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**An institutional analysis of the green housing transition in
China - examining developers' capacity to deliver green
housing in the Chinese housing market**

H. Jiang

A thesis submitted for the degree of
Doctor of Philosophy (PhD)

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Department of Urban Studies and Planning
University of Sheffield

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September 2019

The candidate confirms that the work submitted is her own, except where work which has formed part of jointly authored publications has been included. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

The work in Chapter 8 and some of the work in other chapters of the thesis has appeared in publication as follows:

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Abstract

Climate change has become a core issue worldwide. The building sector contributes up to 30% of global carbon emissions and has been identified as the sector with the greatest potential to reduce carbon emissions. The concept of 'green housing' has been introduced to deal with climate issues in housing sector. Green housing development requires complex socio-technical transitions; it does not just refer to using green materials or technologies, but also, and most importantly, the response of market actors and the institutional contexts to support transitions. However, little is known about the capability of housing developers towards green housing transition within a Chinese context. Thus, this thesis addresses this under-studied gap and investigates market responses to the Chinese government's green housing regulations by examining the capacity of developers to adopt such regulations and deliver green housing, and identifying the key institutional constraints of the Chinese green housing transition.

The research adopts an institutional analysis as the conceptual framework and a mixture of quantitative (questionnaire survey) and qualitative (interview and work placement) methods. The empirical results in this thesis indicate that developers recognised that green housing was likely to become one of the mainstream trends in the future Chinese housing market. Indeed, a majority of them have changed, or are changing, their attitudes towards green housing transition in China. However, developers also face a series of barriers and have a dilemma in delivering green housing. Moreover, the research also reveals that the Chinese housing industry has a resistance to promoting green housing transition due to a variety of institutional constraints from both institutional environment and housing market perspectives. The dual focus on understanding to constraints formed a balance between dealing with wider institutional complexity and actual transactions. Overall, this research provides an empirical analysis of the constraints that exist to achieving a green housing transition in China. The findings of this thesis could help policymakers identify problems in the adoption of green housing regulations and provide potential solutions for the market.

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Chapter 1. Introduction

1.1 Research background

A growing body of scientific evidence shows that climate change, caused by human activities, is real and urgent (WWF, 2016). Nowadays, how to reduce carbon consumption has become a core issue worldwide. The latest international legally-binding agreement to 'strengthen the global response to the threat of climate change' is the Paris Agreement, adopted in December 2015 (UNFCCC, 2015). The Agreement establishes an international warming goal of well below 2°C on pre-industrial average and requires signatory countries to develop their own strategies for achieving this common goal. This research argues that when considering carbon emission issues, it is important to re-think our ways of living and developing and to 'responsibly meet humanity's goals and aspirations' (Bajdor, 2012, p.236). In order to achieve international carbon reduction targets, different countries and industries are making different responses to their ways of consumption and construction.

As a key carbon emitter, the building sector has been criticised (Stadel et al., 2011; Wang, 2014) for the huge scale of construction and the utilisation of large amounts of materials and energy (Wang, 2014; Invidiata and Ghisi, 2016). The concept of 'green housing' has been introduced into technical and political arenas and construction practices across the globe as a means of responding to the issue of high carbon emissions in the housing sector. Green housing has been seen as a housing type that 'providing people with healthy, applicable, efficient space and natural harmonious architecture with the maximum savings on resources (energy, land, water, materials), protection for the environment and reduced pollution throughout its whole lifecycle' (Li et al., 2016; Kibert, 2016). Research evaluating green housing policies argues that green housing could be an efficient type of building to reduce the issues of carbon emissions in the housing sector (Ghaffarian Hoseini et al., 2013; Wang, 2014).

China has become the major energy consumer in the world since 2014, accounting for 23.4% of global consumption (Edenhofer et al., 2014). As the leading carbon contributor, China has struggled with its rapid economic growth and carbon emission issues for over the last two decades (Cai et al., 2018; Mi et al., 2017). The building sector is one of the pillars of

industry for the China's national economy, contributing about 7% of the national gross domestic product (GDP) (NBS, 2015), but the sector contributes 28%-30% of China's total carbon emissions (Ma et al., 2014), with the housing sector accounting for 24.5% of the building sector (BERCTU, 2016). According to data from the China Database of Building Energy Consumption and Carbon Emissions (CABEE, 2017), the total energy consumption in China's civil building sector reached 857 million tons of standard coal equivalent (Mtce) in 2015, representing 19.93% of total energy consumption in China. The amount of carbon consumed continues to grow, since China is currently in a rapid urbanisation period and the housing market in China continues to expand (NBS, 2015). Therefore, exploring how the Chinese housing sector might adopt green housing practices and reduce its carbon emissions is key to achieving China's low carbon future (Jiang and Payne, 2019; Ma et al., 2019; Shuai et al., 2019).

The green housing agenda is novel, however, the pathway towards green housing development is not straightforward. Hoffman and Henn (2008, p.391) states that '... barriers faced by the green building movement are no longer primarily technological and economic. Instead, they are social and psychological.' It means that a green housing transition not only requires the innovation and improvement in technological and economic factors, more importantly, it requires the transformation of all aspects of society in order to situate low carbon technologies into everyday being. There is an increasing body of literature on green building development and transitions (e.g. O'Neill and Gibbs, 2014; Gibbs and O'Neill, 2014; Berry et al., 2013), which combines new materials and green technologies with social structures and institutions and argues transitions will shape/constrain choices between different green housing development pathways (Cherry et al., 2017).

Recent work by scholars (Rosenbloom, 2017; Payne and Barker, 2018; Jiang and Payne, 2019) has drawn attention to the contribution of institutional understandings to the green housing transition and in particular, the complex state-market interactions that, they argue, are implicit in conceptualising the transition. The interaction between governance structures and house building actors is particularly salient in this body of work (Lazoroska and Palm, 2019). Set against this is an existing body of research that suggests responses to carbon emission reduction can be understood primarily in terms of the development of new forms

of state policy and regulation, and thus processes of change are driven primarily by political and institutional changes (e.g. Bulkeley and Betsill, 2005; Bai et al., 2009; Economy, 2014; Han, 2019). Governments, it is argued, need to find new directions to regulate carbon consumption behaviour, through a mix of compulsion and encouragement (Dobson, 2003). The implicit assumption here is that market actors will then respond to new forms of policy and regulation and adapt their market activities. However, due to the complex nature of housing markets, green housing transitions are not straightforward, but full of challenges and complexities (Payne and Barker, 2018). The argument presented in this thesis is that it is essential to understand market conditions and market actors' responses and capacities in order to better understand these complexities and challenges if green housing policies and regulations are to be successfully introduced into, and implemented by the market. As such, research exploring the views of developers to gain a deeper understanding of the green housing transition in China from the perspective of market actors is warranted.

Developers are 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). Indeed, green housing development has been reshaping the construction industry, changing the physical structures of housing, and rethinking the development principles in housing delivery (Kibert, 2012; Zhao et al., 2016). In turn, as developers are the major delivery agents of houses, the extent to which the housing system can transition to greener development practices depends largely on developers' capacity and willingness (Zhang et al., 2011a) to deliver green housing.

Drawing on the perspective of state-market interactions, research on developers' motivations and decisions enables knowledge exchange and enhances transparency between the state and the market (Lazoroska and Palm, 2019). In other words, developers' capacities for delivering green housing development influenced by state governance can be examined. However, much of the existing literature on environmental transitions focuses on the investigation of the actions of the state (Hakkinen et al., 2016; Quitzau et al., 2013), rather than on developers or the implementation of green housing policies from the perspective of the market (Debie and Raimbault, 2016; Jiang and Payne, 2019). Some suggest this is partly due to policy-makers' conceptualisation of their own positions as

standing apart from the market and market actors (Adams and Tiesdell, 2010). The argument here is that research on developers is a gap that is worthy of being explored and requires addressing in order to better understand developers' capacity to deliver green housing, and to contribute to broader debates on market complexity in green housing transitions (Payne and Barker, 2018).

