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Green housing transition in the Chinese housing market: a behavioural analysis of real estate enterprises

Abstract

The concept of green housing has been introduced in China to deal with climate issues in the housing sector. Green housing development requires a complex socio-technical transition based not just on green materials or technologies, but also, and most importantly, on the behavioural transition of housing market actors. Little is known about how Chinese real estate enterprises are responding to the green housing transition within a Chinese context. Addressing this gap, our research aims to determine whether, and to what, extent Chinese real estate enterprises are transitioning toward greener housing practices and what constraints may exist. This research gap is particularly pressing given the Chinese government's ambitions to promote energy efficiency in the new urban building sector by requiring 50% of urban new buildings to be green buildings by 2020 (NDRC, 2016). Our research reveals Chinese real estate enterprises face a dilemma of 'going green' and a range of institutional constraints that currently frustrate their uptake of green housing practices. Our research furthers knowledge on environmental and housing market governance within non-western and non-liberal contexts.

Keywords

Socio-technical transitions; Green housing; Institutional analysis; Real estate enterprises; State-market relations;

Highlights

- A stylised representation of the housing market as a specific institutional ensemble is depicted.
- A range of institutional constraints to the green housing transition were identified through the investigation of real estate enterprises' behaviours.
- Real estate enterprises face a dilemma of 'going green' in the transition towards a green housing future.
- Additional work is needed to establish a clear policy pathway to guide future market action to ensure short-term behaviours contribute to long-term institutional change.

Declarations of interest: None

Word count: 8,992

1. Introduction

An increasing body of scientific evidence shows that climate change, caused by human activities, is real and urgent (WWF, 2016). China has become the largest carbon contributor worldwide since 2014 and accounts for about one-quarter of global carbon emissions (Xu and Lin, 2017; Edenhofer et al., 2014). The figure continues to grow as a consequence of China being in a period of rapid urbanisation and industrialisation (NBSC, 2015). Globally, the building sector contributes up to 30% of carbon emissions, with the housing sector accounting for 24.5% of this sector (BERCTU, 2016). According to data from the China Database of Building Energy Consumption and Carbon Emissions (Ma and Cai, 2019), energy consumption in the Chinese civil building sector reached 857 million tons of standard coal equivalent (Mtce) in 2015, which accounted for 19.93% of China's total energy consumption. It is therefore not surprising that the building sector has been identified as the sector with the greatest potential to reduce carbon emissions (IPCC, 2007; GhaffarianHoseini *et al*., 2013).

In recent years, the concept of 'green housing'[1] has emerged in the Chinese housing policy agenda and has since become a dominant trend for new housing building in China (Wu *et al*., 2018, 2015; Tan *et al*., 2018; Jiang, 2016). To promote green housing development, the Chinese government has issued various policies and regulations into the Chinese housing market. However, the successful implementation of green housing policies and regulations largely depends on market actors' willingness to engage with the standards set (Zhang *et al.,* 2011a). This is especially true with regard to real estate enterprises, who are the major delivery agents of houses and often characterised as 'impresarios, orchestrating developments by bringing together labour, capital, and land to create the right product in the right place at the right time' (Adams *et al.,* 2012, p.2582).

Whilst some scholars have evaluated the Chinese government's transition towards green housing as an effective approach to reduce carbon emissions in the housing sector (Wang, 2014; GhaffarianHoseini *et al*., 2013), comparatively little research has been undertaken to determine whether, and to what extent, Chinese real estate enterprises are transitioning toward greener housing practices and what constraints may exist. This research gap is particularly pressing given the Chinese government's ambitions to promote energy efficiency in the new urban building sector by requiring 50% of urban new buildings to be green buildings by 2020(NDRC, 2016).

We address this gap in knowledge by showing how China's real estate enterprises have responded to green housing policies and regulations. In doing so, we identify a range of key 'institutional' constraints that exist which we argue are preventing the transition towards a green housing future in China. Our research adopts a qualitative 'behavioural' approach, drawing on institutional and socio-technical transitions literatures to conceptualise the complexity and dynamics evident in market responses to state-led policy change (Payne and Barker, 2018). What follows is a review of previous work on green housing in China, an overview of the conceptual and methodological approaches and a discussion of the results. The paper is concluded with an overview of the contribution to knowledge.

2. The Green Housing Transition in China

2.1 Green Housing Policy

At the national level, China's 13th Five-Year-Plan (FYP) requires the government to 'promote building energy efficiency and develop the entire industrial chain of green buildings' (NDRC, 2016). The latest goal in the 13th FYP period requires 50% of urban new buildings to be green buildings by 2020. At the local level, the survey by Zhang *et al.* (2018) found there to be a total of 102 provincial green building policies and regulations in China. Amongst these, many focused on targeting housing market actors and encouraging them to adopt green housing developments. These supply-side policies can be grouped into four categories: land-related policies, direct or indirect subsidies, preferential policies for projects, and preferential policies for enterprises (Shi *et al*., 2014; Darko *et al*., 2017; Zhang *et al*., 2018).

[1] Generally, green housing is seen as a housing type that 'provid[es] people with healthy, applicable, efficient space and natural harmonious architecture with the maximum savings on resources (energy, land, water and materials), protection for the environment and reduced pollution throughout its whole lifecycle' (Li *et al.,* 2016; Kibert, 2016).

In 2006, the Chinese government also issued the Evaluation Standard for Green Building (ESGB) as the main technical basis for carrying out and evaluating green building practices in China. This was updated in 2014. A Green Building Label can be applied for by real estate enterprises if their housing projects meet all the control items in the Standard and they are encouraged to select an appropriate score and innovation indicators. The Green Building Label has three levels (one-star, two-star and three-star) that are based on performance against all the indicators in the ESGB (MOHURD, 2014). It is worth noting that since 2014, Green Building labels are divided into two categories in the ESGB: Green Building Design Label which is conducted after the examination of design and planning documents; and, Green Building Operation Label which is conducted after one-year's operation of the building (MOHURD, 2014).

This suite of green housing policies, regulations and the Evaluation Standard play a crucial role in guiding and incentivising 'green' housing market activity and the operation of real estate enterprises in China (Zeng *et al.,* 2011; Ye *et al.,* 2013). However, some scholars have argued there to be a 'lack of policy rationality' in green housing policies in China (Li and Shui, 2015; Shen *et al.,* 2017). The efficacy and validity of current Chinese green housing policies has been questioned for a variety of reasons such as a shortage of post-policy supervision (Huang *et al.,* 2015); a lack of incentives to foster market-based mechanisms to develop green housing (Li and Shui, 2015); and, overlapped and unclear standards and regulations (Zhang, 2015). It is arguable these policy constraints may lead to a lack of market attractiveness for green housing development which could dissuade Chinese real estate enterprises from delivering green housing developments. Such is the basis of the empirical study that follows.

2.2 Green Housing Development

Based on information released by the MOHURD, Table 1 represents the number of buildings receiving a Green Building Label between 2008 and September 2016. The data reveals that the growth rate of green buildings has accelerated significantly in recent years. Nevertheless in 2015, the 1,092 buildings achieving the Green Building Label accounted for only 12% of building starts (NBSC, 2015), indicating that the market penetration of green building development in China remains limited.

	2008	2009	2010	2011	2012	2013	2014	2015	2016 (Sept)	Total
No.	10	20	82	241	389	704	1,092	1,533	444	4,515

Table. 1: Numbers of green building in China (2008-September 2016) (Source: http://www.cngb.org.cn)

Additionally, according to Zhang et al. (2018), increasing levels of green development in the housing sector faces greater challenges than the commercial sector. Among the housing projects successfully achieving Green Building Labels in 2015, the proportion of those achieving a three-star Label was only 14.9%. This proportion was even smaller – 4.5% – for projects with Green Building Operation Labels in the same year. These numbers are much lower than those in the commercial sector.

