysis: Research and Practice* 9(4): 383–404.

Fraser-Moleketi G (2003) Quality governance for sustainable growth and development. *International Review of Administrative Sciences* 69(4): 463–470.

Fujita K and Hill RC (2007) The zero waste city: Tokyo's quest for sustainable development. *Journal of Comparative Policy Analysis: Research and Practice* 9(4): 405–425.

Gilley B (2014) *The Nature of Asian Politics*. New York: Cambridge University Press.

Goh DPS (2001) The politics of the environment in Singapore? Lessons from a "strange" case. *Asian Journal of Social Science* 29(1): 9–34.

Gou Z and Lau SSY (2014) Contextualizing green building rating systems: Case study of Hong Kong. *Habitat International* 44: 282–289.

Han H (2017) Singapore, a garden city: Authoritarian environmentalism in a developmental state. *The Journal of Environment & Development* 26(1): 3–24.

Hardoy JE, Mitlin D and Satterthwaite D (2001) *Environmental Problems in an Urbanising World*. London and Sterling: Earthscan Publications Ltd.

Heinzle SL, Yip ABY and Xing MLY (2013) The influence of green building certification schemes on real estate investor behaviour: Evidence from Singapore. *Urban Studies* 50(10): 1970–1987.

Heng LL (2008) A fine city in a garden. Environmental law and governance in Singapore. *Singapore Journal of Legal Studies* July: 68–117.

Héritier A and Eckert S (2008) New modes of governance in the shadow of hierarchy. *Journal of Public Policy* 28(1): 113–138.

Ives M (2013) *Singapore takes the lead in green building in Asia. Yale Environment 360*. Yale School of Forestry & Environmental Studies. Available at: http://e360.yale.edu/feature/singapore_takes_the_lead_in_green_building_in_asia/2720/ (accessed 27 March 2016).

Joss S (2015) *Sustainable Cities: Governing for Urban Innovation*. London: Palgrave Macmillan.

Khoo L (2016) Singapore ranks top in sustainability among Asian cities, second globally. *The Business Times*, 13 September. Available at: www.businesstimes.com.sg/government-economy/singapore-ranks-top-in-sustainability-among-asian-cities-second-globally (accessed 20 January 2017).

Koski C (2010) Greening America's skylines: The diffusion of low-salience policies. *The Policy Studies Journal* 38(1): 93–117.

Laitner M, Stella A and Zamoyski M (2007) Green building city survey. *NYUJ Legislation & Public Policy* 11: 81–103.

Lee K-W (2010) Regulating design in Singapore: A survey of the Government Land Sales (GLS) programme. *Environment and Planning C: Government and Policy* 28(1): 145–164.

Lee T and Koski C (2012) Building green: Local political leadership addressing climate change. *Review of Policy Research* 29(5): 605–624.

Lim C (2013) Green buildings need careful management to perform. *Eco-Business*, 16 September. Available at: www.eco-business.com/news/green-buildings-need-careful-management-perform/ (accessed 2 April 2016).

Lo FC and Yeung YM (1996) *Emerging World Cities in Asia Pacific*. Tokyo: United Nations University Press.

Low L (2001) The Singapore developmental state in the new economy and polity. *The Pacific Review* 14(3): 411–441.

Low N, Gleeson B, Elander I, et al. (2000) *Consuming Cities: The Urban Environment in the Global Economy After the Rio Declaration*. New York and London: Routledge.

McCann E (2017) Governing urbanism: Urban governance studies 1.0, 2.0, and beyond. *Urban Studies* 54(2): 312–326.

National Climate Change Secretariat (NCSS) (n.d.) *Singapore's emissions profile*. Available at: www.nccs.gov.sg/climate-change-and-singapore/national-circumstances/singapores-emissions-profile (accessed 31 May 2016).

National Parks Board (n.d.) *A special tribute to Mr Lee Kuan Yew: The man behind the greening of Singapore*. Available at: www.nparks.gov.sg/about-us/special-tribute-to-mr-lee (accessed 26 January 2016).

Neo H (2013) Nature and the environment as an evolving concern in urban Singapore. In: Ho ELE, Yuan Wong C and Ramdas K (eds) *Changing Landscapes of Singapore*. Singapore: NUS Press, pp.61–80.

Newman P and Matan A (2013) *Green Urbanism in Asia: The Emerging Green Tigers*. Singapore: World Scientific.

Ng MK (2007a) Sustainable development and governance in East Asia world cities. *Journal of Comparative Policy Analysis* 9(4): 321–335.