Some studies conclude that developers are facing a variety of political, cultural, financial and technical barriers when they attempt to deliver green housing. These barriers include insufficient policy implementation efforts (Zhang et al., 2011a); technical difficulties in delivering green housing during the construction process (Osmani and O'Reilly, 2009); asymmetric information conflict between government and market (Liu et al., 2013); and value conflicts between different actors involved in constructing green housing (ibid.).

It is interesting to note that most of these barriers are 'institutional'; they stem from a lack of support by society, housing markets or governments or a lack of efficient institutional instruments to govern change. From this perspective, green housing targets are likely to be better achieved through the cooperation of developers and with enough knowledge and awareness of how to deal with these barriers and challenges.

Although some previous research have analysed the challenges to green building development based using methods such as semi-structured interviews, questionnaire surveys or case studies (Darko et al., 2017; Payne and Barker, 2018), most of these research have concentrated on developed countries and commercial buildings (e.g. Dippold et al., 2014; Kok et al., 2011; Fuerst et al., 2014), rather than on housing practices and in developing countries. The responses and capacities of developers in China towards green housing development are largely overlooked in existing studies (Chang et al., 2018). It is an important gap in knowledge to examine, since the extent to which carbon regulation in the housing sector can be achieved relies heavily on the implementation of green housing policies by developers. Chinese developers' capacity to adopt such regulations and policies remains a significantly under-researched topic. These research gaps are particularly pressing given the Chinese government's ambitions on promoting carbon emissions reductions in the urban building sector (NDRC, 2016) by requiring 50% of new buildings to be green buildings

by 2020. Therefore, in this research, the capacity and perceived institutional constraints faced by Chinese developers in implementing green housing targets are explored.

1.2 Research aim, objectives and research questions

This research addresses these aforementioned gaps in knowledge by showing how China's developers have responded to institutional change related to the green housing transition in the Chinese housing market. It adopts a new institutionalism approach to develop a conceptual framework, and uses a mixture of quantitative and qualitative methodological approaches, drawing on the literature on institutional and socio-technical transitions to conceptualise the complexity and dynamics of market responses to state-led policy change (Payne and Barker, 2018). This research provides the first thorough empirical analysis of state-market relations in the green housing transition in China.

The main aim of the research is:

To investigate the institutional constraints on the green housing transition in China by evaluating the capacity of Chinese developers to deliver green housing in the Chinese housing market.

To achieve this aim, four research objectives were set out for the research:

- Objective 1: To investigate the potential impacts on developers of current carbon regulation and green housing development policies in China;
- Objective 2: To evaluate the contribution of new institutionalism theory to the understanding of green housing transitions and to develop a conceptual framework;
- Objective 3: To examine developers' capacities for the implementation of green housing targets in the Chinese housing market; and
- Objective 4: To identify the key institutional weaknesses in the green housing transition in China.

In order to address the research aim and objectives, and in response to the research gaps identified in the literature review, seven research questions (RQs) were identified:

- RQ 1: What is the current status of carbon regulation and green housing policies in China?
- RQ2: What are the potential drivers and challenges faced by developers to the implementation of carbon regulation and green housing policies in China?
- RQ 3. What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?
- RQ 4: What are Chinese developers' attitudes towards the green housing transition?
- RQ 5: What are Chinese developers' behaviours towards the green housing transition?
- RQ 6: What are the key constraints faced by Chinese developers when delivering green housing?
- RQ 7: How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?

First, before investigating the institutional constraints on the green housing transition in China, an understanding of the current status of green housing development in China is necessary. RQ 1 and RQ 2 aim to address objective one from two different perspectives. RQ 1 provides a research background of how and to what extent the Chinese government has paid attention to green housing development; while RQ2 targets to find potential impacts of green housing policies from the developers' perspective. These two research questions have been primarily addressed in the literature review.

Secondly, the research gaps were generated from a review of the literature. It is vital to choose an appropriate research theory to address these key areas of investigation. RQ 3 addresses objective two which is to justify why the new institutionalism theory has been chosen to develop a conceptual framework for this research; what key areas of investigation can be generated by putting the institutionalism lens on; and why a mixture of quantitative (questionnaire survey) and qualitative (interview and work placement) methods was appropriate to addresses an institutional analysis in this research.

Thirdly, RQ 4 and RQ 5 aim to target objective three from two different perspectives. The Chinese developers' capacities for the implementation of carbon regulation targets in the Chinese housing market were investigated by examining their attitudes and behaviours towards the green housing transition. RQ 4 aims to gather more general attitudinal data from developers in order to provide a broadly representative view of developers' capacities. RQ 5 aims to gather detailed qualitative data to capture some of the complexity and dynamics of developers' behaviours in relation to green housing. RQ 6 targets objective four which was to investigate the key institutional constraints of China's green housing transition from the developers' perspective. These three research questions have been primarily addressed in the empirical analysis.

Finally, RQ 7 aims to combine all the insights and knowledge from the literature reviews, research theory and empirical data in order to make additional contributions on providing more feasible policy recommendations for the Chinese green housing transition.

1.3 Structure of the research

The following chapters are structured to address the research objectives and research questions (shown in Figure 1.1) which can be seen from three logical structure figures (Figure 1.2; Figure 1.3; and Figure 1.4).

Research Questions

Q1: What is the current status of carbon regulation and green housing policies in China?

Q2: What are the potential drivers and challenges faced by developers to the implementation of carbon regulation and green housing policies in China?

Q3: What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?

Q4: What are the Chinese developers' attitudes towards the green housing transition?

Q5: What are the Chinese developers' behaviours towards the green housing transition?

Q6: What are the key constraints faced by Chinese developers when delivering green housing?

Q7: How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?

Figure 1.1 List of research questions (illustrated by the author)

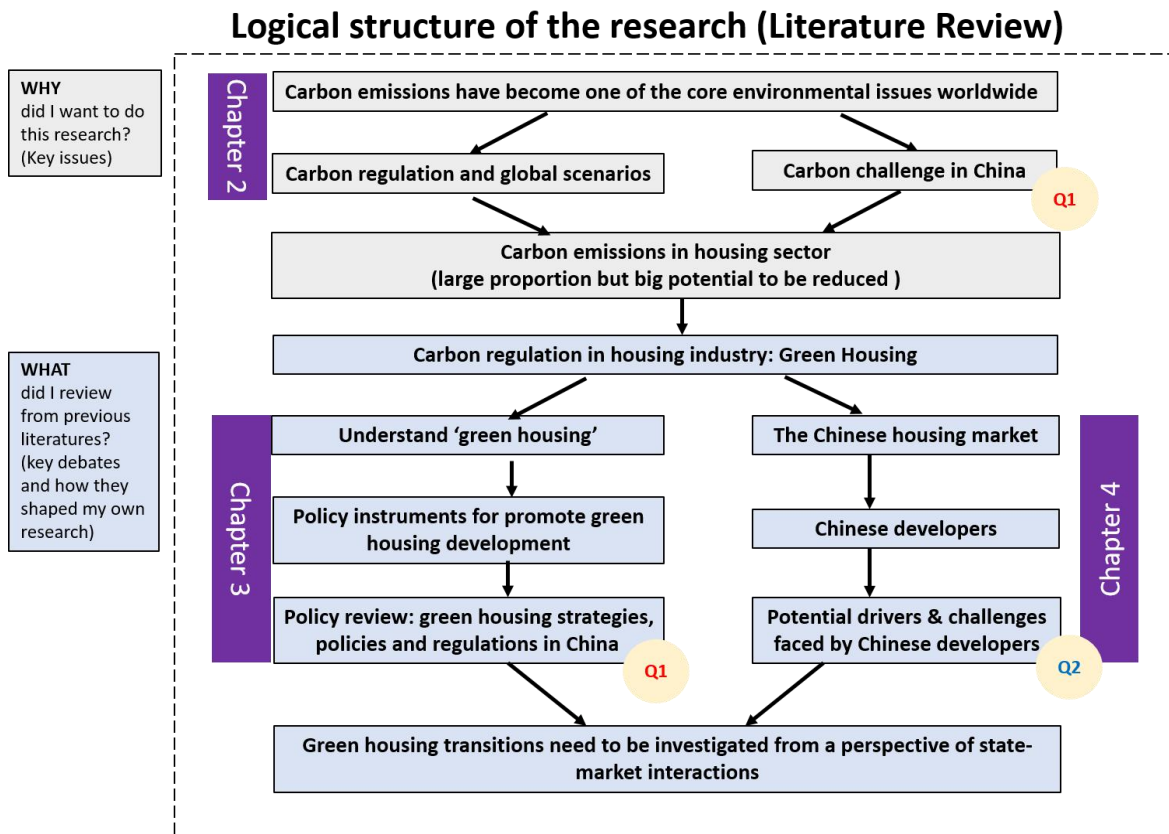


Figure 1.2 Logical structure of the research (Literature review) (Illustrated by the author)