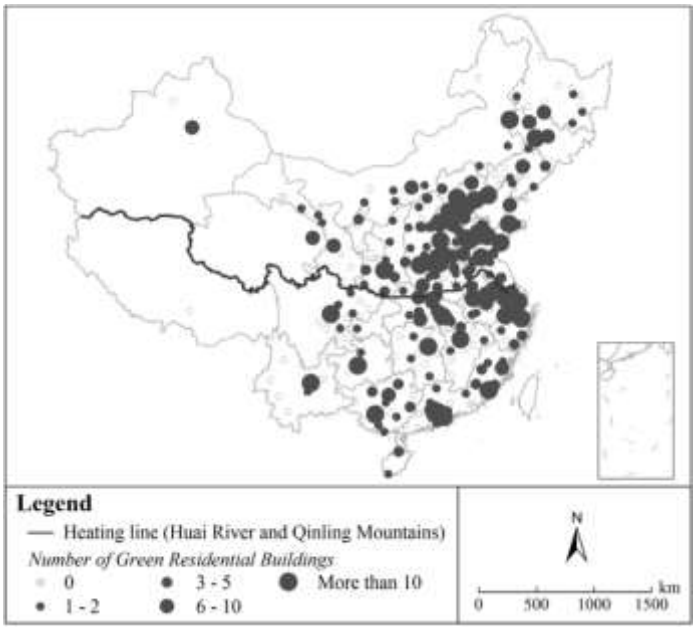

Figure 1: Numbers of green housing distributed in China (Source: Zhang *et al.,* 2018)

Figure 1 shows the geographic distribution of green housing projects by cities in China (Zhang *et al.* 2018). It can be seen that there is a spatial imbalance in the development of green housing, which can be explained by three reasons (Zou *et al*. 2017): the great differences of physical and climatic conditions between cities; different levels of economic growth; and different public polices, including mandate and incentive policies between cities. This uneven distribution of green housing has been alleviated in the recent years, but is still noticeable. Zhang et al. (2018) also reveal that, as of 2015, 80% of green housing projects in China were developed in 20% of cities and 70% of these green housing projects were occupied by 30% of the population.

2.3 Green Housing Adoption by Real Estate Enterprises

A variety of drivers for real estate enterprises towards green housing development have been identified in the international literature, such as greater return on capital (Fesselmeyer, 2018) or the effect that such initiatives can have on companies' reputations and competition abilities (Zhang *et al.,* 2011b). However, the effectiveness of these drivers are questioned by a number of international studies that have examined the barriers facing real estate enterprises when adopting green housing development practices (Chan *et al*., 2018; Sharma, 2018; Qin *et al*., 2016; Hurlimann *et al.,* 2018). Although there are differences between green housing development contexts within developed and developing markets, the adoption of green housing with these two market contexts has been shown to face generally similar barriers (Nguyen *et al*., 2017). We argue that drawing on this body of international work will yield a more comprehensive understanding of the potential barriers facing China's real estate enterprises, which is necessary for formulating richer and more sophisticated pathways to overcome them (Chan *et al*., 2016). What follows is a synthesis of international research on barriers to green housing development arranged around four categories.

2.3.1 Financial factors

The high costs, especially initial costs, associated with higher levels of uncertainty pertaining to envisaged rates of return on capital within green housing developments are often seen as a major barrier to real estate enterprises (Choi, 2009; Ying *et al*., 2012; Marker *et al.,* 2014). There is a widespread perception in the housing industry that green buildings are more expensive to construct than those using traditional building processes (Rehm and Ade, 2013; Zhang *et al*., 2011a; Dwaikat and Ali, 2016). As the World Green Building Council (2013) notes, incremental costs of green housing include 'soft costs' (intangible items or services such as green housing certification fees, design and consultation fees) and 'hard costs' (such as the cost of green materials and green equipment). These issues complicate the implementation of cost control in green housing projects, making it problematic for real estate enterprises to keep within their projects' budgets. Another important cost in housing is time. Delays in green housing projects are caused by several factors, such as the longer time needed to approve new green technologies and the lengthy implementation time of introducing onsite technologies (Hwang and Ng, 2013).

2.3.2 Market factors

For real estate enterprises, payment from consumers is the major, and sometimes, only opportunity for them to collect rewards from green housing investments (Zhang *et al*., 2018). However, previous studies show that ordinary consumers do not have the specialised knowledge required to assess the 'greenness' of buildings (Brounen *et al.,* 2013; Zhou, 2015; Zhang *et al.,* 2016). Moreover, Davis and Metcalf (2016) found that the green certifications could not provide efficient information to consumers and could not help consumers to make efficient decisions. This issue is more noticeable in China (compared to developed western countries) because information transparency within the Chinese housing market is insufficient and the consumers' awareness of green housing is scarce (Zhou, 2015).

2.3.3 Policy factors

Much of the existing literature reveals that policy resistance is one of the major barriers to green housing development (Chan *et al.,* 2016; Darko and Chan, 2017). In green housing transitions, incentives are usually provided by the government as motivators for promoting market adoption (Olubunmi *et al*., 2016). However, studies have shown that many countries are still lacking incentives for green housing (Serpell *et al*., 2013; Luthra *et al.,* 2015; Zainul Abidin *et al.,* 2013). In addition, another political barrier is the lack of codes and regulations for green housing development. Although some countries have introduced green housing policies and regulations, implementation of those policies and regulations is either inadequate or absent (Luthra *et al.,* 2015; AlSanad, 2015). Furthermore, Mousa (2015) states that most governments in developing countries are unable to identify priorities of development and plan strategically. In this case, non-transparent and under-regulated activities may materialise within housing markets.

2.3.4 Technological factors

Some studies show the lack of technical knowledge could be another important barrier (Hwang and Ng, 2013). At the origin and application level, the lack of professional knowledge of real estate enterprises is obvious (Mousa, 2015). Moreover, there is also a lack of skilled employees in the market (Wang, 2014). If a designer or an engineer cannot make effective decisions about how to integrate green equipment into a housing development, the design might be jeopardised and this may cause delays to projects and add extra costs (Shi *et al.,* 2013). One of the reasons why this problem persists is the lack of available training for project staff (Luthra *et al.,* 2015).

The above review shows how real estate enterprises face a variety of barriers from a range of factors. Where green housing development decisions are considered by real estate enterprises, these factors are likely to interact and make the situation even more complex. The extent to which these barriers exist in the Chinese context, and lead to Chinese real estate enterprises favouring traditional housing construction processes rather than adopting green housing development techniques, is a necessary area of further investigation upon which we have based our empirical study.

2.4 Conceptualising the Green Housing Transition

In this research, we consider a green housing transition as a form of socio-technical transition by which housing developments are transferred from traditional methods of planning and construction towards 'greener' ways of doing so. Socio-technical transitions refer to major shifts that move beyond technical dimensions to encompass broader institutional, cultural and behavioural dynamics relevant to societal change processes (Geels, 2004, 2010). Socio-technical transitions are long-term and non-linear processes and macroscopic, which affect the entire organisational field (Geels and Schot, 2010). There are three main characteristics that socio-technical transitions:

- *Multi-factor*: transitions need to be achieved by the interplay of many factors such as technical, societal, financial and behavioural changes. All the factors are influenced by each other.
- *Multi-actor*: transitions require a dramatic change in the thinking and behaviour of all actors. In the housing sector for example, these actors are real estate enterprises, consumers and policymakers (Dent *et al*., 2012).
- *Multi-level*: changes happen at various levels; individual behaviour changes at the micro-level; institutional structures and rules transform at the meso-level; and wider societal and cultural changes take place at the macro-level (Chan *et al.,* 2016; Darko and Chan, 2017; Geels, 2010).

