Geoforum 61 (2015) 1–12

Contents lists available at ScienceDirect

Geoforum

journal homepage: www.elsevier.com/locate/geoforum

State power and environmental initiatives in China: Analyzing China's green building program through an ecological modernization perspective

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ARTICLE INFO

Article history:
Received 22 August 2014
Received in revised form 19 January 2015

Keywords:
Ecological modernization
Green buildings
State
Environmental governance
China
Property market

ABSTRACT

This paper applies the ecological modernization (EM) framework to analyze China's green building program. EM focuses on the effective institutionalization of environmental objectives into respective political and economic systems, and thus provides valuable insights into the roles of the state and other stake holders in environmental regulation. Since the mid-2000s, the Chinese government has advanced an aggressive green building campaign, which is distinguished by its speed, scale, and evolution from one of voluntary participation to a top-down implementation through administrative hierarchies. While this has resulted in a remarkable growth of green building projects, questions remain about the effectiveness and sustainability of such a state-centered approach. Though interviews with officials, planners, architects, real estate developers, and property managers in several Chinese cities, data analysis of the green building stock, and surveys of architects, this paper analyzes Chinese green building patterns and situates such patterns among the contradictory motivations of different levels of government and their relationships to different stake holders. This research finds that the top-down state apparatus is not sufficient to overcome these contradictions and the profit motives of the property developers. However, many underdeveloped opportunities exist to leverage property developers, building professionals, and the public to engage in green building practices. In the end, I argue that the state must embrace reform to build flexible and collaborative movements with other parties with strong public participation. China's ecological modernization process may feature a stronger state and faster changes, but it is not exempted from the need of political modernization.

Introduction

2013 was a disastrous year for China's environment. Beginning in January, Beijing and large parts of northern China experienced record levels of air pollution, dubbed by the *New York Times* as an "airpocalypse" Wong (2013). The most dangerous particle, PM2.5, was measured to have a concentration of 700 mg per cubic meter, while the WHO standard is less than 25 mg (Economist, 2013). Later that year, similar episodes were repeated at the northern city Harbin and the southern Yangtze River Delta. Alarms also sounded over the conditions of rivers, ground water, and farm soil throughout China. The Chinese state found itself struggling to cope with the international criticism and public outcry regarding its environmental record.

The irony is that the Chinese government has made major efforts to build environmental institutions since the 1980s. For example, China established environmental protection agencies at the national and local levels, issued countless pieces of environmental legislation, signed international treaties, and, more recently, invested more than any other country in clean technology (Shapiro, 2012). Yet, environment conditions continue to worsen. Scholars fault China's environmental governance as the root of the problem. For the past 30 years, China has prioritized economic development, which has created contradicting incentives at the central and local levels, leading to a persistent weakness in environmental law enforcement. The limits on information transparency and the general restrictions on – and even retributions for – public participation, have also led to weak public awareness and monitoring (Economy, 2004; Shapiro, 2012; Carter and Mol, 2007). While it is apparent that China's environmental governance requires an overhaul, the complexity of such governance and its

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http://dx.doi.org/10.1016/j.geoforum.2015.02.002
0016-7185/

interplay with many other spheres of China's economic and social life suggest an enormous and complex undertaking.

In this regard, ecological modernization (EM)–a theoretical framework that emerged from studies on political and environmental practices in Northern and Western Europe in the 1980s-provides valuable directions for reform. EM focuses on the effective institutionalization of environmental objectives into their respective political economic systems, involving the roles of technology, state, economic incentives, and public participation (Mol and Buttel, 2002; Milanez and Bührs, 2007)

This paper examines the potential of applying EM to understand China's green buildings (GBs) program. The EM framework has been used to analyze China's environmental governance (Carter and Mol, 2007), and China's eco-city development (Caprotti, 2014; Chang and Sheppard, 2013; De Jong et al., 2013; Pow and Neo, 2013; Chien, 2013). While most Chinese eco-cities are still in various stages of construction, its official GB program has been in operation since 2006. As a component of the eco-city concept, China's GB program offers an excellent vehicle to examine environmental governance, as it represents an interface of many different stake holders – different levels of governments, planners, developers, architectural designers, engineers, builders, and users (owners or tenants) – and it is riddled with powerful and vested interests (Zhou and Cai, 2014).

Globally, GBs are key to reducing the carbon footprint and pollution of the built environment. China's staggering building boom – the World Bank (2007) estimates that half of the world's new construction would take place in China until at least 2015 – means that GBs in China will have profound global implications. GBs are also linked with public health, as the most severe air pollution episodes occur during the winter heating seasons.

China's GB program started in the early 2000s, initially as a governmental collaboration with foreign architects, non-government organizations (NGOs) and foreign governments. In 2006, it became a national project and an indispensable component of China's international pledge to reduce its carbon intensity. From several demonstration projects in the early 2000s, the number of GB projects in China grew to 2500 by the end of 2013, totaling over 143 million $m^{2\,in}$ gross floor space.[1] Although at that time GBs still constituted only a tiny fraction of China's total building stock, the government has a target for GBs to comprise 20% of new construction by 2020. This large-scale effort also means that China could be on track to have half of the world's GB floor space by 2020 (Qiu, 2013). Compared to other GB programs around the world, China's program is distinguished by its massive scale and rapid evolution from a voluntary experiment to a program with a top-down implementation through an administrative hierarchy within just a few years. It raises questions about the effectiveness and sustainability of relying on the state bureaucracy to enforce environmental initiatives.

In advanced capitalist societies, the environmental governances in recent decades have been shaped by contestations and compromises of the state responding to public pressure and an overriding growth narrative under neoliberalism. Harvey (2010) argues that the capital accumulation necessitates a "spatial fix," which can be performed in part by a new developmental paradigm. The term "sustainability fix" was coined by While et al. (2004), drawing attention to the selective incorporation of ecological goals in urban governance to service growth in post-industrial cities. China's eco-city programs show similar tension because the state mandates from the top are often underwritten into the development priorities by the local governments (Pow and Neo, 2013). Yet, China's urban governance differs from western ones in its dominant and relatively autonomous central state without credible opposition; an underdeveloped codification of state-business relations and, thus, plenty of room for corruption; and a general lack of channels for public participation. Within this context, the state behavior may be influenced by forces different from the global discourse of neoliberalism, as assumed in the "sustainability fix" thesis. A closer scrutiny of the bureaucracy is necessary to discern the policy practices and alternatives. Given that China's GB governance is still very young and in a state of flux, there are opportunities to build more a collaborative framework in an uniquely Chinese EM model.

Green building and ecological modernization

Ecological modernization theory (EM) emerged from the debates on capitalism, sustainability, and the state dating back to the 1980s. Unlike neo-Marxist scholars such as O'Connor (1994), Schnaiberg (1980), and Harvey (2010) who view capitalism as a fundamentally unsustainable regime due to its drive for endless growth, profit maximization, and capital accumulation, proponents of EM argue that the processes of modernization and capitalism can be compatible with environmental priorities. The theory draws upon the considerable progress of the environmental policies of northern and western European countries while acknowledging the merely moderate progress in North America (Buttel, 2000). Earlier EM scholars advocate molding capitalist institutions to account for environmental causes such as efficiency and externalities. Christoff (1996) calls such an approach "weak" EM, representing a corporate, technocratic solution to environmental problems. A "strong" EM should address the economical, systematic, communicative, deliberative, democratic, and international dimensions of environmental institutions. More recently, EM has more deeply examined the relationship between the state, civil society, and capitalist corporations (Buttel, 2000).