As can be seen from Figure 1.2, Chapter 2 provides a literature review of global scenarios of carbon regulation and sets out the status of carbon regulation and climate governance in China. Chapter 3 narrows down to the housing sector, clarifies the definition of green housing, introduces key policy instruments used to promote green housing development and provides a policy review of green housing policy instruments in China. These two chapters provide the context for addressing RQ1. Chapter 4 addresses RQ2 and reviews developer-related literature including housing market operations in China, Chinese developers and the potential key drivers/challenges to delivering green housing. At the end of Chapter 4, the specific research gap will be identified and discussed in more detail as the focus of research.

Logical structure of the research (Conceptual framework & Methods)

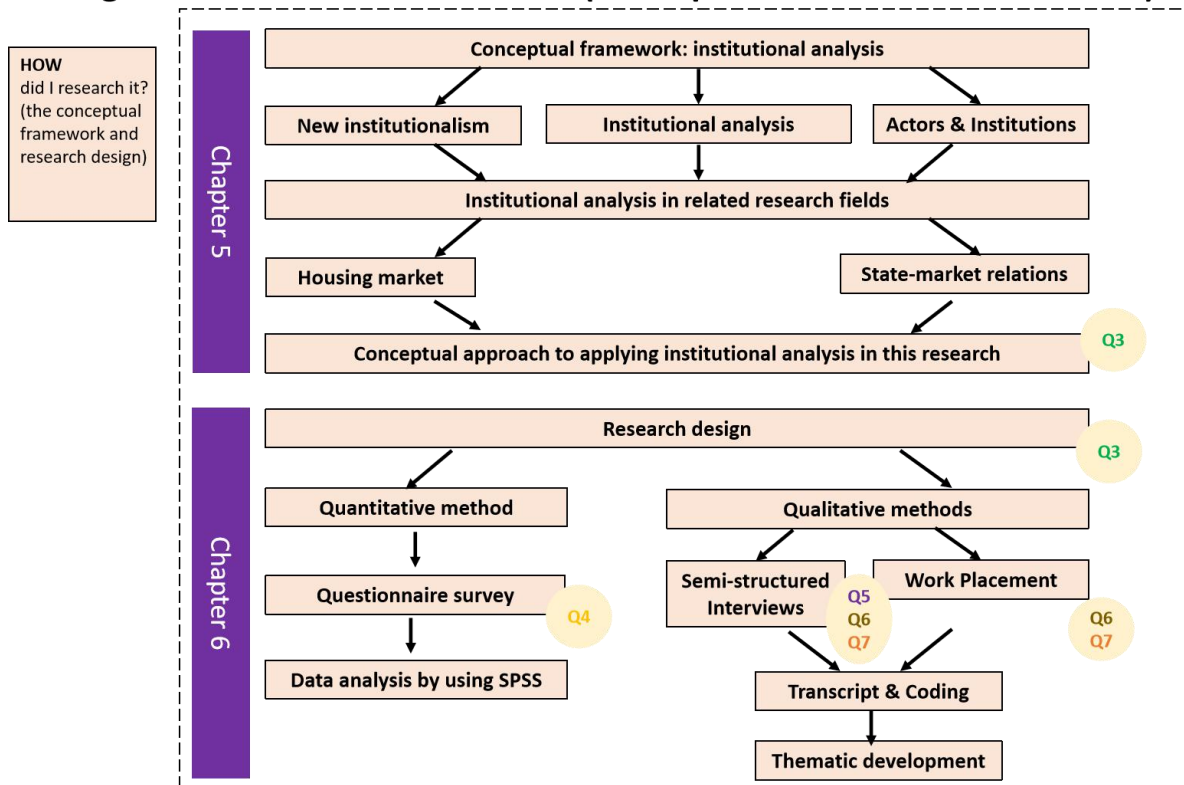


Figure 1.3 Logical structure of the research (Conceptual framework & Methods) (Illustrated by the author)

Figure 1.3 shows that after the literature review, Chapter 5 addresses RQ3 and builds a conceptual framework for the following research. Chapter 6 continues to address RQ3 and describes and justifies the methods used in this research: both quantitative and qualitative methodologies are used in order to address different research questions.

Logical structure of the research (Empirical analysis & Discussion)

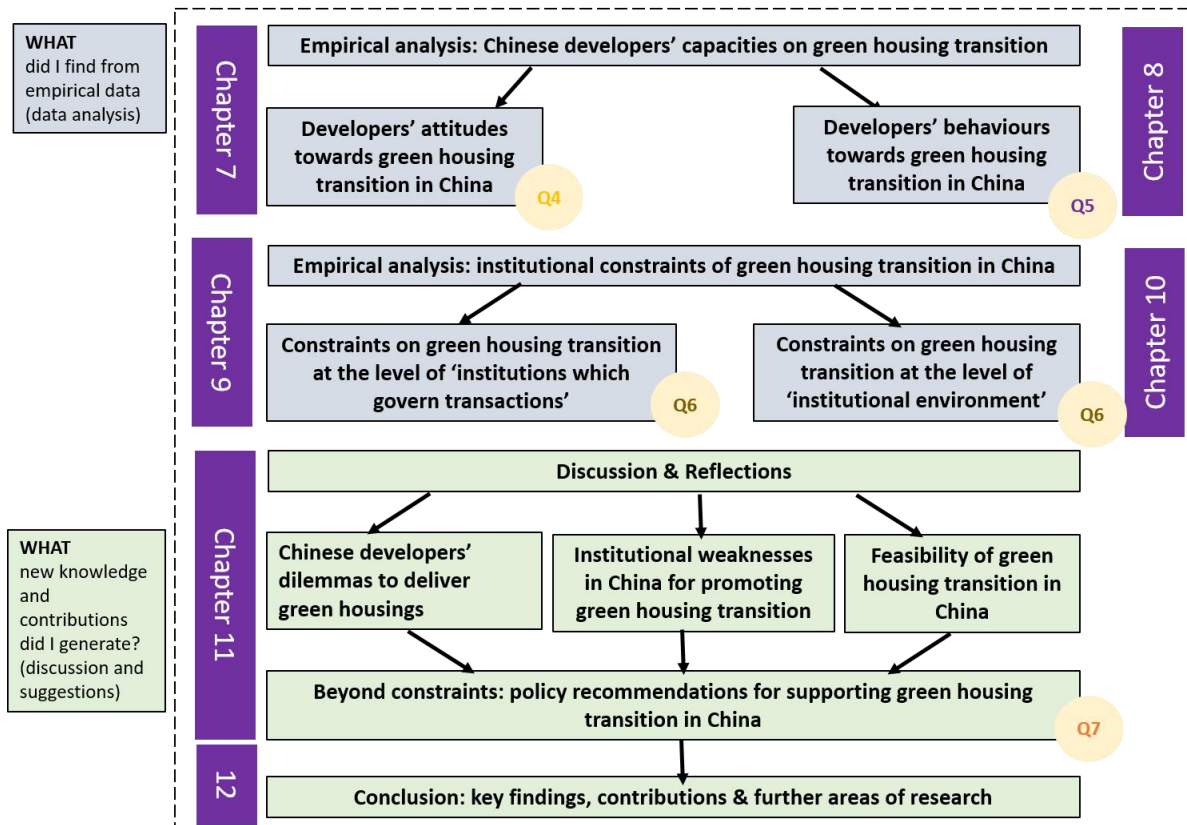


Figure 1.4 Logical structure of the research (Empirical analysis & Discussion) (Illustrated by the author)

After the literature review, conceptual framework and methodology chapters, Figure 1.4 shows that the thesis structure divides and presents the empirical results in four chapters: Chapter 7 and Chapter 8 present developers' attitudes (Chapter 7) and behaviours (Chapter 8) in order to address RQ4 and RQ5; Chapter 9 and Chapter 10 address RQ6 and presents institutional constraints on the green housing transition in China from the developers' perspective at two institutional levels.