Rosenbloom (2017) indicates that the implicit ideas in this framework are state-market interactions. *State* represents the policy agenda that develops incentives to activate market innovation and entrepreneurship into a new 'regime'. *Market* represents the social agenda that makes reactions to such incentives in the market regime. In a green housing transition, both governments and market actors face immense pressures to challenge and gradually replace the conventional practices of housing construction with ones that are greener.

Green housing transitions are viewed as being goal-oriented and purposive to successfully address climate change issues. Green housing transitions are therefore different from other transitions which may be largely 'emergent' (Smith *et al.,* 2005). Moreover, as climate protection is a public good, private actors such as enterprises, industries and consumers often have little incentive to address it (Geels, 2018). As such, green housing transitions should not be regarded as a challenge only for policymakers, but rather, as a prudent social learning process (Stirling, 2007). How market actors participate in experimental green housing projects, so as to 'stretch existing routines and stimulate reflexivity' (Geels, 2010, p.500), is of fundamental importance for both the efficacy of green housing policy and the overall success of a societal transition toward a green housing future.

As green housing transitions are multi-actor, multi-factor and multi-level tasks, we argue the need for an analytical framework that enables these factors to be examined empirically. We draw on the work of Payne and Barker (2018) to develop a framework based on the principles of new institutionalism, which provides 'a bridge between macro-/ structural perspectives and more micro-/ process approaches' (Thornton and Ocasio, 2008, p.99). New institutionalism provides an explanation of how institutions - defined as forms of ongoing and relatively stable patterns of social practice based on mutual expectations that owe their existence to either purposeful constitution or unintentional emergence (Bathelt and Gluckler, 2014, p. 346) - shape the behaviour of market actors (Scott, 2008; DiMaggio and Powell, 1991), which in turn influence institutions. From this perspective, housing market activities are embedded within an institutional environment that sets the principles and rules as the basis for market production. Some argue it is important for market actors to follow these principles and rules to gain legitimacy in specific environments and mobilise their resources to maximise efficiency (Yang *et al.,* 2012). In contrast, others consider how actors accommodate strategic responses to handle institutional constraints (Yang and Wang, 2011) and benefit from institutional capital (Grewal and Dharwadkar, 2002). Taking an institutional appraoch therfore involves examining the dynamic interaction between how market actors operate and the wider institutional relations of which they are a part (Payne, 2019).

2.4.1 Analytical Framework

There are three levels of analysis that an institutional approach typically adopts: *societal organisation*, which includes political, social, economic, legal norms, conventions, rules and regulations; *networks*, which includes rules, conventions and relationships influencing the functionality & reflecting the dominant traditions / interests within a society; and, *actors*, which are those organisations operating within a given network pursuing a common objective with defined choices, behaviours and motivations. A stylised example applying this to an institutional ensemble of a typical housing market is depicted in Figure 2.

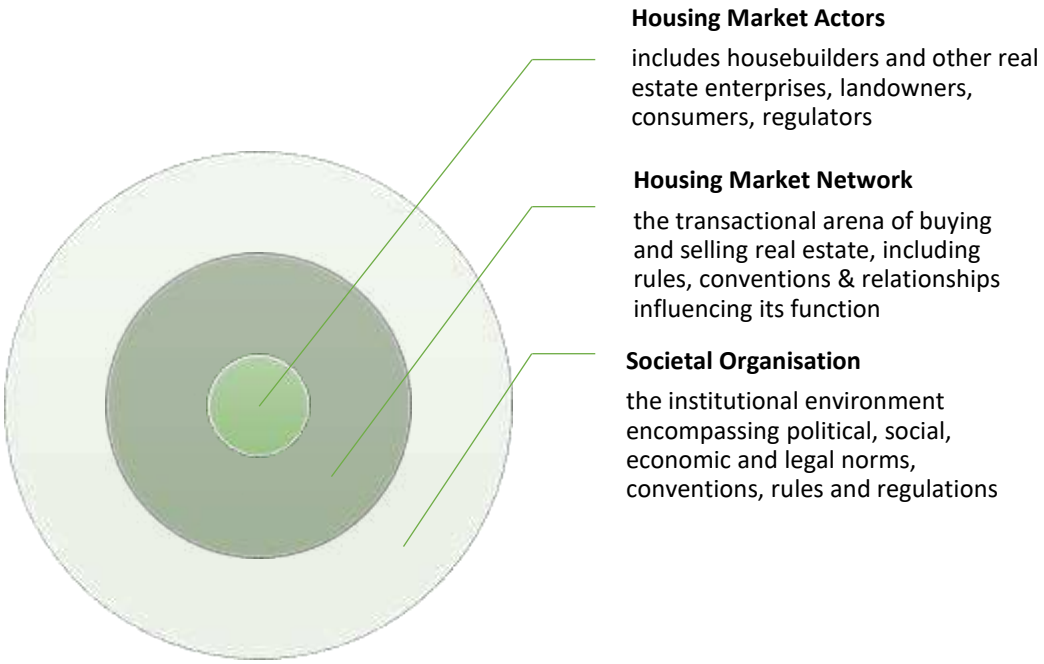

Figure 2: A stylised representation of a housing market as a specific institutional ensemble (Source: Authors' own analysis)

Using the above framework, we conceive of real estate enterprises as housing market actors in pursuit of specific goals, where the impact of significant societal organisational and network change, such as green housing policy, is most obvious. Comparatively, institutions are the stabilisations or correlations of the interactions between individual and collective actors and thus associated with specific economic and social processes, not with specific outcomes or measurable characteristics (Bathelt and Gluckler, 2014). Thus, our analytical approach focuses on the level of the real estate enterprise, rather than the level of the housing market or individual, to undertake an empirical investigation that explicitly links real estate enterprise behaviour with the green housing transition taking place in the Chinese housing market. This apporach enables us to consider the multi-factor, multi-actor and mutli-level aspects of transitions identified in our conceptual framing above.

3. Methodology

The empirical research set out to examine whether, and to what extent, Chinese real estate enterprises are transitioning toward greener housing practices and what institutional constraints may exist in preventing the transition. Our research adopted a qualitative 'behavioural' approach, drawing on institutional and socio-technical transitions literatures to examine the complexity and dynamics evident in market responses to state-led policy change (Payne and Barker, 2018). Elite in-depth interviews were chosen as the key methodological approach to enable the garnering of detailed knowledge and understanding of the dynamic interaction between how Chinese real estate enterprises operate and the wider institutional relations of which they are a part. To achieve this, the interviews focused on examining:

- the perceptions and attitudes of real estate enterprises toward the green housing transition, including current and potential impacts of green housing regulations and policies;
- the willingness of real estate enterprises to change their current traditional constructions skills and business strategies towards those that are greener;
- the key constraints faced by real estate enterprises when developing green housing;
- the green strategies adopted or likely to be adopted by real estate enterprises and the extent to which these are envisaged or in operation.

Interviewees were recruited from a targeted sample of leading real estate enterprises who were, to varying degrees, experienced in green housing in China (CIHAF, 2016) and who were therefore able to provide rich and detailed data on the complexities of the green housing transition. Existing statistics show that the market share of the top 10, top 20, top 50 of Chinese developers calculated by sales volume was 24.05%, 32.21%, and 45.29% respectively (Fangchan, 2018), indicating that the Chinese housing market is highly monopolised. In total, ten

real estate enterprises from the public and private sector agreed to be interviewed, with five of these being in the top 10 green real estate enterprises in China (CIHAF, 2016). Interviewees have been anonymised at their request to avoid identification but Table 2 provides some limited background information. Directors or middle-level managers were selected to ensure familiarity with their enterprise's green housing strategy.