Rather than viewing the state and the market as adversaries or the state essentially as an enabler of capitalist accumulation, various strains of EM view the state as the ultimate arbiter of, and facilitator between, different interests. It favors a consensus- and negotiation-based rule-making process instead of a top-down command and control process (Mol and Buttel, 2002; Jänicke, 1990; Mol and Spaargaren, 2002b). EM also rejects any universal ideal for environment institutions and instead emphasizes comparative studies and unique pathways for countries. China features prominently in the work of EM scholars such as Carter and Mol (2007), Rock (2002), and Mol (2006). China itself has also embraced the vocabulary of ecological modernization in its official discourse, although mostly focusing on its techno-economic rather than political dimensions (Zhang et al., 2007, p. 665). EM has been criticized, however, by neo-Marxists on the basis of its lack of concern for the capitalistic drive for resource consumption and the associated environmental impacts (Pred and Watts, 1992); by deep ecologists for its anthro-centric bias; and by post-modernists for its uncritical embrace of the discourse of modernization (Mol and Spaargaren, 2002a). Nevertheless, as an optimistic, pragmatic, and policy oriented theoretical framework, EM provides insights into effective practices in different social contexts and guidance for policy makers and environmental advocates in promoting sensible policy changes. For China, it is particularly useful because EM is critical of the top-down commanding approach of the state even as it acknowledges its central roles. It offers paths for the state to become an effective collaborator.

The global GB movement is a good example of an ecological modernization project. It emerged after the oil shock of the

[1] Based on the MOHURD issued report, May, 2013, available at http://www.gbmap.org/article1.php?id=1035. The total is 76 million. This total also includes the total LEED area in China, reported as 67 million available at http://www.usgbc.org/articles/heading-back-china.

1970s, which set off a series of energy-related technological innovations and public policy changes in advanced capitalist economies. Given that the state had already been institutionalized in the construction sector through land acquisition protocols, planning ordinances, building codes, and other regulatory processes, the incorporation of environmental mandates such as more compact urban planning and efficient buildings is a natural progression.

Internationally, the GB movement shows striking institutional differences, exemplified by the United States, Germany, and Singapore. The United States offers a market-driven example with indirect governmental supports. The LEED (Leadership in Energy and Environmental Design) system developed by the non-governmental US Green Building Council in 1998 was first adopted by select public agencies, but it has since developed a market appeal based on its publicity value among corporations and organizations and energy savings for property owners and tenants (Gauthier and Wooldridge, 2012; Cidell, 2009a,b; Fuerst and McAllister, 2011; Wiley et al., 2010). It also excels at creating an "ecosystem" of accredited professionals that includes accountants, lawyers, consultants, designers, planners, building material and equipment suppliers, and builders. This network allows for the rapid dissemination of information, comprehensive technical support, widespread promotion, and better accountability (Cidell, 2009a, b). It has since become an international benchmark, used in 40 countries, with China ranking third in the total number of LEED projects and second in gross square meters (USGBC, infographic-LEED-World[2]). However, LEED has also been criticized because its rating system is based on an assessment of the building design, not on the actual energy use over the building's projected life (Brown, 2010). LEED's reliance on technological solutions, corporate leadership, and the market represents a largely corporate and technocratic approach to the environment (Knack, 2010). It is questionable whether premium ecological enclaves of LEED buildings can transform the unsustainable urban system (Hodson and Marvin, 2010).

European approaches differ from the North American one because the EU countries have more powerful state apparatuses for spatial planning and infrastructure construction; thus the state assumes more instrumental roles in initiating and guiding the GB movement (Newman et al., 2009; Urteaga, 2011; Wende et al., 2010). Germany, for instance, has incrementally strengthened its building energy code five times since 1977, each with more stringent energy standards. The government-owned banks also provide comprehensive technical and financial support for building energy efficiency schemes (Schimschar et al., 2011; Buehler et al., 2011). Germany's construction industry developed energy-saving systems that yield highly efficient buildings, exemplified by the Passive House, a type of state-of-the-art building with ultra-low energy consumption (Passive Housing Institute). Germany's Green Party, environmental NGOs, and a generally better-informed and more engaged public all contribute to more effective environmental governance, exemplifying the EM framework. Currently, the EU has the lowest average building energy use per capita of all the developed regions (Fig. 1). In 2010, the EU even adopted a directive stating that all member states must lower all new construction to "near zero" levels of energy consumption by 2020 (Schimschar et al., 2011).

In Asia, Singapore represents another extreme, in which the state is direct and forceful. The powerful Building and Construction Authority (BCA) – a branch of the Singaporean government – oversees all construction activities in Singapore.

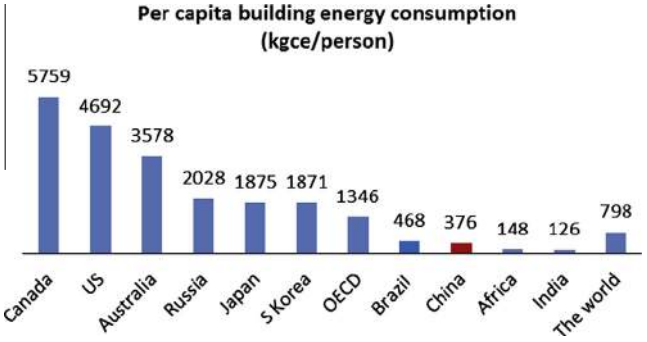


Fig. 1. International building energy consumption. *Source:* NRDC 2012.

Although its GB program (Green Mark certification) was launched as recently as 2005, Singapore's target of 80% of its building stock meeting the GB standard by 2030 is the most aggressive in the world (Singapore Sustainability Blue Print, 2009). Through governmental mandates on new construction and retrofits to existing buildings, as well as incentives to developers, the number of GB projects increased from 17 in 2005 to 1600 in 2013, which accounts for 20% of the gross floor space in Singapore (BCA, 2013, *Singapore Sustainability Blue Print*, p. 46). However, it is important to note that Singapore had built up its GB architectural training capacity long before it mandated its GB program (Hwang and Tan, 2012; Chan et al., 2009; Ofori and Kien, 2004).

These three examples reflect different articulations of state-business-public partnerships, and they have all influenced China's GB approach. The LEED system was promoted earliest and was the most influential on the GB standards for architects in China. German companies dominate the premium segments of construction in China as building material and technology suppliers and consultants. However, China's political system is most similar to Singapore's, with a centralized authority – the Ministry of Housing and Urban and Rural Development (MOHURD) – overseeing most of the non-industrial construction in China. MOHURD has thus become the logical locus for China's GB program.

The following section examines China's GB program and its prominent patterns. Approximately fifty interviews were conducted with governmental officials, real estate developers, brokers, and property management firms between the summer of 2011 and the winter of 2013 in Beijing, Shanghai, Dezhou in Shandong province, Nanchang in Jiangxi province, Guangzhou and Shenzhen in Guangdong province, and Chengdu in Sichuan province. These locations are selected to cover the core urban zones on China's coast with significant GB activities and two inland cities (Nanchang and Chengdu) for comparisons. A database of China's green buildings stock was compiled based on online sources updated through early 2013. I also surveyed 121 senior architects in a stratified sample of leading architecture design institutes in 13 major coastal cities, Shandong province, and two of the largest inland cities, Xi'an and Chengdu (Table 2[3]). Within each institute, at most two senior architects were interviewed by telephone based on a questionnaire regarding their GB experiences, practices and barriers.