The two strands of the research come back together in Chapter 11, which examines how the research aim, objectives and questions have been addressed; how the conceptual framework is applied to the understanding of developers' dilemmas and institutional weaknesses in the green housing transition in China; and, what new knowledge and contribution has been made in this research. Chapter 11 also addresses RQ7 to provide a list of potential policy recommendations by combining the knowledge generated from the understanding of existing research, the conceptual approach and this thesis' empirical

findings. The research concludes with a summary chapter (Chapter 12) of the main findings and contributions and recommendations for future work.

Chapter 2. The carbon challenge and the low carbon agenda

2.1 Introduction

Global warming caused by human activities has become increasingly serious worldwide (WWF, 2016) and the reduction of carbon emissions has become internationally urgent. Recent literature shows that climate governance has moved in new directions worldwide in this century, from sustainable development to carbon regulation (While et al., 2010; Payne and Barker, 2018). Compared with the idea of sustainable development with its characteristics of flexibility and lack of prescriptive target-setting, the concept of carbon regulation more directly addresses carbon emission issues and more clearly sets reduction targets for regional strategies and the key carbon emission industries (While et al., 2010).

This chapter provides an overview of the carbon challenge and how it can be understood. To do this, the chapter contains two sections. First, after outlining the current carbon challenge, it reviews ideas of carbon regulation and global scenarios to justify why it is important to focus on the implementation of carbon regulation. Secondly, it reviews carbon regulation and climate governance in China with the aim of showing how China's approach to carbon regulation is different from western countries and the distinct challenges that face China that perhaps do not face the West. Overall, this chapter addresses part of RQ1: what is the current status of carbon regulation and green housing policies in China?

2.2 Carbon regulation and global scenarios

2.2.1 The carbon challenge

Carbon emissions have become one of the core international issues. The United Nation's Intergovernmental Panel on Climate Change (IPCC, 2007) points out that the global average temperature rose by 0.74°C between 1906 and 2005. The current rates of carbon emission would cause further temperature rise and continue to trigger issues in the global climate system. Depending on the current level of carbon emissions, Hong Kong Special Administrative Region (HKSAR) government (2010) predicts that the global temperature could be increased by between 2°C and 6 °C during the 21st century. Consequently, carbon

emission issues have led to many environmental problems, for example, air pollution (Grano, 2016; Wong and Karplus, 2017) and global warming (Zhang and Wang, 2017).

Studies have revealed that carbon emissions are largely caused by human activities, such as transport (Hoen et al., 2014), building (Zhang and Wang, 2017; Baiocchi et al., 2010; Streimikiene, 2015; Das and Paul, 2014) and industry (Wang and Yang, 2015; Lin and Wang, 2015). However, many studies suggest that the current level of carbon emissions caused by human activities has great potential to be reduced. For instance, the IPCC (2007) predicts that by 2030, the global building sector is expected to reduce carbon emissions by 6 billion tons per year. Subramanyam et al. (2017) analyse the potential carbon reduction of 80 countries by 2020. They believe that the building sector can cost-effectively reduce around 29% of global building-related carbon emissions, which is the largest source of carbon emission among all sectors reported from the IPCC.

2.2.2 Carbon regulation

The increasing concerns about carbon emissions have led to the problem becoming a priority in eco-political efforts towards the concept of climate protection (While et al., 2010; Zhang and Zhou, 2016; Bulkeley and Castán Broto, 2013). The earliest urban responses to carbon emission took place in the end of the 19th century (Bulkeley and Castán Broto, 2013). After that, the concept of sustainable development was gradually introduced into policies and spatial development strategies. The term 'sustainable development' has been defined in many ways: a most frequently-used definition is: 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland et al., 1987), derived from the Brundtland Report, *Our Common Future*, in 1987. The Rio Earth Summit in 1992 signalled that ideas of 'sustainable development' have become major guiding principles for all the international development activities (Keeble, 1988).

Nevertheless, scholars have criticised sustainable development as a contested ideology due to the lack of consensus on what should be changed as a response (Arman et al., 2009; Higgins, 2013). While et al. (2010) support this point and they characterise sustainable development as being too flexible and lacking prescriptions for target-setting. In contrast to

the comprehensiveness but ambiguity of sustainable development, the concept of 'carbon regulation' (While et al., 2010) has become a new 'master concept' in spatial regulation (Keil, 2007). Although this concept seems to be framed within the broader sustainable development framework, the low carbon agenda with 'carbon regulation' challenges mainstream modes of urban governance under sustainable development and opens up possibilities for introducing a new set of values which are more related to carbon emissions (While et al., 2010).

Carbon regulation highlights a set of instrumental and clear targets: 'to reduce the concentration of greenhouse gases, especially carbon dioxide, in the upper atmosphere to a required level as quickly and efficiently as possible' (While et al., 2010, p.84). In other words, carbon regulation requires the political imperative of carbon emissions reduction as a first-order priority for governments. This new concept emphasises a regulatory fix for the current economic-environmental crisis.

2.2.3 Global scenarios of carbon regulation

The ideas of carbon regulation have been adopted in the climate governance arena and have formed a particular regulatory logic on carbon emissions internationally (Bulkeley and Castán Broto, 2013; While et al., 2010). Notable landmarks for carbon regulation include the IPCC's first report in 1990, and the Kyoto Protocol of 1997, which required signatory countries to reduce their carbon emissions by 5.2% between 2008 and 2012 compared with the level in 1990 (Protocol, 1997). The latest international legally-binding agreement to 'strengthen the global response to the threat of climate change' is the Paris Agreement, adopted in December 2015 (UNFCCC, 2015). The Agreement establishes an international global warming reduction goal of well below 2°C on pre-industrial averages and requires signatory countries to develop their own strategies for this common goal (UNFCCC, 2015). Under the guidance of the Convention, the Paris Agreement has become a landmark and a new beginning for international responses to the carbon challenge (He, 2016).

The ideas of carbon regulation have been experimented with by different states in order to meet the Paris Agreement's carbon reduction targets. Many countries have taken action and published relevant national strategies to deal with their own carbon challenges. For

instance, the Clean Growth Strategy in the UK and the UK Low Carbon Transition Plan (HM Government, 2017; 2009); the National Low-Carbon Strategy (SNBC) in France (UNFCCC, 2017); the Climate Action Plan 2050 in Germany (BMUB, 2017); and the Mid-Century Long-term Low-Greenhouse Gas Development Strategy in Canada (Government of Canada, 2016) are the basis for national approaches to tackling and responding to climate change. These countries set their carbon reduction goals from 1990 levels by 2050 in the Strategy's documents (80% in the UK; 75% in France; 80-95% in Germany; and 80% from 2005 levels in Canada) and the action frameworks to deliver on these carbon reduction targets.