1	A	Private & large size	All China regions	Director
2	B	Private & large size	All China regions	Manager
3	C	Private & large size	All China regions	Manager
4	D	Public & large size	Mainly in Beijing	Chief Engineer
5	E	Private & middle size	Mainly in Shandong province	Manager/ Reviewer of green buildings
6	F	Private & large size	North China	Manager
7	G	Public & middle size	Mainly in Beijing	Manager
8	H	Public & large size	Mainly in Beijing	Manager
9	I	Private & large size	All China regions	Manager
10	J	Private & large size	North China	Manager

Table 2: Interviewees' background information

Thematic analysis (TA) was used to identify, analyse, and interpret patterns of meaning ('themes') within the qualitative data (Clarke and Braun, 2017). The qualitative data was transcribed, coded and a range of themes constructed to ensure there was no deviation from the main research aim (Clarke and Braun, 2017). Six intersecting themes were developed, namely: emerging green housing concepts and strategies; balancing costs and benefits; balancing policy requirements and consumer demand; building brands; integrating market resources; and, 'cheating' in green housing practice. The results are presented in the next section and are arranged around these themes.

4. How are Chinese real estate enterprises transitioning toward greener housing practices?

4.1 Emerging green housing concepts & strategies

During the interviews, a small number of real estate enterprises highlighted that they were actively transforming their business strategies to align themselves with the concept of green building and ecological development. For instance, Interviewees I and G said:

> *We are also changing our concept and using a greener way of thinking to guide our design and construction. We believe that green building will surely become the main trend in the future and the most beneficial model for the ecological development of the whole society [Interviewee I].*

> *(There are) transition costs… but there are more risks if we do not transit. We believe that this series of upgrades (green transitions) are an inevitable evolution of the enterprise development process… Enterprises who do not transit themselves may not find their own future [Interviewee G].*

Their point of view was that the green housing transition was not simply a technical issue but rather, a transition toward a different 'world-view'. However, this 'pioneering' approach was still relatively rare in the Chinese housing market, with most real estate enterprises interviewed finding themselves being pushed to transition their concepts and strategies by external factors such as policy changes or competitors' actions. One state-owned enterprise interviewee said:

> *The development company like us belongs to such middle level. Coupled with the leader's understanding, I feel that our company's intention is not high. In my position, I do not feel that going smoothly, unless the government asks us to do so [Interviewee D].*

However, some interviewees disagreed with this perspective, stating that real estate enterprises' should be increasing their environmental responsibilities towards society. When asked if government policies had affected their business concepts and development behaviours, these interviewees stated that their green housing strategies were designed to achieve standards above the government's current requirements:

> *I think it (the green housing transition) should not be pushed by policies, because when the policy affects your behaviours, it means that your company is not responsible, it is the government who take all the responsibilities. We hope to promote (the green housing transition) before the government (asks), we like this logic [Interviewee F].*

In order to achieve the governments' green housing requirements, many of the larger real estate enterprises interviewed had put 'green' into their business strategies, with some developing green housing as the priority and others willingly disclosing a range of data to evidence their commitment. For example, interviewees A and I mentioned:

> *In 2015, we are aiming to transform from traditional developers to being a new light asset-based green enterprise. Under the company transition process, we admitted that the biggest challenge is to endure the temptation, especially as the current housing market is very hot. But green transformation is our main strategy and an inevitable direction [Interview A].*

> *Our environmental data is very detailed. We not only disclose the carbon emissions comparison data in accordance with international standards, we also hired a third-party agency to carry out certification testing. In addition, we also announced the energy saving data of our green buildings, the energy conservation and emission reduction targets for next year, and the clear target values for industrialised residential products and supply chain energy management [Interviewee I].*

In summary, the data so far has emphasised that real estate enterprises have recognised the inevitable direction of green housing policy in China and have sought to incorporate the concepts and strategies of green housing into their business culture and commitments to varying degrees and through varying push and pull motivations.

4.2 Balancing costs and benefits

Almost all interviewees talked about the significant cost issues that were involved when considering green housing developments. Those costs are incurred at different stages of housing development and the interviewees mentioned the existence of specifics concerns in: the early design stage (materials procurement, technology, equipment, design and consultation, green building label applications etc.); the mid-term construction stage (the construction team and construction risk control); and, the later operation stage (equipment operations and maintenance). That the cost issue was raised in all stages shows that real estate enterprises are very concerned about the economic costs of the green housing transition, as the following quote shows:

> *Green housing means spending money, applications mean spending money, technology means spending money, materials mean spending money. To expect developers not (to) consider the costs...well... it is unrealistic [Interviewee G].*

At the same time, the interviewees revealed different capacities for such expenditure. Larger companies were more willing and able to invest more money on green technology research and green housing development:

> *Our research on green housing is very strong. We have our own Green Building Development Research Centre, which has a lot of money invested in it every year, including green technology research and development, personnel training and the like [Interviewee I].*

In contrast, smaller businesses experienced difficulties with regard to capital turnover and, as a consequence, were less willing and had less ability to undertake green housing investment, as one interviewee from a mid-size enterprise said:

> *Our business type does not allow us to be a market leader. Our main objective at this stage may be to speed up capital turnover and expand our scale. We do not have much energy or money to do things which have more risks [Interviewee E].*

The interviews revealed that the less experienced real estate enterprises found it extremely difficult to work out the cost changes that would take place during green housing development when compared to conventional forms of development, largely as a result of policy ambiguity:

> *(The) big problem is that we simply do not know the requirements of the green housing, or what changes would happen to our costs [Interviewee E].*

In terms of benefits, most real estate enterprises said that they did not gain benefits, especially monetary profits, that they had expected from delivering green housing. They also noted that it cannot clearly be seen which parts of a given benefit were gained by adding 'green' features on houses. Elucidating further upon this theme, one interviewee highlighted consumer demand as an additional anticipated benefit not necessarily realised:

> *It is difficult at this stage to say clearly how much profit green housing can bring to us because the extra cost added, but buyers do not buy it, and the government does not subsidise it, so this part of the cost needs to be borne by ourselves, let alone profits, maybe it will become clearer in the longer term [Interviewee G]*

All real estate enterprises interviewed who were actively developing green housing were looking to achieve a point of balance between their capital investment and increasing green housing output. Some enterprises were more willing to invest greater amounts in green housing development. This was especially true of those enterprises that had earned money from previous green housing developments. These enterprises were thus more willing to reinvestment in future green housing research and development.

Nonetheless, the main factors restricting real estate enterprises investing in greater levels of green housing were high-priced materials and technical applications. These two related issues may be improved when the supply chain becomes more mature in the future. Indeed, this could gradually transform the investment behaviour of real estate enterprises given this research has shown that if more profit can be earned through green housing development, real estate enterprises will be prepared to invest further.

4.3 Balancing policy requirements and consumer demand

Whilst both government policy requirements and consumer demand relating to green housing influenced the behaviour of real estate enterprises, the research revealed a conflict between the governments' and consumers purpose of green housing. Real estate enterprises perceived the government's purpose for green housing as a tool to achieve carbon reduction targets, whereas they perceived consumers as viewing green housing as a product to meet rigid demands for comfortable and healthy housing and related day-to-day activities.