[2] See Infographic: LEED in the world, http://www.usgbc.org/articles/infographic-leed-world.

[3] The original plan for the survey aims for at least 10 completed questionnaires from architect institutes in all provinces covering the entire coastal area and many inland provinces. It turns out, however, that it is extremely difficult to collect responses from less developed provinces, due to local unfamiliarity with the green building concepts. As a result, provinces with more experience in green building had a relatively higher proportion of respondents. While the survey was designed with the province as the basic geographical unit, most responses came from provincial capitals, with Shandong province the only exception, because of the concentration of architectural institutes in provincial capital cities. As a result, the distribution of responses is not statistically representative of the entire architectural profession in China, but it roughly reflects the geography of China's green buildings (Table 2).

China's green building program

The decade of the 2000s marks the turning point for GBs in China. Before 2000, governmental branches, research institutes, architects and NGOs had made experimental and haphazard exploration into energy and water efficient construction techniques. As China emerged as the largest CO_2 emitter in the world, the Chinese government saw buildings as a venue to meet China's international pledge to lower its carbon intensity. Studies show that building energy consumption in construction and maintenance in cities accounts for 46.7% of the total energy consumed in China and 60% of the carbon emissions (Li et al., 2014; Mo, 2009). Presently, China's per capita building energy consumption is among the lowest in the world, only one fifth that of Japan and South Korea and one third that of the EU countries. However, this low consumption is a result not of better building quality but of a low standard of living. The thermal insulation building envelop in China is very poor compared with those of developed countries (Li et al., 2014). The densely populated areas in the southern half of China do not have central heating, even though the average January temperature can be below 0 °C. The needs for winter heating in the south have already generated intense debates (Li, 2013). As incomes rise, heating provisions and air-conditioning use will become more common. Without well-insulated buildings, the increased energy consumption will greatly undermine the Chinese effort to reduce air pollution and carbon emissions. The greening of China's buildings is an urgent task.

The Chinese state has taken both mandatory and voluntary measures to promote GB. Since 2000, MOHURD has increased the mandatory energy conservation for new buildings, mandating them to be 50–65% more efficient than the basic standard of the 1980s. In 2006, MOHURD issued its first voluntary GB rating system, which measures the site planning, energy use, land use, water conservation, and internal air quality (Zhou et al., 2011). It certifies buildings on a scale of up to three stars, with three stars representing the best environmental performance. Provinces or provincial level municipalities are responsible for evaluating the one- or two-star projects, while the MOHURD certifies the three-star projects. The standards have been updated continuously and expanded to include different types of buildings. To promote the GB adoption rate, on January 1, 2013, the State Council issued the Green Building Action Plan (China State Council, 2013 Action Plan hereafter)[4], which sets the goal that by 2015, 20% of all new buildings have to be green and that all newly built public buildings and affordable housing financed by the state have to be green certified. The 2-star and 3-star buildings will be eligible for state subsidies and local planning priorities.[5] The local governments are required to develop their own action plans to at least be compatible with that of the central government. China's approach is thus similar to Singapore's in its staged goals and reliance on the state apparatus. However, China is not Singapore. The vast geographical scale comes with greater climatic diversity and huge disparities in socioeconomic development and governmental capacities, thus making GBs far more challenging.

The state attention has had remarkable effects. Fig. 2 shows the dramatic increase in the number of green building projects and floor space in China after 2010. The LEED and GB labels are the two most mainstream standards in China, but they are applied to very different building types (Fig. 3). The LEED designation is seen as a more prestigious, internationally approved badge of honor displaying corporate social responsibility. It is especially attractive for

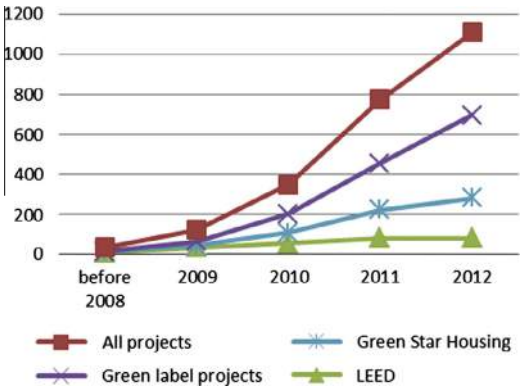


Fig. 2. Growth of green buildings, 2008–2012.

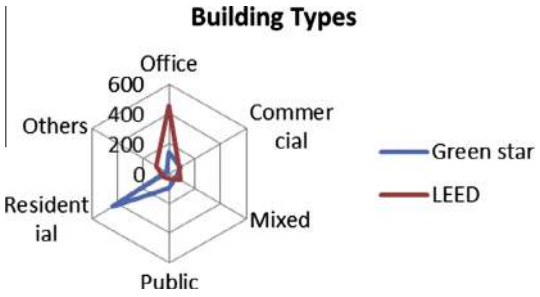


Fig. 3. LEED and China's green building label.

high-end offices and commercial complexes hosting foreign corporations and upper-class clientele, as well as prominent public landmarks. The growth of LEED is moderate only because a growing list of buildings is still going through the lengthy certification processes. The domestic GB standard is applied to more mainstream residential and public buildings. In terms of both the number of buildings and floor space, new GBs in 2012 have exceeded all the previous years combined. The proportion of the ratings by number of stars is approximately 3:4:3 as of early 2013 (author's database). Yet together, GBs remain a tiny fraction, not even reaching 1%, of the gross floor space under construction in 2012.

The vast majority of China's GBs are concentrated in the coastal regions. The areas with a significant presence of GBs are either the largest metropolises or their vicinities. The eight cities with the largest numbers of GB projects together comprised 57.5% of China's GB stock in 2012 while only constituting 0.7% of the total population and 15% of the entire urbanized built area[6]. China's three core zones of development – the Yangtze River Delta, the Pearl River Delta, and the Bohai Rim region – contain over 70% of China's entire green building stock (Fig. 4).

Chinese GBs also have a prominent luxury bias, which is due in part to the early influence of the LEED system, which has morphed into a luxurious corporate symbol in China. Most LEED buildings are collections of state-of-the-art technology, such as the Grand MOMA in Beijing, the first LEED gold building in China, and Vanke's headquarters in Shenzhen, rated as LEED platinum – both designed by American architect Steve Holl. MOHURD wisely moved away from the high-tech features of LEED by emphasizing passive technology, such as better-insulated windows and walls, external shading, green roofs, and natural ventilation and lighting. However, most building professionals I interviewed, with the exception of

[4] See the link for details, http://www.gov.cn/zwgk/2013-01/06/content_2305793.htm.

[5] Press release of the green building action plan, http://news.dichan.sina.com.cn/2013/02/27/658127.html.

[6] Population figure is based on China's 2010 Population census (National Bureau of Statistics of China) and the Urbanized Area is based on the *China Urban Construction Statistical Yearbook* (MOHURD, 2011).