In the academic arena, many studies focus on exploring carbon regulation policies and strategies and their influences on social activities. Different scholars have categorised regulations into different types (see Wong and Zapantis, 2013; Testa et al., 2011; Zhang and Wang, 2017; Cardenas et al., 2016) and there are some debates in the literature about different regulation approaches aimed at the same carbon reduction objectives. For example, academics have carried out evaluations of emissions trading (Bailey, 2007; Wong and Zapantis, 2013), carbon offsetting (Bumpus and Liverman, 2008; Baldwin 2009), and both mandatory and incentive instruments of carbon reduction (Zhang and Wang, 2017; Testa et al., 2011). These carbon regulation strategies represent not only a financial calculation in cost-benefit analysis, but also a 'reorganisation of economic principles' (Boykoff et al., 2009). In this case, carbon regulation can be seen as introducing a new set of 'calculative practices' (Miller, 2001) into urban governance, and these new 'calculative practices' could help to shape economic and social relations (While, 2013). In addition, carbon regulation policies need to be customised by every government because of the particular set of conditions created by the specific institutional constraints in each economy (Berkeley, 1998).

2.2.4 Key debates in carbon regulation

Currently, a number of arguments around carbon regulation can be derived from the literature (see Allcott and Greenstone, 2012; Bretschger and Zhang, 2017; While et al., 2010). First, there is a consensus that carbon regulation policies mean a degree of higher costs in the short term (Allcott and Greenstone, 2012). This issue depends on a variety of factors, but most importantly on growth mechanisms and low carbon innovations (Gans,

2012; Bretschger and Zhang, 2017). In Bretschger and Zhang's (2017) model, carbon regulation has a positive effect on innovation and investments but a negative effect on production or construction. For instance, the application of carbon taxes could improve the incentive to alternatives away from energy inputs in response to which companies and industries would seek low carbon technologies to improve their energy efficiency. This brings about spillover effects on different levels of the economy, and in the long-run, would contribute to welfare gains from carbon regulation. However, Allcott and Greenstone (2012) argue that there is a limited scope for win-win situations with carbon regulation since there are 'limited possibilities to consume less energy without reducing welfare by removing existing inefficiencies' (Bretschger and Zhang, 2017, p.2).

Secondly, these short-term costs are also largely affected by the growth rate of the country (Hübler et al., 2014). More specifically, Bretschger and Zhang (2017) state that for developing countries, achieving reduction targets of stringent emission intensity is significantly easier than achieving absolute carbon emissions reduction. In China, the welfare loss of achieving 65% reduction of carbon emission intensity by 2030 relative to the 2005 level is less than half a percent (Bretschger and Zhang, 2017, p.17). Welfare costs increase substantially with the stringency of carbon regulation policies. It means that even taking into account the ability of an economy to apply low carbon innovations according to changing mechanisms, the costs of carbon regulation cannot be disregarded when the economic growth rate is high (ibid.)

Thirdly, 'uncertainty' is the main issue of carbon regulation. Pollitt (2008) believes that how to manage uncertainty is one of the key focus for successful regulation and carbon regulators should try to manage the policy risks more carefully in order to minimise the impact on the cost and price of any market development. According to the result from Gottinger's (1995) model, the actual response to regulations is also highly uncertain. If the uncertainty of such mechanisms is relatively high, states may need to rely on adaptable, market-driven strategies rather than on complex, costly regulatory schemes (ibid.). Overall, it is emphasised that carbon regulation represents a harder-edge form of policy (While et al., 2010) and the expectations of the market for adopting carbon regulation are still not clear.

2.3 Carbon regulation and climate governance in China

Section 2.2 has given a general overview of carbon regulation. However, these reviews are mainly based on literature relating to western countries, and it is questionable that whether those ideas and arguments about carbon regulation could apply to the Chinese context. In general, studies of urban development issues in China have relied on theoretical perspectives limited to the West and applying them to China can, in some cases, be problematic since development in China has differed from that of the West. For example, China has a semi-authoritarian political system in the context of the delivery of carbon regulation which is different from the Western capitalist markets (Westman and Castán Broto, 2018).

In 2014, China became the largest carbon contributor worldwide, accounting for about one-quarter of global emissions (Edenhofer et al., 2014; Xu and Lin, 2017). The figure has continued to grow since that time as a consequence of China's rapid urbanisation and industrialisation (NBS, 2015). The United Nations (2017) reported that the recent global calls for low carbon growth increasingly rely on how China can achieve its carbon reduction goals. A number of studies show that China's carbon reduction motivation was initially and primarily driven by international pressures, but currently, China's endeavours to mitigate carbon emissions are based on its own interests (Boyd, 2012). This is because that the Chinese government believes that the existing development pathway in China is no longer feasible for future development (Zhang, 2015) since more and more serious environmental issues have been exposed, such as air pollution (Wang and Hao, 2012) and ecological damage (Wu et al., 2016).

2.3.1 Carbon regulation in China

Since the 1990s, China has established its own national environmental strategy and has gradually transferred its policy attentions to a low carbon context. In 1994, the Chinese government published China's version of Agenda 21 (United Nations, 1992): *White Paper on China's Population, Environment, and Development in the 21st Century* (State Council, 1994) which provides the overall strategy for Chinese sustainable development. In 2003, the National Development Reform Commission (NDRC, 2003) promulgated the Program of Action for Sustainable Development in China in the Early 21st Century, which contained the

specific objectives, principles, and priority areas for sustainable development in China. In 2007, the NDRC adopted a National Climate Change Programme.

The Five-Year Plan (FYP) is one of the significant Chinese national programs, ratified by the highest legislative organisation in China, the National People's Congress (NPC). It provides a clear national strategy, goals and frameworks for the China's next five years of development and aims to have a substantial impact on China's development landscape at the national level (Wu et al., 2019). The FYPs have become a powerful driving force for China's economic and social development, providing structural guidance for macroeconomic and social activities and acting as the basis for the government to carry out duties of providing public services. At the same time, it is also an important tool for carbon regulation in China. It provides guidance and motivation to promote cooperation between the state and society, government and markets, central and local governments, and domestic and international institutions (Hu, 2016).

China's 12th FYP (2011-2015) (NPC, 2011) has been a remarkable policy document since it not only reveals the government's economic and social priorities and guidelines, but dedicates its environmental section to mitigating climate change, environmental issues and emphasises carbon-related concerns. It is 'not only the first Five-Year Plan that mentions climate change, but it is mentioned at the top of the environmental section' (Bapna and Talberth, 2011, p.3). Before the publication of the Paris Agreement in 2015, China put forward ambitious post-2020 Intended Nationally Determined Contributions (INDC) goals which included a 60%-65% reduction of carbon intensity of GDP in 2030 compared with the 2005 level; an increase of about 20% in non-fossil energy in primary energy consumption; and achieving the carbon emissions peak before or by 2030. Guided by those targets, China has promoted transitions in energy production and consumption in a low carbon direction (NDRC, 2015).

In 2016, the Central Committee of the Communist Party of China (CPC) announced China's 13th FYP (2016-2020) for National Economic and Social Development, in which carbon regulation principles were strongly emphasised (CPC Central Committee, 2016). China's engagement with mitigating climate change and realigning its energy sector suggests that

the country is acknowledging the urgency of tackling the implications of its high emissions strategies, translated in the 13th FYP.

In order to achieve its carbon reduction ambitions, the State is creating institutional conditions conducive to carbon regulation. China has medium- and long-run strategies for promoting carbon reduction and has incorporated carbon regulation into its national strategy (e.g. the 13th Five-Year Plan) (CPC, 2016). Local authorities are required to formulate practical medium- and long-term plans for carbon reduction based on their local conditions, and to make links between the 'low carbon plans' and other local initiatives, such as spatial planning, economic development planning, energy-saving planning, industrial planning and science and technology planning (Jin and Hunter, 2013).

However, only a few academic research have focused on investigating carbon regulation directly in the Chinese context. In China, the government combines direct control and voluntary measures to administer carbon emission reduction. For example, Jin and Hunter (2013) outline the Chinese operational mechanisms for carbon regulation which include: (a) an integrated decision-making mechanism which coordinates environment, resources, society and economic development; (b) incentive and restraint mechanisms for production, distribution, and consumption by government, industries, and the public; (c) management systems and operating mechanisms compatible with low carbon development; (d) systems and mechanisms for supporting low carbon technological innovation; (e) green market mechanisms, for example, carbon emissions trading, and green credit systems; and (f) statistics, tracking, and evaluation systems that accurately measure the performance of officials relative to low carbon development.