For real estate enterprises, this had become a challenge to be balanced, with state-owned real estate enterprises being more inclined to achieve government targets and standards set out in the ESGB rather than delivering green homes to meet growing consumer demand or achieving higher standards:

> *Every year, the upper level leader will assign us targets for how much green housing must be completed. As a state-owned enterprise, we must complete the target... it is more of a political task... [Interviewee H].*

In contrast, private enterprises were more likely to exceed, or aim to exceed, national green housing standards. This dual focus on meeting the government's policy requirements and considering consumers demand demonstrated their ability and capacity to adjust their conventional development decisions by analysing consumers' buying behaviours whilst meeting government standards, as one private real estate enterprise explained:

> *Our corporate nature leads us to be more market-oriented, that is to say, the market is the sole criterion for testing a product. In my opinion, how to make consumers recognise our houses is more important than just simply completing policy requirements [Interviewee A].*

However, private enterprises revealed their struggles in identifying a clear consumer demand for green housing. In contrast, an emerging market demand for healthy housing led some real estate enterprises to replace part of the defined concept of green housing with the concept healthy housing. They felt this more neatly matched consumer demand and enabled them to sell healthy housing under the guise of green housing. These private

enterprises advertised their green housing projects as healthy housing as a means of ensuring sales, as one interviewee mentioned:

> *Actually, they [the major green real estate enterprises] do not make money because of green housing, (instead) they are really meeting the house buyers' needs for a healthy life. Their projects happen to be associated with 'green' ideas, so the public think it is 'green housing', but in fact it is no., But they [the companies] make money because of 'green' housing [Interviewee B].*

Although green housing and healthy housing have different definitions, real estate enterprises we able to change the development approach in order to meet what they perceived as consumer demand for healthy housing from a green housing product. This strategy was an effective way by which private real estate enterprises were able to balance government requirements with consumer demand.

4.4 Building brands

As previous research has shown that real estate enterprises would be more willing to actively participate in promoting green practices if they found that those practices helped them to gain competitiveness in the market (Zhang *et al.,* 2011a), this research sought to examine if green housing development could help real estate enterprises build their company brand and, in doing so, improve their market competitiveness. A small number larger enterprises were already considered 'pioneers' for green housing having undertaken successful brand-building strategies, as one interviewee revealed:

> *When people refer to green housing, they will first think of xxx and xxx (two well-known green real estate enterprises in China), which shows that their brand-building is very successful. People can distinguish them from other developers based on 'green' ideas [Interviewee B].*

In contrast, the smaller real estate enterprises were considered to be followers of this pioneering approach in the green housing transition. However, a few were beginning to use green housing as a selling point to increase their market competitiveness:

> *There are some small-scale companies, or medium-sized companies with no local background, no local force, no strong capital, no strong brand, so this (green branding) is their competitiveness [Interviewee J].*

Another important point to note at this juncture is that although both state-owned and private real estate enterprises sought to build their brands by developing green housing, their starting points were different. Private enterprises were more devoted to building their green brand because they identified an emerging business opportunity and were, fundamentally, more profit-orientated:

> *Brand-building has two meanings for us. The minor meaning is to build a green development image for the company, to improve market competitiveness, and build consumer trust in our products, so that they are more willing to buy our houses. In the bigger picture, we can make more consumers aware of green housing in general from learning about our brands and products [Interviewee I].*

In contrast, state-owned enterprises were generally less motivated by profit but did strive to achieve the standards and progress established by upper level government leaders:

> *Because we are state-owned enterprises, our business has always emphasised being what we call 'a responsible developer'... We achieved Two-Star Green rating for social security housing, and the project was the first one to get green certification for operation [Interviewee H].*

The enthusiasm of state-owned real estate enterprises for building green housing thus came from two factors. The first was the upper-level requirements of government leaders who wanted state-owned real estate enterprises to play a leading role in influencing market transitions. The green housing projects built by state-owned real estate enterprises were, therefore, more likely to be experimental and subsidised by the government. Therefore, state owned enterprises did not experience the level of economic pressure that faced private sector enterprises in delivering such projects. The second factor came from the state-owned enterprises themselves, and the Chinese corporate culture of seeking recognition from the government or top leaders.

Interestingly, whether large or small, state-owned or private, all the real estate enterprises interviewed mentioned two important approaches for enhancing brand competitiveness. The first was applying for green housing certificates (nationally or internationally). Certificates provided by the government or international organisations were seen as the best evidence to demonstrate the quality of their projects, making it easier to obtain consumer recognition and trust (Heinzle *et al.,* 2013; Kahn and Kok, 2014). Interviewee E pointed out that:

> *We have strict requirements for our own projects and all the projects need to be applied... And we do not just apply for national green building labels, we also apply for LEED, Healthy Housing Standards, etc. [Developer E].*

The second approach was to expand publicity. All real estate enterprises noted how they sought to prominently highlight the green concept of their developments and the direct benefits that this could bring to consumers in the advertisements when selling houses. They also actively attended green housing-related conferences or events to improve their media exposure in the green housing field, as the following quote shows:

> *Advertising is a very necessary method, because most of the public do not actually know what 'green housing' is. Although we are developers, (and) for the purpose of making profits, (advertising) can be said to be a promotional tool, but we also use this tool to make more people know about green housing, I think we also play a widespread role [Interviewee C].*

This section has revealed the complex drivers and motivations of real estate enterprises in building their brand and the varying levels of emphasis they placed on promoting green housing.

4.5 Integrating market resources

As the costs of green housing are mostly generated through the purchase of green products, whether through consulting services or green materials and equipment, the ability of real estate enterprises to integrate market resources in their development practices and find an appropriate balance between cost and benefit was an important point raised in the research. Indeed, as green housing development involves various stakeholders and an extensive supply chain, how enterprises efficiently and effectively obtain these resources, whilst trying to reduce costs and ensure quality, was an area of concern identified in the interviews, as Interviewee A noted that:

> *An ordinary developer does not have relevant experience. He's told to go ahead with the integration of related resources, but the integration of resources also needs skills [Interviewee A].*

As a complex project, the whole-life-cycle of green housing involves the use of resources from all aspects of the housing market institution. In addition to dealing with the government departments and consumers, real estate enterprises need to build close ties with stakeholders in the green housing supply chain who provide the necessary green housing resources. However, the research revealed that real estate enterprises considered China's green housing supply chain industry not yet to be fully developed. As a result, real estate enterprises reported finding it difficult to access to high-quality resources and partners in the housing market:

> *China is not like those western countries who has mature industry chain, the whole societies have very good support for their resources, if you have the money, you do not need to worried about how to get appropriate resources in the market, we are not like that... [Interviewee I].*

The most important green housing stakeholders mentioned by the interviewees were design and consulting companies; certification and technology consultants; suppliers of green technologies, materials and equipment; specialist construction teams; and, property management companies. Interviewees voiced their concerns over some of these stakeholders claiming to have the necessary skills and expertise when in fact they were unqualified or inexperienced, as Interviewee B complained:

> *The current situation is like 'three-Nos', they have no qualification requirements, no staffing requirements, and no technical skills 'requirements. Some dummy corporations which only have two or three people, also dare to participate in the market competition and solicit projects [Interviewee B].*

As a result, some real estate enterprises had to develop their own standards for screening the supply chain. Some enterprises established their own green supply chain to meet their green housing development needs.

One interviewee from a top green housing real estate enterprise explained how they had dealt with the issue over time and had developed long term partnerships with trusted suppliers:

> *In our early years, there were very few resources in the market at that time, but we have now established good relations with excellent suppliers. We used this cooperative system to turn the problems in the construction process into a common problem with them [suppliers]. Coupled with long-term cooperation, we have a number of long-term partners… (and) they help me control the risks [Interviewee A].*

The findings show how the biggest real estate enterprises were able to establish supply chains and share risks with their suppliers and construction teams to reduce development uncertainty. From the perspective of the housing market institution, some other leading enterprises interviewed revealed they were making efforts to establish coalitions and alliances with other developers to lead the green housing transition in the housing market, as one interviewee from a top green real estate enterprise showed:

> *We and few other developers in the industry make up a coalition of Chinese green housing, and there are some other alliances in the market. These alliances are social organisations, our goal is to pull the industry in a green housing direction [Interviewee I].*

When asked how they established these alliances to enable the green housing transition, the same interviewee further explained:

> *We work together with a few top developers to create two lists which we call the Green List and the Black List. If some of the suppliers provide something that is not green or even has negative environmental effects, they will be put on the Black List. Over time, no enterprises would choose them and bad materials would be excluded, the products in the market will become greener [Interviewee I].*

The industry alliances that have been formed and led by the leading green real estate enterprises show how proactive they are were integrating market resources and driving the green housing transition in the housing market forward.