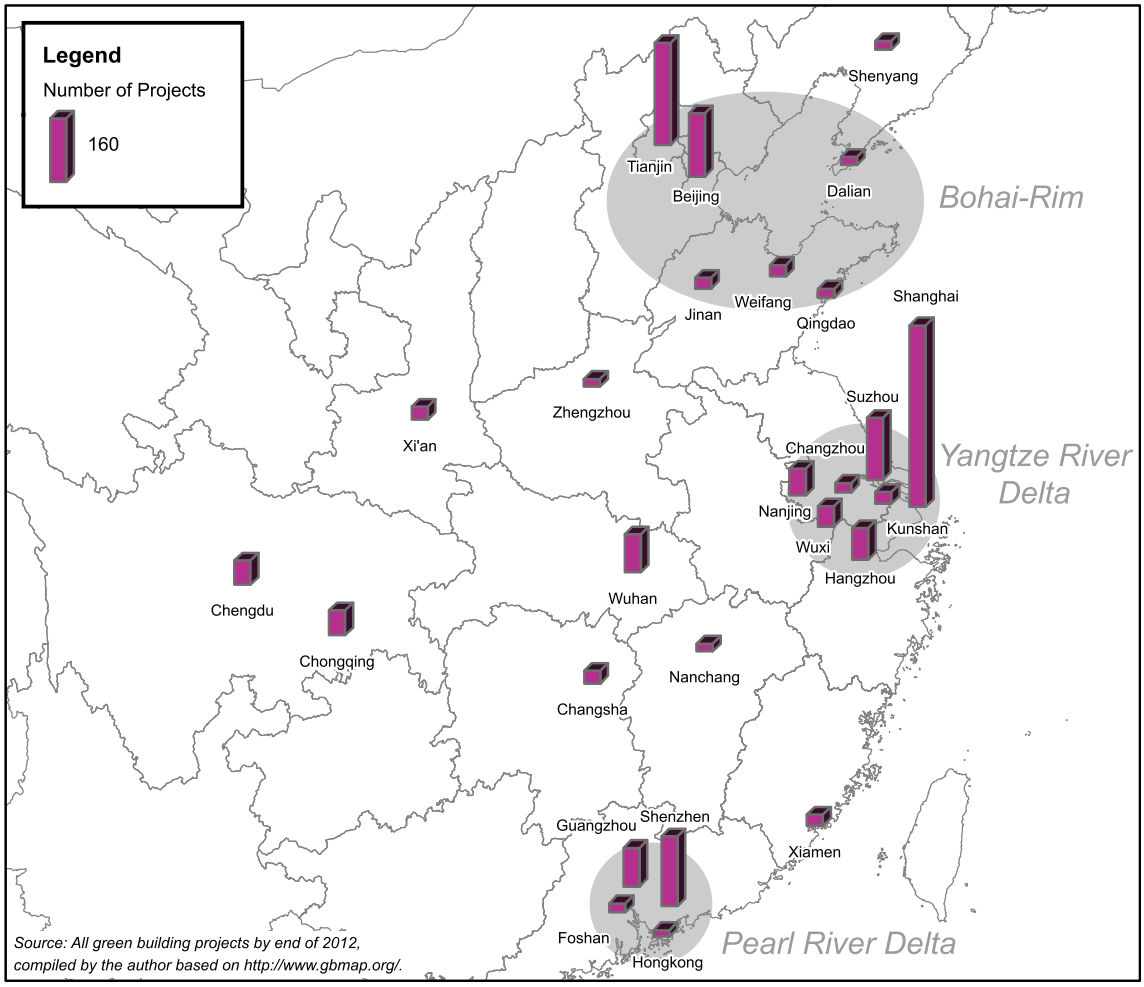


Fig. 4. Distribution of green buildings in China in March 2013. *Source:* compiled from my own database, based on www.gbmap.org.

a few leaders in the promotion of China's GBs, assumed that GBs must come with signature technologies, such as solar roof tops, and geothermal pumps. The perception is even more pronounced in inland provinces. When asked to provide a good example of a GB in Chengdu, the official from the Sichuan Construction Bureau pointed to Raffles City, a newly built, LEED gold-certified commercial/office complex also designed by Steve Holl. The flamboyant complex features geothermal wells, rain water recycling ponds, and high-performance glazing and energy efficient equipment.[7] It is also an upscale symbol of conspicuous consumption with human spaces and local vegetation relegated to marginal positions (Fig. 5). The engulfing scales – and sterile, cold, and geometric appearances – make it difficult for the average observer to determine what is so "green" about it. The luxury bias is so pervasive that a Beijing city-planner bluntly asked why the government should promote GBs because such buildings usually consume more energy.

China's own GB label did not escape such bias, even though the additional costs to meet the GB standard can be moderate with wise technology choices (Yip et al., 2011; Sun and Shao, 2008). Qiu (2013), the former head of the MOHURD, citing research from 213 GB projects, claims that the average increased cost of 'building green' is ¥31/m^2 for one-star housing, ¥88/m^2 for two-star housing, and ¥196/m^2 for three-star housing – all costs that can be recovered in 2–6 years. Yet comparing 330 commercial green apartment units with the average of three conventional ones nearby, I found that the green apartments cost on average almost ¥2000, or 20% more, and the management fee is 36% higher than the conventional average (Table 1). Because the management fee levels are typically correlated with the perceived status of a particular residential complex, this indicates that green housing complexes are built to be higher-end. The situation has improved

Fig. 5. Capital and Raffles City, Chengdu, by Steve Holl, 2007–2012, LEED gold.

[7] Based on description by Steve Holl Architects, http://www.stevenholl.com/project-detail.php?type=housing&id=98.

Table 1
Comparisons of green apartments vs. conventional apartments at the end of 2012. The comparison excludes subsidized affordable GB apartments, which constituted an insignificant proportion by then. The conventional prices are taken as an average of three nearby apartment complexes based on soufun.com. The difference is statistically significant at the 0.01 level for both the apartment sale price and management fee.

		Mean	*N*	Std. deviation	Std. error mean
Average apartment sale price (Yuan/m^2)	Green building	¥12,021.65	330.0	11,340.8	624.3
	Peers	¥10,094.82	330.0	8615.2	474.2
Average management fee (Yuan/mo./m^2)	Green building	¥2.02	292.0	1.6	.1
	Peers	¥1.48	292.0	1.1	.1

slightly as prices and management fees for GBs both decreased in 2012 as GBs moved to areas with lower housing prices. The gaps between green and conventional apartment prices shrank from 23% in 2009 to 18% in 2012 (price), and the management fees dropped from 32% in 2009 to 29% in 2012; however, the gaps are nowhere near closed. The luxury bias runs counter to the purpose of GBs to reduce the building energy consumption. The higher management fees offset the energy savings in GBs, thus undercutting its incentives for ordinary tenants. The following section explains the pattern of GB development by discussing it in the context of China's urban governance.