Zhang and Zhou (2016) classify Chinese carbon regulation instruments into three categories, namely direct carbon regulation; economic carbon instruments; and soft carbon instruments. Direct carbon regulation are direct control regulations which provide clear orders or prohibitions to the businesses on what they should or should not do. These regulations are compulsory for the industries. Economic carbon instruments include all the monetary incentives to encourage businesses to reduce carbon emissions, for example, providing subsidies, tax deductions or tax exemptions. Soft carbon instruments are voluntary for industries to comply with, for example, applying green building certifications.

This voluntary approach provides many opportunities for stakeholders in the industries to increase their market competitiveness (ibid.).

Overall, although the concept of carbon regulation has been adopted in the climate governance arena and have formed a particular regulatory logic on carbon emissions internationally (Bulkeley and Castán Broto, 2013; While et al., 2010), the understanding of carbon regulation under the Chinese context is still vague and lacks detailed investigation. Therefore, a further review of the unique context of urban and climate governance in China is required to explain why carbon regulation in China is different from western countries and what distinct challenges face China in delivering carbon regulation.

2.3.2 Urban and climate governance in China

Some western politicians associate governance with strict regulations and may regard them as limitations on market growth (Allmendinger and Ball, 2006). In China, however, intervention by the government has not been considered as an obstacle to the national development. According to Wu et al. (2015), government intervention in China has become an important mechanism for shaping the market according to the needs of the state and the general public. Wright (2010) provides three reasons for the strong acceptance by society and industries of the dominant status of the government in China: (1) State-led economic development policies; (2) Late industrialisation; and (3) Socialist legacies.

In terms of economic development policies, the achievements of Chinese economic reform in the last 30 years have made the society 'accept authoritarianism' (Fang, 2012, p.126), especially those stakeholders with close relationships with the government, such as housing developers. For example, it can be seen that there are various ways that planning can shape the housing market including the creation of plans and the provision of strategic market transitions. The production of spatial plans, visions, planning frameworks and policies are particularly useful tools for the government as the 'plan maker' to display their vision of how an area should change over time (Wu et al., 2015). Chinese political leaders are confident that planning can be a dominant force in promoting China's economic growth. This is largely because of the proactive interpretation of the value of planning in China associated with the political support of planning at the highest level. Wu et al. (2015) further

state that strategic plans are a key method for promoting areas and planning has become the most important tool for municipalities to attract new industrial developments and investments.

In addition, without the market-shaping forces created by the government, China would not have been able to regulate the uncoordinated competition between municipalities that would have resulted in far greater costs than any short-term profits (Wu et al., 2015). The fierce competition between cities has resulted in their over-expansion, which threatened to destroy the environment and the surplus production of certain industries. In this sense, 'the value of regulation is its ability to prevent or at least significantly reduce the costs of an unregulated market' (Wu et al., 2015, p.2). The market-shaping mechanism of planning also allows the government to open up new market directions, such as green housing transition, that would otherwise be left untouched by other market actors (ibid.). Overall, the regulatory planning mechanisms have proven to be essential for the development success in the Chinese case.

Moreover, Lawrence and Martin (2012) state that political power in contemporary China is fragmented, complex and competitive. Within the one-party system, Chinese local governments normally follow national government's instructions and implement centrally-determined strategies and regulations (Liu and Qin, 2016). 'Fragmented authoritarianism' (Lieberthal and Oksenberg, 1990) describes how bureaucratic units gain influence in Chinese political decision-making, and thereby, in negotiating and bargaining within the political system (Lieberthal, 1992). The authorities are present within and between horizontal authorities (central and local governments) and vertical authorities (Ministerial Departments) (Dai, 2015; Lo, 2015b) and result in 'multiple axes of authorities at times intersecting and at other times remaining parallel' (Cai and Aoyama, 2018, p.72). China's carbon regulation-related departments can be characterised as simultaneously hierarchical and fragmented. They have changed considerably over the past decades in order to achieve strategic goals and increase flexibility of China's climate governance, but they also produce overlapped jurisdictions and misaligned policies (Korsnes, 2014; Andrews-Speed, 2012; Shen, 2017).

However, some evidences show that, in contrast to the common perception of a highly hierarchical top-down governance, climate governance in China displays a degree of flexibility (Lo, 2014; Economy, 2014; He, 2014). To explain, China's climate governance was characterised by a state-centred approach and top-down control lines, the national government set the overall strategy for China's low carbon agendas (Li and Wang, 2012; Price et al., 2011). At the same time, local authorities have a degree of flexibility to produce local-level carbon reduction policies and regulations based on their local conditions (Liu and Salzberg, 2012; Cai and Treisman, 2006; Lo and Tang, 2006; Qi et al., 2008). Thus, decentralisation of climate governance in China involves 'a delicate balance between maintaining top-down control and making room for local interests' (Westman and Broto, 2018, p.214).

However, most local governments tend to choose to achieve short-term economic growth goals rather than long-term carbon emissions reduction goals (Jin and Hunter, 2013). This is not surprising since over the past three decades, the Chinese State has normally used the local GDP growth rate to assess the performance of local government officers (ODCCC, 2013). In addition, local leaders generally rely on strong GDP performance in their jurisdiction areas to 'demonstrate their talent and managerial skills in the hope for career progression' (Wang et al., 2012, p.354). On the one hand, with tax revenue being one of the key income sources for the local governments, they are more willing to increase local GDP in order to expand the tax bases (NAES, 2012). The main source of tax revenue for local authorities is corporate income tax, thus, large-scale development projects, such as housing community development, are extremely important to local authorities. On the other hand, local authorities not only play a role as regulators like the national government, but they are also the biggest beneficiaries of land development since as landowners they are the only legal institutions to acquire and sell land (Yao et al., 2014; Zhang, 2015). As a result, local governments tend to protect these large taxpayers, such as private housing developers, even if they generate large-scale carbon emissions (Zhao et al., 2014).

2.4 Summary

Carbon regulation in China differs from the existing frameworks of carbon regulation in the West in some notable ways. First, there is a strong acceptance of governance intervention in

China under its top-down governance system. Secondly, China's highly strongly yet fragmented authoritative state mechanism provides a unique context. Thirdly, the strengths of China's state-led carbon regulation and climate governance lie in its long-term efficiency (Gilley, 2012). Although public concerns about air pollution or climate change issues are on the rise (Grano, 2016; Wong and Karplus, 2017), the Chinese model can be characterised as non-participatory, and other than the state, actors affected by the policy transitions play a limited role in shaping carbon regulation policies (Mol and Carter, 2006).

Overall, we are now in an era where the reduction of carbon emissions has become the priority of environmental regulation. However, the transformation to a low carbon future is likely to be 'incremental rather than radical' (While et al., 2010, p.83). This chapter has reviewed current global scenarios relating to carbon regulation which provide the broader background for doing this research.

Under this circumstance, all the key carbon emission industries are required to make changes towards a low carbon direction. As one of the key carbon emission industries, it inevitable that the housing industry will need to respond and ultimately adapt to this changing policy landscape. The next chapter examines existing research on how the housing sector response to the current low carbon agenda and provides the definition of 'green housing'.

Chapter 3. Carbon regulation in the housing sector: green housing

3.1 Introduction

Globally, movements promoting carbon regulation are now shaping the practice of key carbon emission sectors of society towards low carbon practices (While et al., 2009). The building sector has been heavily criticised as a major contributor to carbon emissions with a contribution of up to 30% of international carbon emissions (Wong and Zhou, 2015; Wang, 2014; Dong et al., 2017, 2018; Shan et al., 2018). However, it has also been identified as the sector with the greatest potential to reduce carbon emissions (Rode et al., 2011; Yeheyis et al., 2013; IPCC, 2007; International Energy Agency, 2013; Wu et al., 2018). To address the carbon challenge in the housing sector, therefore, a new concept of 'green housing' has been introduced into political and market arenas.