4.6 'Cheating' in green housing practice

As the above sections have shown, Chinese real estate enterprises were, to varying degrees, actively responding to the green housing transition in the housing market and adjusting their behaviours toward green housing development. However, the research also revealed these behaviour were not always 'positive' due to a range of complexities in the nature of their business and how they chose to respond to green housing policy requirements. Indeed, some real estate enterprises were revealed to be 'cheating' in their development of green housing.

Some interviewees mentioned that the latest ESGB requirements had a loophole due to its two-stage evaluation i.e. real estate enterprises can apply for green-design certificates during the design stage and green-operation certification once the construction has been completed for one year. This, they argued, led to a 'performance gap' between enterprises' commitments and later operations of the whole life cycle of the houses. In other words, once real estate enterprises are awarded the design certificate, they may not follow the design and planning documents and may cut corners in later stages of the development process. The following quote provide an illustration of this loophole:

> *If you do green housing, whether you apply for national standard or local standards, after submitting your planning documents and getting the green design labels, then you are done. Only very good companies still do green housing operations, but as you said, it should be a whole-life-cycle project, but unfortunately many companies cannot achieve it [Interviewee B].*

These respondents continued to provide an explanation for why developers could 'cheat' in the green housing development process. First, this two-stage evaluation system allows developers to falsely advertise their housing projects as 'green' because they have the design labels and housebuyers do not understand whether the projects are only designed 'green' or actually operate 'green':

…No one will consider this (that the design label will be invalid), because the houses have all been sold, right? That is the first thing, this design label allowed a lot of developers to advertise their housing as green housing [Interviewee B].

Second, interviewees stated that government supervision was insufficient in the construction and operation periods of green housing development:

Even if you design houses in a green way, you still can construct them in a non-green way - no one monitors it… it is difficult to monitor, because it is not necessary, so in the end, those projects would become semi-green, fake green or even non-green projects [Interviewee B].

Moreover, the presale mechanism in China's housing market allowed real estate enterprises to sell houses whilst they were still under construction, exacerbating the 'cheating' issue, as the following quote illustrates:

Some of them sell their houses under the banner of 'green housing' and increase the price of their products, but they were not built as well as they claimed, which made housebuyers uncomfortable [Interviewee I].

5. Discussion

5.1 The dilemma of 'going green'

Comparing the barriers of green housing development faced by real estate enterprises as evidenced in the international literature review with the empirical data presented above, we suggest this research supports the assertations of Nguyen *et al*. (2017) that many of the barriers faced by real estate enterprises in developed and developing countries are quite similar. For example, the higher costs of green technologies and equipment (Dwaikat and Ali, 2016; Rehm and Ade, 2013; Marker *et al*., 2014), the lack of consumer awareness (Payne and Barker, 2018; Brounen *et al*., 2013) and the inefficient policies and regulations (Darko and Chan, 2017; Zainul Abidin *et al*., 2013; Luthra *et al*., 2015) were all highlighted by Chinese real estate enterprises in this research.

Further, this research has revealed that Chinese real estate enterprises face a specific dilemma in delivering green housing under the Chinese institutional condition. First, the empirical evidence revealed conflict between government and consumers in the Chinese housing market. New institutionalism tells us that companies tend to strive for legitimacy while maintaining efficiency (Yang *et al.,* 2012) and this research revealed that Chinese real estate enterprises sought to meet government requirements in order to strive for policy legitimacy, while meeting consumer demand to maintain operational efficiency. However, such conflict between government and consumers in green housing development placed real estate enterprises in the 'middle' of this dynamic, since they had to find the most appropriate approach to meet requirements from both the policy regime and market regime in green housing decision making.

The situation faced by Chinese real estate enterprises is even more challenging when considering the added costs (both monetary and time costs), especially in the short term. The empirical evidence showed that even when the government implemented incentive policies and provided subsidies to real estate enterprises who developed green housing, these subsidies were not enough to cover the extra costs of 'going green'. As profit making companies, the only way for private real estate enterprises to cover these costs were to pass them onto consumers. However, the research also revealed that, currently, real estate enterprises perceive a lack of public acceptance of green housing in China. The transition of consumer awareness and house buying behaviour is ongoing but progressing very slowly and not in line with the Chinese government's plans to see 50% of urban buildings to be green buildings by 2020. As a result, Chinese real estate enterprises face a dilemma of seeking to meet government regulations while also addressing limited consumer demand, with the short-term cost pressures and long-term transition pressures needing to be absorbed and dealt with by them.

The data also revealed how real estate enterprises were adjusting to the green housing transition in different ways, elucidating the different types of pressure facing them. For example, state-owned real estate enterprises were more inclined to accomplish the government's goals, while private real estate enterprises are more likely to focus on increasing their market competitiveness. Further, large enterprises had more ability to invest in green housing and more actively develop their green business behaviours, for example through building brands and integrating market resources, while smaller enterprises behaved more passively.

Drawing on the principles of institutional analysis set out in Section 2.4, our research has shown how Chinese real estate enterprises developed a range of strategic responses to handle the institutional constraints of 'going green' and in some cases, took advantage of institutional capital to achieve this. Indeed, the larger, pioneering real estate enterprises sought to drive change in the institution to favour their own interests by developing coalitions and alliances, investing in green housing technologies and integrating market resources.

In this sense, the success of individual real estate enterprises depends on their capacity to address the collective action necessary to achieve a successful green housing transition, which depends, in turn, on the power distribution within the prevailing institutional framework (Hall, 2010). Such transitions are extremely difficult in China since the Chinese housing market is still not completely marketized. The power asymmetry in the political culture in Chinese society acts to intensify the real estate enterprise's dilemma in 'going green', since it remains difficult to 'turn green into gold' in the Chinese housing market.

5.2 Institutional constraints in the green housing transition

The behaviours of real estate enterprises explored in this research reveal a range of institutional constraints that face the green housing transition in China. These institutional constraints can be discussed in the three levels of the institution as shown in Section 2.4.1. First, the empirical evidence has revealed that some green real estate enterprises are aware of the importance of the green housing transition and are changing their business concepts towards green development. However, changes in beliefs cannot always be fully translated into changes in behaviours. Many of enterprises are adopting a 'wait-and-watch' mentality until the institutional conditions for green housing become more favourable and certain.

Second, the efficiency and effectiveness of current green housing regulations and policies have been questioned by real estate enterprises. The lack of long-term monitoring in the ESGB reflects the government's lack of attention to the whole-life-cycle concerns of green housing. As a result, the current ESGB insufficiently drives real estate enterprises' behaviour to the operation stage. If enterprises perceive 'failings' in green housing policy instrument design, it can influence their opinions of state capabilities in the implementation of such policy instruments. This can be seen as an indication of limited political will to achieve carbon reduction goals in the housing sector (Payne and Barker, 2018). Since green housing development is still in its infancy in China, many related policies have been dynamically adjusted during this early transition stage. This brings forward a range of uncertainty issues. This constraint is particularly serious within the Chinese top-down system. Consequently, the perceived credibility of Chinese green housing policy instruments by real estate enterprises may have direct impacts on their willingness to investment in green housing. Due to the uncertainty of current green housing policies and regulations, longer-term housing market trends and regulation trends are currently unknown and more work should be done on examining the perspective of real estate enterprises in the years ahead.