Ng MK (2007b) Governance for sustainability in East Asian global cities: An exploratory study. *Journal of Comparative Policy Analysis* 9(4): 351–381.

Ostojic DR, Bose RK, Krambeck H, et al. (2013) *Energizing Green Cities in Southeast Asia: Applying Sustainable Urban Energy and Emissions Planning*. Washington, DC: World Bank Publications.

Pereira AA (2008) Wither the developmental state? Explaining Singapore's continued developmentalism. *Third World Quarterly* 29(6): 1189–1203.

Perry M, Kong L and Yeoh BSA (1997) *Singapore: A Developmental City State*. New York: Wiley.

Rees W and Wackernagel M (1996) Urban ecology footprints: Why cities cannot be sustainable – And why they are a key to sustainability. *Environmental Impact Assessment Review* 16(4–6): 223–248.

Reyes E (2013) New study shows strong business case for upgrading buildings. *Eco-business*, 13 September. Available at: www.eco-business.com/news/new-study-shows-strong-business-case-upgrading-buildings/ (accessed 3 April 2016).

Schroeder H, Burch S and Rayner S (2013) Novel multisector networks and entrepreneurship in urban climate governance. *Environment and Planning C: Government and Policy* 31(5): 761–768.

Smith R and Wiek A (2012) Achievements and opportunities in initiating governance for urban sustainability. *Environment and Planning C: Government and Policy* 30(3): 429–447.

South China Morning Post (2014a) The rise and rise of the Asian megacity (and why 'metacities' are the next big thing) 15 June. Available at: www.scmp.com/magazines/post-magazine/article/1530748/larger-life-rise-and-rise-asian-megacity (accessed 28 April 2016).

South China Morning Post (2014b) Megacities of Asia part III: The rise of the 'Megaregion'. 29 June. Available at: www.scmp.com/magazines/post-magazine/article/1540813/megacities-asia-part-iii-grey-areas (accessed 28 April 2016).

Swyngedouw E (1992) The Mammon quest. 'Glocalisation', interspatial competition and the monetary order: The construction of new scales. In: Dunford M and Kafkalas G (eds) *Cities and Regions in the New Europe: The Global–Local Interplay and Spatial Development Strategies*. London: Belhaven Press, pp.39–67.

Swyngedouw E (2005) Governance innovation and the citizen: The Janus face of governance beyond-the-state. *Urban Studies* 42(11): 1991–2006.

Tan PY, Wang J and Sia A (2013) Perspectives on five decades of the urban greening of Singapore. *Cities* 32: 24–32.

Torfing J, Peters BG, Pierre J, et al. (2012) *Interactive Governance: Advancing the Paradigm*. Oxford: Oxford University Press.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2013) *Urbanization trends in Asia and the Pacific*. 6 November. Available at: www.unescap.org/resources/urbanization-trends-asia-and-pacific (accessed 20 May 2016).

Van der Heijden J (2014) *Governance for Urban Sustainability and Resilience*. Cheltenham, England: Edward Elgar.

Van der Heijden J (2016) Opportunities and risks of the 'new urban governance' in India: To what extent can it help addressing pressing environmental problems? *Journal of Environment & Development* 25(3): 251–275.

Van der Heijden J (2017) *Innovations in Urban Climate Governance: Voluntary Programs for Low-Carbon Buildings and Cities*. Cambridge, UK: Cambridge University Press.

Wescott CG and Jones LR (2007) Managing urban growth in Asia. *Journal of Comparative Policy Analysis* 9(4): 337–349.

Wong CML (2012) The developmental state in ecological modernization and the politics of environmental framings: The case of Singapore and implications for East Asia. *Nature and Culture* 7(1): 95–119.

Wong JLH (2011) Creating a sustainable living environment for public housing in Singapore. In Yuen B and Kumssa A (eds) *Climate Change and Sustainable Urban Development in Africa and Asia*. Dordrecht: Springer Science + Business Media, pp.117–128.

World Bank (2016) World Development Indicators. Available at: http://databank.worldbank.org/data/home.aspx (accessed 15 August 2016).

Ye L, Cheng Z, Wang Q, et al. (2015) Developments of green building standards in China. *Renewable Energy* 73: 115–122.

Yiing CF, Yaacob NM and Hussein H (2013) Achieving sustainable development: Accessibility of green buildings in Malaysia. *Procedia – Social and Behavioral Sciences* 101: 120–129.

Zia A and Koliba C (2011) Accountable climate governance: Dilemmas of performance management across complex governance networks. *Journal of Comparative Policy Analysis* 13(5): 479–497.

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