The stake holders: bureaucracy, the market, building professionals, and the public

State and contradicting incentives of Chinese local governments

There has been considerable debate on whether the state is a good institution to implement genuine environmental programs. Dryzek (1990, 1994) examines the roles of the administrative state, capitalism, and liberal democracy as the three institutional nexuses of the western world to address the ecological crisis. He argues that the administrative state has the benefit of a long-term vision and a "distinctive claim to ecological rationality [that] rests on its purported embodiment of common purpose, neutral expertise, capacity to make sense of complex problems and the will and authority to effect solutions to those problems" (1994, p. 180–181). However, using Lindblom (1977)'s famous formulation of the administrative state having "strong thumbs, [but] no fingers", Dryzek argues that the state is constrained for three reasons. First, it is difficult to ensure compliance on the part of subordinates. Second, rigid bureaucracy can only concentrate on a few limited targets or routines, and cannot address complex and variable problems. The solution of one problem often leads to problems in other areas. Third, hierarchical systems also have a natural tendency to obstruct the free transmission of information and resist the institutionalization of learning derived from trials and errors (1994, p. 181–182). James Scott (1998), a prominent critic of state intervention, argues that the state often subscribes to a faith in high modernism, which he describes as wanting "to use state power to bring about huge, utopian changes in people's work habits, living patterns, moral conduct and world view" (p. 5). This faith, combined with authoritarian power, leads to social engineering and intervention to enhance the legibility of the reality in the eyes of the state. However, because interventions from above do not give sufficient allowance for real, functioning social orders and ignore practical knowledge, informal processes, and improvisation in the face of unpredictability (p. 6), their efforts often end in failure.

While the Chinese state is often assumed to be monolithic, direct and efficient, Lieberthal and Oksenberg (1988) use the term "fragmented authoritarianism" to describe the policy implementation process in China:

> "Policy X resulted from a bargain among Ministry A, B, and C and province D, . . .Disgruntled Ministries E and F, losers in the deal, planned to pursue strategies to erode agreement. . . .The bargain sought to reconcile the conflicting organizational missions, ethos, structures and resource allocations of the ministries involved. Thus, policies are not necessarily either coherent or integrated responses to perceived problems or part of a logical strategy of a leader or fraction to advance power and principle."
>
> [p. 4]

The Chinese GB program illustrates such problems. Two sets of relationships are at the core of the Chinese administrative structures. The first is the relationships between the upper and low level governmental branches. In Chinese, this relationship is referred to as *tiaotiao*, or the vertical commanding system. The second is the relationship between the different governmental branches at the same level, referred to as *kuaikuai*, or horizontal coordination among equal parties in the local area.

The central government makes strategic decisions based on national interests. Given China's resource insecurity, pollution, and international pledge to reduce carbon intensity, a GB program ought to be implemented as quickly as possible. The MOHURD is the leading ministry for GB development within the central government. However, it is not the only ministry that matters in the construction industry. The Ministry of Land and Resources (MOLR) controls land allocation, while the Ministry of Finance (MOF) controls taxes and finances for development. On top of these ministries, the National Development and Reform Commission (NDRC) is the only institution capable of coordinating ministries and is tasked with approving major industrial and infrastructural projects. While MOHURD can create building codes and GB standards, a national action plan would have to be endorsed by the MOLR and MOF. These ministries would only comply if the NDRC made the call. It has taken several years to get the NDRC on board with GB development, so the Action Plan was issued by the State Council and drafted by the NDRC and MOHURD[8] with the support of MOF.

The combination of these ministries and the NDRC in the central government is replicated at the provincial level with provincial branches charged with devising their own regional targets based on the instructions from *tiaotiao*. However, setting any regional target requires coordination among said branches through *kuaikuai*, which is dominated by local concerns. The Action Plan authorizes the provincial governments to develop their plans, thus granting them significant discretion. The result of negotiations between *tiaotiao* and *kuaikuai* is that most provinces ratified the "hard" requirements in the Action Plan but had difficulties generating their own innovations. For example, by early 2014, 25 out of 31 provinces/autonomous regions dutifully issued their own action plans, with all but one replicating the mandatory measures for state-funded buildings. The local incentive programs, however, required additional coordination with other branches and financial support, so only the six richest provinces offered financial subsidies, and the four poorest provinces promised tax rebates or floor space awards (Ma et al., 2014). The rest 15 provinces included only weak provisions such as considering GBs for building awards or adjusting floor space calculations to avoid inadvertently penalizing

[8] See the link for details, http://www.gov.cn/zwgk/2013-01/06/content_2305793.htm.

GBs – neither required approval from other governmental bodies. The commitment and enthusiasm at this level have already dimmed.

The province, however, is only an intermediate layer – the most important layer for GB implementation is the municipal one. This is where the conflicts of interest between GB implementation and economic development are the most intense. Municipal leaders, often mayors, hold tremendous power over the local planning apparatus and development projects. At this level, concerns over carbon emissions and China's energy security are remote, and the supervising power of the central government is at its weakest. Instead, local economic growth and the property market are the overwhelming priorities for municipal leaders. Because land is owned by the state, municipal governments can purchase farmland at a low price from farmers, and auction the land to developers at a far higher rate (Tian and Ma, 2009). These funds, called land lease fees, are the single largest income (83% nationwide in 2010) for local governments and the main financial source for urban projects (Man, 2010; Wu, 1999, 2002; Borst, 2011). Land development brings growth in the GDP, tax revenue, employment, and improved public facilities, and it also improves the financial and trade statistics, all of which will bring rewards to local officials. It is no wonder that local governments care about them immensely (Economy, 2004; Mol and Carter, 2007; Richerzhangen and Scholz, 2008). In Harvey's terms, land development is the magic panacea for the "spatial fix," not exactly for capital accumulation, but for governmental revenue and bureaucratic careers.

While municipal governments could not completely ignore the *tiaotiao* mandates, they have every incentive to "translate" green building and eco-development into "building" and "development" with a "green" façade. The heavy concentration of GBs on the wealthiest coastal areas reflects the development priorities of the local governments. Governments in these regions face stronger pressures from the central government to reduce carbon emissions, so they seek out GB as one way to comply. They also see GB as an opportunity to expand markets for local products. Construction can provide an effective demand for local industries because building materials are bulky and more likely to be sourced locally. Coastal cities have strong manufacturing industries, from heating/cooling equipment to doors, windows, and solar panels. Regional enthusiasm for GBs, is thus tied to upgrades of the local industries. The Weifang City government in Shandong province, for example, promotes solar thermal installation as the local GB standard because it hosts one of the largest solar thermal companies. In less developed regions, however, similar industrial considerations actually discourage GBs because the more expensive building materials would have to be imported. Because less developed regions face less central government pressure to reduce their carbon footprints, there is little interest to push for GB development.

Real estate prices are also another key consideration. In rich cities, high real estate prices ease the absorption of the additional construction costs, and governments feel more confident to issue higher GB standards. However, in less developed regions, the real estate prices are lower, and governments are reluctant to force additional costs for fear of upsetting the local real estate markets.