Statistics has shown that, globally, China ranks top 2 in building energy consumption and ranks top 1 in housing energy consumption (Zhang et al., 2015). Lynn et al. (2017) calculated that energy consumption in the Chinese building sector occupies about 46.7% of total energy consumption. It is predicted that the Chinese building sector need to contribute more than 50% of energy savings in order to reach the goal which to peak carbon emissions by 2030 (ibid.). Thus, to what extent China could achieve its commitment to peak the carbon emissions is largely related to the energy conservation and carbon emissions reduction in its building sector (Liang et al., 2014, 2017; Zhang and Peng, 2017).

At the same time, China is experiencing its rapid urbanisation (Sandanyake et al., 2018): during the past decade, the housing sector occupied 40% of the energy in civil building sector in China (Huo et al., 2018a, b; Zuo and Zhao, 2014). Population growth, rapid urbanisation, and people's increasing disposable income have increasingly created demands for purchasing housing and the installation of energy-consuming equipment in the houses (Fan et al., 2017). As a result, this has led to the dramatic increase of energy use and carbon emissions, especially in the housing sector (Huo et al., 2018b). A green housing transition is highly needed to address its carbon issues in housing sector.

This chapter introduces the ideas of ‘green housing’, and explores how and to what extent ideas of green housing have been introduced into China’s climate governance. First, it reviews the ideas and definitions of green housing. Secondly, it explains green housing transitions. Thirdly, it reviews the current global policy instruments for promoting carbon emission reduction in the housing sector used in different countries or regions, and what lessons can be learned by China. Fourthly, it retrospectively traces the development of green housing policies (including key strategies, policies, regulations and standards) in the Chinese housing sector over the last two decades. Overall, this chapter aims to continue addressing RQ1: What is the current status of carbon regulation and green housing policies in China?

3.2 Understanding ‘green housing’

3.2.1 Defining green housing

Over the past few decades, since environmental issues have become more sensitive and serious, the words ‘sustainable’ and ‘green’ have often been used interchangeably in academic fields, and have also gained recognition in the building construction industry (Zhang et al., 2011; Korkmaz et al., 2009). First of all, it is essential to examine what is meant by ‘green building’, since green housing is one key category of it. Many scholars define ‘green building’ as an environmental solution in built form, which involves an integrated approach to saving energy, effectively using resources and minimising environmental impacts through building material production, building design and planning, construction and operation stages, and over the whole-life-cycle of the building (O’Neill and Gibbs, 2014; Keeping and Shiers, 2004). Other scholars (Li et al., 2019, 2020) emphasise the relationships among humans, environments and buildings, and define green building as ‘a building that can save resources to the maximum extent during its life cycle, including energy, land, water, materials, etc., hence protecting the environment, reducing pollution, and providing people with healthy and comfortable habitation spaces’ (Li et al., 2020, p.2).

However, due to different research perspectives and focuses, precise definitions of ‘green building’ are debated. For example, from the perspective of resource-efficiency and ecological principles, the main purpose of green buildings is to minimise negative

environmental impacts and to enhance users' health (Kibert, 2012; Robichaud and Anantatmula, 2010). From the perspective of a circular economy, green buildings can contribute to creating a virtuous circle of ecological, natural and human systems (Luo, 2016). In other words, green buildings, using modern construction systems, material regeneration principles, and multi-disciplinary green technology, in accordance with local environmental and resources status, can achieve an economic, ecological and social multi-win situation. From the perspective of sustainable energy performances, green buildings are viewed as sensible and practical buildings contributing to reducing carbon emissions and reducing energy consumption in the building sector (GhaffarianHoseini et al., 2013). Overall, it can be said that green buildings have four main principles:

- minimizing impacts on the environment;
- enhancing the health conditions of occupants;
- producing returns on investment for developers and local communities; and
- taking the whole life cycle of buildings into consideration during the planning and development process (Robichaud and Anantatmula, 2010)

Generally speaking, a green house is a type of house that is sustainably designed, constructed and managed to be environmentally friendly (He et al., 2019). Green housing, as a branch of green building, meets all the general requirements of green buildings, while strongly emphasising residence health, comfort and safety in the context of livable space for people (Anantatmula, 2010; Gabay et al., 2014). It is an architectural concept to meet modern development requirements, but does not require a specific housing type, nor does it distinguish between regions (He et al. 2019, p.709). Zainul Abidin et al. (2012, p.374) also emphasise that 'for a house to become 'green', every phase of the building process (design, construction and operation) must incorporate environmental considerations such as energy and water efficiency, resource efficiency, indoor quality, waste and pollution control, house maintenance and the overall impact of the house on the environment'.

It is worth noting that some alternatives to these definitions of green housing have been introduced into global housing sectors with different focus, such as 'low carbon housing' (Davies and Osmani, 2011; Reid and Houston, 2013); 'energy-efficient housing' (Sharp et al.,

2015; Golubchikov and Deda, 2012); 'high-performance housing' (Korkmaz et al., 2010); and 'eco-housing' (Smith, 2012; Blok, 2014). These terminologies are sometimes used interchangeably in academic research or political fields. In the strict sense, these concepts represent different types of housing, both of which are linked and differentiated. For instance, the goal of low carbon housing is obvious (Chen, 2011): to control carbon consumption and emission during the whole housing cycle in order to address climate change through rational design and technologies. Energy-efficient housing pays attention to energy efficiency and is largely intertwined with energy-efficient designs and advanced integrated technologies to reduce energy demand and resource consumption (Golubchikov and Deda, 2012).

Green housing moves beyond this to also emphasise water consumption and other resource consumption, as well as influences on the wider environment (He et al., 2019). The core concept of green housing is to 'achieve environmental friendliness, reduce environmental pollution, and constitute a sustainable dependency with natural environment' (Li et al., 2016, p.231). From these perspectives, the concept of green housing is considered to be broader than 'low carbon housing' or 'high performance housing'. However, energy efficiency and carbon emissions are also very important elements of the green housing life-cycle process, since green housing is largely intertwined with energy efficient designs and advanced integrated technologies in order to cut energy and resources consumption (GhaffarianHoseini et al., 2013). It is also worth noting that the effective alternative should not only achieve 'carbon regulation' goals, but also 'high-performance' functions. In other words, the energy efficiency of green housing cannot come at the cost of reductions to the users' living standards or comfort levels (WGBC, 2013).

Global policymakers have introduced the concept of green housing to indicate the requirements of carbon regulation into housing policy arenas to reduce or eliminate the negative impacts of housing sectors on the climate (WGBC, 2017; Hwang et al., 2016). From a policy perspective, housing is considered green if it is able to meet minimum thresholds of environmental performance via an evaluation process by a green building rating system such as LEED in the US, BREEAM in the UK and CASBEE in Japan (Ozolins et al., 2010; Anzagira et al., 2019). Quite often, what precisely constitutes green housing varies depending on the country and policy agenda. Indeed, Shi and Lui (2019) argue that due to

different economic development states, environmental conditions and housing development scales in different countries, green housing does not have international consensus on a definition.

For example, the U.S. Green Building Council (2014) defines green housing as ‘homes that are built to be healthier and safer by providing cleaner indoor air. They use less energy and water, leading to monthly savings on utilities, and maintain their value over time’. Or as another example, the Green Building Council of Australia (2013) defines a green house as ‘a high performing home that is energy and water efficient, has good indoor air quality, uses environmentally sustainable materials and also uses the building site in a sustainable manner’.