Third, the empirical findings revealed that real estate enterprises perceived there to be a lack of public acceptance of green housing in China. Low levels of consumer awareness and demand for green housing add further constraint to the green housing transition. Transition theories tell us that changes in building activities are affected by varying factors and different actors, which interact with one another. Improper connections between any two groups within the housing market institution will make it far more difficult for the transition to be achieved. In China, the policy instruments for the green housing transition are more biased towards guiding and shaping real estate enterprises' behaviours. This research shows that the current transition in place does not deal with the fundamental dilemma which is the disconnection between government policy and consumer awareness and demand for green housing.

Fourth, the fragmented structure and immaturity of the current green housing supply chain industry acts as another significant institutional constraint. There is currently no minimum skills threshold to enter the green housing industry, which has increased uncertainty and risks for real estate enterprises and the housebuilding system. This lack of professionals and skilled employees has been addressed, to some extent by the bigger real estate enterprises who have developed a system of familiar and trusted supply chain actors through long-term cooperation and in alliance with their peers. However, this shows how government regulation has been limited in shaping the green housing supply chain. As a result, although few large and advanced real estate enterprises have been able to integrate market resources, most prefered to maintain conventional construction approaches to reduce risks and costs.

6. Conclusion

This research has revealed how Chinese real estate enterprises have responded to green housing policies and regulations and has identified a range of 'institutional' constraints that currently face enterprises in the transition toward China's green housing future. The research adopted a qualitative 'behavioural' approach, drawing on institutional and socio-technical transitions literatures to conceptualise the complexity and dynamics evident in market responses to state-led policy change (Payne and Barker, 2018). This enabled an assessment not just of the strategies and decision making of real estate enterprises, but also of how these decisions were enabled and constrained by the wider institutional environment within which the green housing transition is taking place. Our research reveals that Chinese real estate enterprises face a dilemma in 'going green' and, at the same time, are required to address the institutional constraints that exist.

In light of the varying responses of Chinese real estate enterprises to green housing regulations and the wider green housing transition, we argue the following important research gaps remain unresolved and require further policy and academic attention:

(1) Additional work is needed to establish a clear policy pathway to guide future market action to ensure short-term behaviours contribute to long-term institutional change;
(2) Future research should include case study analysis, particularly with large on-going green housing developments over several years to provide data examining transition efficiency over time.
(3) Future research should examine other key stakeholders' interests, focusing on how interpretations of the transition changes over time, and whether such changes if observed, affect decisions over their selection and adoption choices.

Responsibility for the success of the green housing transition in China has been firmly placed into the hands of Chinese real estate enterprises. Like developed nations, the Chinese Government's ambitions to achieve their policy goals is dependent on how effectively and efficiently these real estate enterprises, both state-owned and private, can transition their business behaviours toward greener ways of delivering homes (Payne and Barker, 2018). The dilemma of 'going green' and the prevailing institutional constraints under which real estate enterprises' decision making must take place, will continue to challenge the Governments ambitions to achieve the green housing transition unless clearer policy pathways to guide future market action are put in place.

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References

Adams, D., Croudace, R. and Tiesdell, S., 2012. Exploring the 'notional property developer' as a policy construct. *Urban Studies*, *49*(12), p.2577-2596.

AlSanad, S., 2015. Awareness, drivers, actions, and barriers of sustainable construction in Kuwait. *Procedia engineering*, *118*, p.969-983.

Bathelt, H. and Glückler, J., 2014. Institutional change in economic geography. *Progress in human geography*, *38*(3), pp.340-363.

BERCTU, 2016. China Building Energy Use 2016. Tsinghua University, Beijing. Available at: https://www.researchgate.net/publication/318106589_China_Building_Energy_Use_2016 [Accessed: 1 March 2019].

Brounen, D., Kok, N. and Quigley, J.M., 2013. Energy literacy, awareness, and conservation behavior of residential households. *Energy Economics*, *38*, p.42-50.

Chan, A.P., Darko, A., Ameyaw, E.E. and Owusu-Manu, D.G., 2016. Barriers affecting the adoption of green building technologies. *Journal of Management in Engineering*, *33*(3), p.04016057.

Chan, A.P.C., Darko, A., Olanipekun, A.O. and Ameyaw, E.E., 2018. Critical barriers to green building technologies adoption in developing countries: The case of Ghana. *Journal of cleaner production*, *172*, p.1067-1079.

Choi, C., 2009. Removing market barriers to green development: principles and action projects to promote widespread adoption of green development practices. *Journal of Sustainable Real Estate*, *1*(1), p.107-138.

CIHAF, 2016*. Annual Report on Green Real Estate Development in China.* CIHAF, Beijing. (in Chinese).

Clarke, V. and Braun, V., 2017. Thematic analysis, *The Journal of Positive Psychology*, 12:3, p.297-298

Darko, A. and Chan, A.P., 2017. Review of barriers to green building adoption. *Sustainable Development*, *25*(3), p.167-179.

Darko, A., Zhang, C. and Chan, A.P., 2017. Drivers for green building: A review of empirical studies. *Habitat international*, *60*, p.34-49.

Davis, L.W. and Metcalf, G.E., 2016. Does better information lead to better choices? Evidence from energy-efficiency labels. *Journal of the Association of Environmental and Resource Economists*, *3*(3), p.589-625.

Dent, P., Patrick, M. and Ye, X., 2012. *Real estate: property markets and sustainable behaviour.* Routledge.

Dwaikat, L.N. and Ali, K.N., 2016. Green buildings cost premium: A review of empirical evidence. *Energy and Buildings*, *110*, p.396-403.

Edenhofer, R. Pichs-Madruga, Y. Sokona, S. Agrawala, I. Bashmakov, G. Blanco, 2014. *Climate Change 2014: Mitigation of Climate Change. Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.

Fesselmeyer, E., 2018. The value of green certification in the Singapore housing market. *Economics Letters*, *163*, p.36-39.

Geels, F.W. and Schot, J., 2010. The dynamics of transitions: a socio-technical perspective.

Geels, F.W., 2004. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research policy*, *33*(6-7), p.897-920.

Geels, F.W., 2010. Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research policy*, *39*(4), p.495-510.

Geels, F.W., 2018. Disruption and low-carbon system transformation: progress and new challenges in socio-technical transitions research and the multi-level perspective. *Energy Research & Social Science*, *37*, pp.224-231.

GhaffarianHoseini, A., Dahlan, N.D., Berardi, U., GhaffarianHoseini, A., Makaremi, N. and GhaffarianHoseini, M., 2013. Sustainable energy performances of green buildings: A review of current theories, implementations and challenges. Renewable and Sustainable Energy Reviews, 25, p.1-17.

Grewal, R. and Dharwadkar, R., 2002. The role of the institutional environment in marketing channels. *Journal of marketing*, *66*(3), pp.82-97.

Hall, P.A., 2010. Historical institutionalism in rationalist and sociological perspective. *Explaining institutional change: ambiguity, agency, and power*, p.204-224.

Heinzle, S.L., Boey Ying Yip, A. and Low Yu Xing, M., 2013. The influence of green building certification schemes on real estate investor behaviour: Evidence from Singapore. *Urban Studies*, *50*(10), p.1970-1987.

Huang, B., Kanie, N., Suzuki, M. and Jiang, P., 2015. Analysis of Economic Incentive Policies for Improving a Low Carbon Society—Case Study of the Building Industry in China and Japan. *Urban Policy and Research*, *33*(2), p.233-246.

Hurlimann, A.C., Browne, G.R., Warren-Myers, G. and Francis, V., 2018. Barriers to climate change adaptation in the Australian construction industry–Impetus for regulatory reform. *Building and Environment*, *137*, p.235-245.

Hwang, B.G. and Tan, J.S., 2012. Green building project management: obstacles and solutions for sustainable development. *Sustainable development*, *20*(5), p.335-349.

IPCC, 2007. Summary for Policymakers, Climate Change, IPCC WG1 Fourth Assessment Report. Cambridge University Press, New York. Available at: http://www. ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf [Accessed: 1 December 2018].