The luxury bias in GB can also be traced to the development priorities of the local governments and the profit motives of the developers. This can be illustrated by two projects in Nanchang, the capital of inland Jiangxi province. The first project is the Alfa International Community, designed by the American A+K architecture firm based on the LEED standards, with high-tech features such as geothermal pump, solar street lighting, Low-E windows, external metal shades, an air circulation system, and an expensive copper pipe system (Fig. 6). The complex guarantees a constant indoor temperature through eight months of heating and cooling per year (in a province with no winter heating provision). The second project is the Mantingchun MOMA (MOMA thereafter), the first 3-star green building in Jiangxi, built by a leading Chinese developer (Fig. 7). It also features a geothermal pump, well-insulated walls and windows, and rain collection and grey water recycling facilities. Rather than offering a constant indoor temperature, MOMA promises to moderate the extreme heat and cold during four months of the year through floor heating and cooling systems. These two projects are fairly compatible in terms of both the distance from the urban center and the neighborhood housing prices. Yet, in the winter of 2013 when I visited Nanchang, prices in Alfa averaged ¥13,000/m^2, while prices in MOMA averaged ¥7500/m^2. Alfa also had much higher management fees (¥2.8/mo./m^2 vs. ¥1.5/mo./m^2) and heating/cooling costs. Both complexes sold well, but Alfa, with its European style exterior and expensive interior design, represents an exclusive upper class environment, while MOMA is hardly distinguishable from the other nearby residential projects. Indeed, units in MOMA are no more expensive than those in the conventional complexes nearby. In this case, the more visibly luxurious Alfa complex has a far higher profit margin, even though MOMA is more sensible from an energy consumption perspective. Alfa is located in a new district (Honggutan) that the Nanchang government is currently promoting, while MOMA is located in an urban infill. Luxury projects in the new district are more attractive for the government because they raise the land lease prices in the scarcely populated area.

Fig. 6. Alfa International Community, Nanchang, pictured in January 2013.

Fig. 7. Mantingchun-MOMA, Nanchang, pictured in January 2013.

The local governments' enthusiasm for new district development has worried the Chinese central government due to mounting local governmental debts, so the central government has imposed developmental restrictions. Local governments thus seek out GBs or eco-city projects to circumvent such restrictions. It is no wonder that more than 200 Chinese cities have declared eco-city plans (Chien, 2013). Rapoport (2014) suggests that such projects are economically rather than ecologically driven. Indeed, GBs and eco-cities are often the "fix" not only for capital accumulation but also for circumventing the central government regulation and macro-economic control.

Leverage in the real estate market

The involvement of business sectors is crucial for the GB program, especially given that China's property market is highly commercialized. EM scholars advocate a shift from command and control-minded state apparatuses to a more flexible and collaborative relationship, more specifically, "from curative and reactive to preventive, from exclusive to participatory policy making, from centralized to decentralized wherever possible and from domineering, overregulated environmental policy to a policy which creates favorable conditions and contexts for environmentally sound practices and behavior on the part of producers and consumers." (Buttel, 2000, p. 61). The goal is to make "the state provides the conditions and stimulates socials' self-regulation' either via economic mechanisms and dynamics or via the public sphere of citizen groups, environmental NGOs, and consumer organizations". The relative success of European countries in reducing their buildings' carbon footprint suggests that the approach can be productive.

Although the Chinese state does realize the importance of motivating developers, it has yet to settle on an effective approach. Today, China has over 800,000 developers of various sizes and origins, the vast majority of which are privately owned, for-profit corporations (China Bureau of Statistics, compiled database). As shown by Fig. 8, surveyed architects perceived a lack of interest on the part of developers and clients to be among the top barriers to GB development. A few of China's leading developers, such as Vanke, Wanda, MOMA, and LVDI are early supporters of GBs. Their interests in GBs are due in part to personal values and brand building. Wang Shi, the charismatic founder of the largest housing developer Vanke, is an avid mountain climber and a self-proclaimed environmentalist. Wanda, the largest commercial real estate developer, is interested in the potential lifetime savings in both the managerial and operational costs of the GBs because it manages most of its own properties, as does Vanke. Some developers are also involved in GB to gain expertise in new building technology. These developers, however, represent a tiny minority. As GB remains a voluntary program, most mid-level developers find no particular reason to embrace it.

The growth of China's GB program between 2008 and 2013 also coincided with a speculative housing market, which has colored the program's implementation. Housing prices increased rapidly in Chinese cities after 2003. Fig. 9 shows that after a temporary hold during 2007–2008 due to governmental control measures, prices took a speedy upturn in 2009, due largely to massive stimulus spending and loose monetary policy designed to counter the effects of the 2008 financial crisis. The stimulus injected a tremendous amount of liquidity into the market, much of which ended up flooding into real estate. In fact, researchers argue that this graph may even under-estimate the housing price increase because it is biased toward smaller cities and newly built areas away from urban cores. Land prices have also appreciated at a rate of 20% annually between 2004 and 2012, constituting the most important driving force for rising housing prices (Wu et al., 2012). This sharp

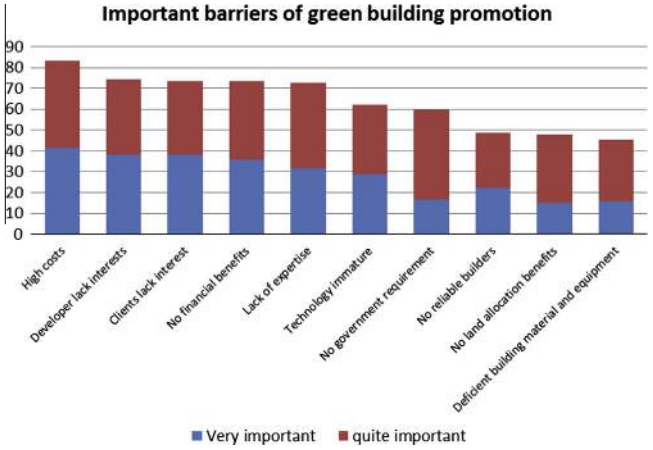
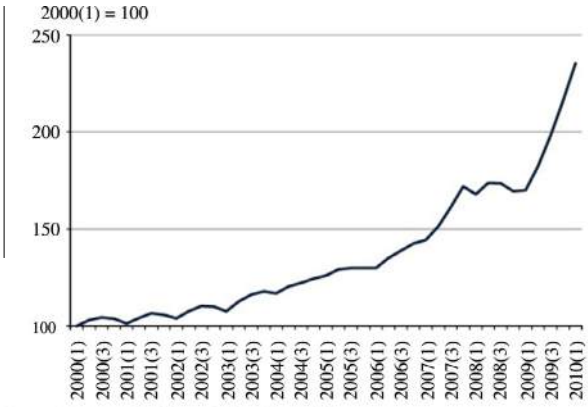


Fig. 8. Barriers to green building development. *Source:* architect survey by author



Source : Institute of Real Estate Studies, Tsinghua University.

Notes: Hedonic models are used to control for quality changes in underlying samples of newly-built, private homes in 35 major markets in China. Real indices are created by deflating with the CPI series for each market. Aggregate indices are computed as the weighted average of the local market series, with transactions volume between 2000-2008 as the fixed weight.

Fig. 9. Housing price increase. *Source:* Wu, Gyourko and Deng, 2012.

increase compelled many urban middle- and upper-class families to invest in multiple houses to preserve their savings or return on investment. The result was a massive construction boom and corresponding high vacancy rates (Barth et al., 2012). Across China, many new towns, districts, and industrial development zones were constructed, some of which became the notorious "ghost cities." Vast apartment blocks and districts have been established with very few people actually living in them[9] (Bar-On, March 3, 2013). Many of these apartments were sold as second or third homes for nearby city residents. Given the new towns' distances from existing urban centers and the lack of quality educational services and health care infrastructure, it is unlikely that these apartments will be fully occupied any time soon.