Jiang, J., 2016. China's urban residential carbon emission and energy efficiency policy. *Energy*, *109*, p.866-875.

Kahn, M.E. and Kok, N., 2014. The capitalization of green labels in the California housing market. *Regional Science and Urban Economics*, *47*, p.25-34.

Kibert, C.J., 2016. *Sustainable construction: green building design and delivery*. John Wiley & Sons.

Li, J. and Shui, B., 2015. A comprehensive analysis of building energy efficiency policies in China: status quo and development perspective. *Journal of Cleaner Production*, *90*, pp.326-344.

Luthra, S., Kumar, S., Garg, D. and Haleem, A., 2015. Barriers to renewable/sustainable energy technologies adoption: Indian perspective. *Renewable and Sustainable Energy Reviews*, *41*, p.762-776.

Ma, M. and Cai, W., 2019. Do commercial building sector-derived carbon emissions decouple from the economic growth in Tertiary Industry? A case study of four municipalities in China. *Science of The Total Environment*, *650*, p.822-834.

Marker, A.W., Mason, S.G. and Morrow, P., 2014. Change factors influencing the diffusion and adoption of green building practices. *Performance Improvement Quarterly*, *26*(4), p.5-24.

MOHURD, 2014. *GB/T50378-2014 National Standard of China: Evaluation Standard for Green Buildings.* China Architecture and Building Press: Beijing. (in Chinese).

Mousa, A., 2015. A Business approach for transformation to sustainable construction: an implementation on a developing country. *Resources, Conservation and Recycling*, *101*, p.9-19.

NBSC, 2015. National Bureau of Statistics China Yearbook 2015. The National Bureau of Statistics of the People's Republic of China, Beijing.

NDRC, 2016. The 13th Five-year-plan for economic and social development of People's Republic of China (2016-2020). Available at: http://en.ndrc.gov.cn/newsrelease/201612/P020161207645765233498.pdf [Accessed 15 June 2017].

Nguyen, H.T., Skitmore, M., Gray, M., Zhang, X. and Olanipekun, A.O., 2017. Will green building development take off? An exploratory study of barriers to green building in Vietnam. *Resources, Conservation and Recycling*, *127*, p.8-20.

Olubunmi, O.A., Xia, P.B. and Skitmore, M., 2016. Green building incentives: A review. *Renewable and Sustainable Energy Reviews*, *59*, p.1611-1621.

Payne, S. 2019. Advancing understandings of housing supply constraints: housing market recovery and institutional transitions in British speculative housebuilding, *Housing Studies*, DOI: 10.1080/02673037.2019.1598549

Payne, S. and Barker, A., 2018. Carbon Regulation and Pathways for Institutional Transition in Market-Led Housing Systems: A Case Study of English Housebuilders and Zero Carbon Housing Policy. *Environment and Planning E: Nature and Space. P.1-24.*

Qin, X., Mo, Y. and Jing, L., 2016. Risk perceptions of the life-cycle of green buildings in China. *Journal of Cleaner Production*, *126*, p.148-158.

Rehm, M. and Ade, R., 2013. Construction costs comparison between 'green' and conventional office buildings. *Building Research & Information*, *41*(2), p.198-208.

Rosenbloom, D., 2017. Pathways: An emerging concept for the theory and governance of low-carbon transitions. *Global environmental change*, *43*, p.37-50.

Serpell, A., Kort, J. and Vera, S., 2013. Awareness, actions, drivers and barriers of sustainable construction in Chile. *Technological and Economic Development of Economy*, *19*(2), p.272-288.

Sharma, M., 2018. Development of a 'Green building sustainability model' for Green buildings in India. *Journal of Cleaner Production*, *190*, p.538-551.

Shen, L., Zhang, Z. and Zhang, X., 2017. Key factors affecting green procurement in real estate development: a China study. *Journal of Cleaner Production*, *153*, p.372-383.

Shi, Q., Lai, X., Xie, X. and Zuo, J., 2014. Assessment of green building policies–A fuzzy impact matrix approach. *Renewable and Sustainable Energy Reviews*, *36*, p.203-211.

Shi, Q., Zuo, J., Huang, R., Huang, J. and Pullen, S., 2013. Identifying the critical factors for green construction–an empirical study in China. *Habitat international*, *40*, p.1-8.

Smith, A., Stirling, A. and Berkhout, F., 2005. The governance of sustainable socio-technical transitions. *Research policy*, *34*(10), p.1491-1510.

Stirling, A., 2007. Deliberate futures: precaution and progress in social choice of sustainable technology. *Sustainable Development*, *15*(5), p.286-295.

Tan, X., Lai, H., Gu, B., Zeng, Y. and Li, H., 2018. Carbon emission and abatement potential outlook in China's building sector through 2050. *Energy Policy*, *118*, p.429-439.

Thornton, P.H. and Ocasio, W., 2008. Institutional logics. *The Sage handbook of organizational institutionalism*, *840*, pp.99-128.

Wang, N., 2014. The role of the construction industry in China's sustainable urban development. *Habitat International*, *44*, p.442-450.

World Green Building Council, 2013. The Business Case for Green Building - a Review of the Costs and Bene*fi*ts for Developers, Investors and Occupants. http://www.worldgbc.org/news-media/business-case-green-building-review-costsand-bene*fi*ts-developers-investors-and-occupants. [Accessed 13 November 2018].

Wu, F., Zhang, F. and Wang, Z., 2015. Planning China's Future: How planners contribute to growth and development. *RTPI: mediation of space–making of place*.

Wu, Y., Chau, K.W., Lu, W., Shen, L., Shuai, C. and Chen, J., 2018. Decoupling relationship between economic output and carbon emission in the Chinese construction industry. *Environmental Impact Assessment Review*, *71*, p.60-69.

WWF, 2016. *Effects of climate change.* Available at: http://www.worldwildlife.org/threats/effects-of-climate-change [Accessed: 23 November 2018].

Xu, B. and Lin, B., 2017. Does the high–tech industry consistently reduce CO2 emissions? Results from nonparametric additive regression model. *Environmental Impact Assessment Review*, *63*, p.44-58.

Yang, Z. and Wang, C.L., 2011. Guanxi as a governance mechanism in business markets: Its characteristics, relevant theories, and future research directions. *Industrial Marketing Management*, *40*(4), p.492-495.

Yang, Z., Su, C. and Fam, K.S., 2012. Dealing with institutional distances in international marketing channels: Governance strategies that engender legitimacy and efficiency. *Journal of Marketing*, *76*(3), p.41-55.

Ye, L., Cheng, Z., Wang, Q., Lin, W. and Ren, F., 2013. Overview on green building label in China. *Renewable Energy*, *53*, p.220-229.

Ying Liu, J., Pheng Low, S. and He, X., 2012. Green practices in the Chinese building industry: drivers and impediments. *Journal of technology management in China*, *7*(1), p.50-63.

Zainul Abidin, N., Yusof, N.A. and Othman, A.A., 2013. Enablers and challenges of a sustainable housing industry in Malaysia. *Construction Innovation*, *13*(1), p.10-25.

Zeng, S.X., Meng, X.H., Zeng, R.C., Tam, C.M., Tam, V.W. and Jin, T., 2011. How environmental management driving forces affect environmental and economic performance of SMEs: a study in the Northern China district. *Journal of Cleaner Production*, *19*(13), p.1426-1437.

Zhang, L., Sun, C., Liu, H. and Zheng, S., 2016. The role of public information in increasing homebuyers' willingness-to-pay for green housing: Evidence from Beijing. *Ecological Economics*, *129*, p.40-49.

Zhang, L., Wu, J. and Liu, H., 2018. Policies to enhance the drivers of green housing development in China. *Energy Policy*, *121*, p.225-235.