This speculative context severely distorted the incentive structure for stakeholders in the building industry, thus hurting the GB drive. First, speculation rapidly drives up property prices, so that as long as locations are desirable, apartments can be sold very quickly. This certainty of sale reduces the competitive pressure for developers to improve their stock. Interviews with developers, major housing brokers, and real estate associations in Beijing all confirmed that before 2003, developers were interested in green technology to strengthen their sales, but that after 2003, few of

[9] China's Real Estate Bubble, CBS news, 60 min. March 3, 2013.

these efforts remained necessary. For architects, GBs require longer design cycles and more customized approaches based on the site and building specifics. Speculation, however, prioritizes the speed and timing of the projects and downplays the value of creative design. Under this time pressure, it is much easier for architects to mass-produce conventional designs than it is to persuade developers to adopt innovative and customized green approaches. For the end users, the attraction of GBs is a more comfortable lifestyle with lower energy costs. However, if apartments are seen primarily as investments and capital assets rather than places to live, home buyers will not be as interested in the quality and energy performance of their apartments.

In 2014, the highflying Chinese housing market suddenly cooled down. Observers predict that the housing market will enter a long period of moderate growth, if not outright collapse. If that is the case, the market may provide more favorable conditions for better quality housing. However, the sluggish housing prices and the pressure of loan payments may also prevent small developers from investing in green technology. In addition, if the building boom is indeed over, it would mean that China's GB drive has missed the opportunity to incorporate environmental features in the largest number of newly built buildings.

Given the reality of the housing market, the Chinese government plans to motivate developers in two main ways: First, it mandates that all publicly funded projects have to meet GB standards, and second, it authorizes local governments to provide subsidies for 2- and 3-star buildings. In theory, subsidies could be used to incentivize developers. However, developers in China have a dubious reputation and are widely seen as profiteers who gain at the expense of the urban populace. Sending more money to developers is thus politically unpopular. While the state approved subsidies for GBs in 2012, no money was actually awarded for any individual project by the end of the 2013, and in 2014, only six of the wealthiest provinces promised subsidies for higher rated GBs.

Interestingly, many of the developers that I interviewed were not particularly enthusiastic about state subsidies either, reasoning that they would not end up with much money because most of it would vanish in the different layers of government. For developers, there are more direct incentives that matter considerably more. Singapore, for example, links high Green Mark ratings with land allocation, with additional awards of 1% to 2% of the permitted floor space/land ratio – something that many Chinese developers would prefer because it would mean more apartment units to sell. There are other localized approaches that can incentivize developers, such as reduced fees or tax rates from local governments, expedited approval processes, land allocation priority, and favorable financial terms. These methods are used in various countries and some localities in China. Four of the least developed provinces in China – Hainan, Qinghai, Inner Mongolia and Guizhou – lack the financial resources of the coast and have opted for such approaches. However, this is not wide spread as the interviews suggest that many officials find linking GB with an additional floor/land ratio to be contentious within *kuaikuai*. The space/land ratio is controlled by the local planning bureau and thus is outside the authority of the local MOHURD branches. In the end, lacking a rich set of tools to mobilize developers, most localities in China instead must rely on "hard measures," such as publically funded buildings, to meet its ambitious GB goals. This severely limits the scale and environmental performance of the GB program.

While the governments focus only on the financial subsidies, there are other institutional opportunities to promote GB. For example, in most Chinese buildings, the property management is run by a third party, which discourages a long-term quality commitment on the part of developers. Those developers most interested in GBs tend to be those who also manage their properties because they are interested in the quality, durability, and operational efficiency of the buildings. Now, as competition between developers intensifies, more and more developers are establishing their own property management branches. The MOHURD should take advantage of this trend to normalize such an institutional arrangement to motivate more developers to choose GBs.

Public awareness and participation

The most crucial element of the EM approach is public support, especially to overcome the lack of information transparency inherent in hierarchical systems (Dryzek, 1990). While the Chinese government's Action Plan recognizes the role of the public, it provides no roadmap for engagement. By relying mostly on the bureaucratic channels, China's GB projects become embedded in an urban governance model that has almost no provisions for independent public participation. The result is evident.

In contrast to the widespread name recognition of LEED labeling in the United States, China's green building label feels like a best-kept secret. Given that the program is young, it is not entirely surprising. However, in 2013, even many building professionals – property brokers, staff members of governmental construction commissions, property managers and architects – had not heard about China's green building label (you know how poor awareness is when the senior managers of Beijing's largest housing broker agent admitted to having no knowledge about the label!). As for public perception, GBs are often misunderstood as properties with lots of green space. In fact, so few people have ever heard about the label that certified GBs hardly bother to mention their certification on real estate marketing websites.

This lack of public awareness about green buildings is not caused by the indifference of Chinese homebuyers to the environmental performance of their homes. In fact, interviews with architects and property brokers in Beijing suggest that the city's residents pay great attention to apartment orientation and natural ventilation, as well as to non-toxic interior furnishings, the spacing between buildings, and green space in the complexes, all of which are taken into account by the GB label. The Chinese public is also sensitive to energy costs, as they spend a higher proportion of their income on energy than do people in developed countries. However, there has been no effort to organize common environmental preferences and concerns into public recognition of the GB label. A leading green building expert, Mr. Wang Youwen, for instance, believes that if Chinese homebuyers were better informed about the heat-conducting index of walls and windows, market forces would compel developers to install better insulation. The Chinese government has made some efforts at public education. For example, the 2010 World Expo in Shanghai featured GB technology, but these were mostly high-tech features designed to impress the audience rather than provide practical information for homebuyers and tenants to evaluate the environmental performance of their buildings. It is striking then, that with so much state attention given to GBs, no effective publicity campaign regarding the GB label or related knowledge about the benefits of green practices has been undertaken.

At least one good example of public mobilization and education in China does exist: The Shenzhen Institute of Building Research. As a center for research and education on, and technological support for green buildings, the Shenzhen Institute provides an excellent model for such efforts (Fig. 10). The Institute's office building has a three-star rating and represents a localized and participatory approach to sustainable building design with an emphasis on passive technology. The building was designed in 2005 in a process that started with an internal competition followed by external bidding, and then incorporated public and expert inputs through various public events, including input from LEED founder Robert Watson. The building's construction took place between 2006

Fig. 10. Shenzhen Architecture Science Research Institute office building.

and 2009, with on-going public participation in offering green solutions (IBR, 2009). The building now serves as a public education venue and hosts group tours for both professionals and community members on a daily basis. It also provides comprehensive technical support and solutions for green buildings in the Pearl River Delta. Among major Chinese architectural institutes, IBR is exceptional in its willingness to take on a leadership role in the industry and engage with the public, while other similar institutes view their roles primarily as consultants to the government. As a result of IBR's work, 90% of the architects that I surveyed in Guangzhou and Shenzhen have been personally involved in designing green buildings, while only approximately 25% of the architects surveyed elsewhere had similar experience. This suggests that China does not lack good examples of public engagement; what it lacks is government commitment and skills for public engagement.

Leveraging the knowledge network of building professionals

The environmental performance of buildings is determined by the integration of many products and systems: architectural designs, construction materials, heating and ventilation systems, water systems, electrical systems, landscaping, construction and maintenance protocols, and building management are all contributing factors. Successful GB projects require intense communication and coordination regarding maintenance and services among people with different expertise and responsibilities, both during the construction process and throughout the buildings' lifetimes. This coordination suggests the importance of capacity building and knowledge sharing among building professionals, which is best accomplished through mobilization in the professional networks. LEED, for instance has been particularly effective in creating a knowledge network among building professionals that provides technological advocates and support. My survey of senior architects in China, however, found that capacity building is only at a nascent stage. Just over 50% of surveyed architectural institutes in China's developed regions have ever been involved in any GB project. Among these institutes with green building experience, about ¾ of them had GBs comprising less than 10% of their projects. Only three institutes had GBs as more than 30% of their projects.

Among surveyed architects, only a third had been personally involved with GBs. The regional survey sample of 10–15 is too small to be reliable, but it still shows evident regional differences (Table 2). In the richest regions – Beijing, Shanghai, Guangzhou, Hangzhou and Shenzhen – the vast majority of architectural institutes have built at least one GB, whereas in the other regions, the majority of institutes have no experience with GB. Even in Beijing and Shanghai, few architects have been personally involved in designing GBs. The only exceptions are Guangzhou and Shenzhen, both in Guangdong province, where all surveyed institutes and 90% of architects had been involved in GBs. The survey also shows that over 70% of surveyed architects readily acknowledged that their lack of experience in GB represented a major barrier, an even higher barrier than the lack of qualified builders, building materials, or technological maturity (Fig. 11).

Table 2
Experience with green buildings. The questionnaire was designed for provinces and national-level cities, but because most of the answers in the provinces, with the exception of Shandong, came from the provincial capitals, the table is listed as cities. I removed Hubei province from the results because only one questionnaire was submitted. *Source:* architect survey.

Region	Respondent's Institute built green building		Respondent designed green building		Total # of architects surveyed
	#	%	#	%	#
Guangzhou	15	100	15	100	15
Shenyang	4	100	4	100	4
Shenzhen	4	100	2	50	4
Hangzhou	7	70	1	10	10
Beijing	10	67	7	47	15
Nanjing	6	60	5	50	10
Shanghai	8	53	2	13	15
Shandong	5	50	4	40	10
Chengdu	3	33	2	22	9
Xi'an	1	14	1	14	7
Fuzhou	0	0	0	0	11
Tianjin	0	0	0	0	10
Total	63	53	43	36	120

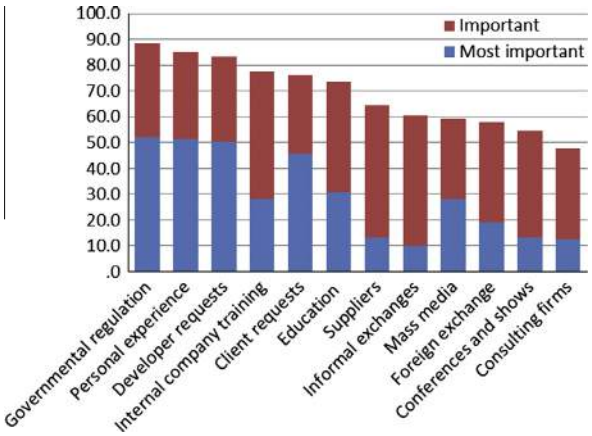


Fig. 11. Sources of green building information. *Source:* architect survey.

The survey also shows that architects primarily receive information about GBs through government mandates and personal experiences, as well as through the requests of developers or clients (Fig. 11). Formal education, foreign and domestic informal networks, and conferences and trade shows, play only limited roles. Interestingly, the survey shows that approximately 30% of respondents consider mass media to be a very important source of information, almost as important as education, and more so than professional networking. These results suggest that professional education and knowledge networks on GB have yet to emerge and that the green buzz among professionals lags behind even the public sphere.

Although they lack experience, Chinese architects do not lack enthusiasm for GBs. When asked about whether they would

recommend GB measures to their clients, over 80% selected 'highly recommend' or 'selectively recommend'. However, they also acknowledged that the incentive structure in the real estate market is not particularly conducive to promoting green buildings. For example, design fees have not increased for over a decade, despite the fact that building budgets have grown tremendously, which discourages innovative design (interviews). The design time cycles are also tight, as developers are always racing against time. For example, one young architect in a large institute in Beijing said that it is typical for him to be working on two dozen projects simultaneously, most of which must be finished within half a year. He inevitably ends up with mass produced blueprints, despite a personal desire to do more creative job. Several overseas architects working in Beijing also commented that the short time-cycle for Chinese architectural firms undermines attention to the environment. Unlike the case of LEED, professional networks are a largely untapped area for China to promote GBs.

In the end, capacity building in GB is a multifaceted process that is governed by diverse institutions and conventions, while the bureaucratic attention is limited to narrower targets and routines, thus "strong thumbs, no fingers." The EM approach suggests a broad collaborative approach. The incorporation of public education and technical support, as exemplified by Shenzhen's Institute of Building Research, and the extensive professional networks developed by LEED, are all models from which the Chinese government could learn.

Conclusion

Compared to other countries, the Chinese GB program is unusually top-down and reliant upon bureaucratic hierarchies and apparatuses for implementation. Whereas the system may have succeeded at jump-starting a nationwide GB program, it has so far failed to address the misaligned priorities of the national and local governments as well as the distortions created by the speculative property market. The limited impact of GBs in the mainstream property market, their geographical unbalance, and luxury bias, the lack of participation and enthusiasm among the majority of developers, the ignorance of the public, and the dearth of knowledge networks among building professionals are all symptoms of the underlying problems of the bureaucratic system.

The point of this paper is not to argue that a governmental approach to the environment is fundamentally wrong. On the contrary, the fast growth of GB projects in China would not have happened without the Chinese state. Rather, I argue that a successful institutionalization of environmental criteria requires the collaborative efforts of many stakeholders. In GB as well as in other spheres, China is playing catch-up and intends to bend the learning curve of greening the built environment. In the world's oldest bureaucracy with a strong central planning legacy, it is not surprising that China's GB program gravitates to state command at this initial stage. Yet, the heavy reliance on a state-centered approach may prevent the program from achieving effective outreach. Ultimately, the absence of any vocal opposition may allow, though not assure, China to meet its GB goal in a record time, but such an approach will be unable to create the collective environment necessary for a quality and sustainable GB program. Bartlett (2005) argues that the state needs to embrace dismantling and transmogrifying changes from within to overcome its limitations in solving environmental problems. Paehlke (1990) suggests that "[E]nvironmentalism cannot be successful in the long run without a continuous enhancement of opportunities for democratic participation" (p. 51). China's experience in GB underscores the importance of coalition building in environmental institutions. The state has to learn to leverage its power wisely by providing enforceable regulation, transparent governance, credible evaluation processes, flexible incentives for developers, and a supportive environment for public interests groups, academics, and market-oriented services for GBs. Good examples already exist, both within and outside of China. Given China's political economic regime, the EM framework in China may differ considerably from those of western countries both in form and in the speed of formation, especially regarding a more powerful role for the state. Yet, as the GB program shows, China can not be exempted from the rule that its ecological modernization is ultimately tied to political modernization.

Acknowledgements

This research is supported by the Peking University-Lincoln Center for Urban Development and Land Policy, the Lincoln Institute of Land Policy, and the Vassar College Collins Fund for Environmental Research. I would like to thank Sun Jiajing, Eroll Kuhn, and Zachary Kent current or former students at Vassar College, and Cai Yifan at Peking University (currently in Clark University), for their help in preparing the database and manuscript.

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