China has used the concept of green housing since 1990s. It published *China's Agenda 21* in 1994 and introduced requirements and measurements to improve housing quality. Starting from 2001, China published Technical Guidelines for Green Eco-community, Evaluation Method and Index System of Commercial Housing Performance (Xie, 2015). In 2006, the Chinese Ministry of Construction provided an official definition of green housing which is ‘the residential building that provides healthy, comfortable and safe living space, also achieves efficient use of resources (energy resources, land resources, water resources and material resources) and minimises the effects to the environment’ (MOURHD, 2006).

This research adopts this concept and definition of ‘green housing’ for two main reasons. First, this housing type meets both carbon regulation and high-performance requirements discussed above and can therefore be considered to be in line with the aim and objectives of the research. Second, since this research explores carbon regulation and developers’ responses to the green housing transition in China, the concepts used need to be in line with the Chinese context, particularly given the fluidity of definitions outlined above. Indeed, the definition of green housing is cited from Evaluation Standard of Green Building (ESGB), which is China’s national, official and most authoritative rating system used to evaluate the quality of green housing in China. Compared with other terms like ‘low carbon housing’ or ‘energy-efficient housing’, ‘green housing’ has been most widely adopted and recognised in Chinese academic, political and empirical arenas.

In summary, although there are different definitions of green housing, both in academic and in policy fields, the above review shows that the key concept of green housing in these definitions can be unified: green housing should achieve the maximum reduction of carbon emissions and the most effective utilisation of all related resources (land, water, energy and materials) in order to minimise effects on the environment (Gibbs and O'Neill, 2014; Keeping and Shiers, 2009). At the same time, green housing should also provide users with comfortable, safe and healthy living and activity spaces throughout the whole life cycle of the housing (design, construction, operation, maintenance, renovation, and demolition) (Yang et al., 2018; Dwaikat and Ali, 2018). This understanding of green housing is represented in the Chinese ESGB standard, which is used to guide the following research.

3.2.2 Whole-life-cycle and key features of green housing

The green housing development process is often associated with an idea of 'whole-life-cycle' development (Yang et al., 2018; Dwaikat and Ali, 2018) which includes five major phases:

- a. Concept and definition;
- b. Design and development;
- c. Manufacturing and installation;
- d. Operation and maintenance; and
- e. Disposal.

The whole life cycle assessment for green housing development is regarded as a promising tool for comprehensively understanding the potential carbon emissions, energy consumption and environmental impact of a building for its entire life cycle (Antón and Díaz, 2014). The operation stage is revealed as having the highest level of carbon emission: for example, Huo et al. (2019a) show that the operational energy consumption accounted for about 70% of total housing-related energy consumption. However, some scholars suggest that the design stage plays the most significant role in reducing the environmental impacts of housing (Shin and Cho, 2015; Basbagill et al., 2013; Antón and Díaz, 2014) since it is the most flexible stage for making changes (Antón and Díaz, 2014) and could offer housing developers information about housing environmental performance in the early stages (Schlueter and Thesseling, 2009). Otherwise, as development proceeds, the flexibility for

reducing environmental impact is limited and the costs of making changes increases. Therefore, it is essential for developers to understand the material, equipment or dimensioning which determine a building's environmental impact at the early stage (Basbagill et al., 2013).

Figure 3.1 provides an example of what kinds of technology are normally used in a green housing project. However, it is essential to consider the local conditions when choosing what kinds of technology or equipment should be used. It is especially important in the Chinese context since China is a large land mass and different regions have very different climatic conditions. For example, the average temperature in southern regions of China is higher than 9°C in the winter and there is normally no requirement for heating systems in housing, and thus, the building energy consumption is relatively low (Guo et al., 2016).

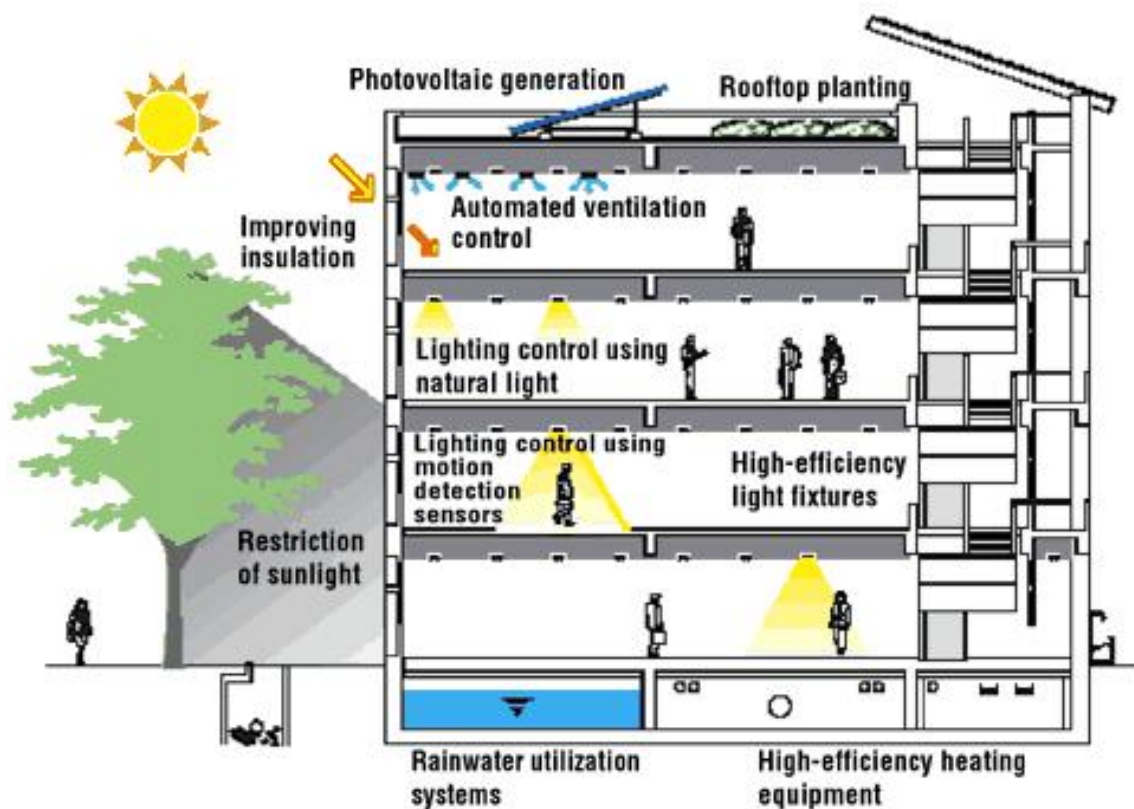


Figure 3.1 Key technologies used in a green housing (Source from: Zafar, 2019)

Generally speaking, two technological strategies are often incorporated when designing a green housing project: the first one is mechanical or active design and the second is architectural or passive design (Kibert, 2016). Active design strategies refer to the use of

mechanical, artificial or electrical technology to cool, heat or illuminate spaces which generally include equipment such as artificial lighting, elevators or air conditioning (ibid.).

In contrast, passive design strategies refer to building designs that do not require mechanical equipment for cooling or heating. They directly address the building envelope such as exterior walls, windows and roofs, and consider day-to-day use costs, the use of sustainable materials and how to optimise solar energy gain and loss in order to reduce energy consumption. Passive design strategies take advantage of the natural and climate elements of the sites to maintain comfortable temperatures and enhance the energy efficiency of buildings (Huo et al., 2019b). Thus, passive design is generally regarded as a cost-effective approach for improving indoor thermal environments (ibid.), for instance, the layout of a building can produce self-shading effects (Chen et al., 2015). In addition, a building's parameters such as the ratio of window to wall or window location can also affect its thermal performance. Insulation prevents heat flow, which is important for keeping buildings temperature comfortable (Gong et al., 2012). Thus, the adequate insulation in housing design can improve comfortable level, reduce heating and cooling costs, reduce energy consumption and also, reduce carbon emissions.

Some key arguments have been generated around green housing development. On the one hand, some research has questioned the claimed benefits of green housing. It is worth noting that green housing is a complex and long-lasting good which involves different objectives such as environmental benefits, functionality and economic benefits (Yang et al., 2018, Hwang et al., 2015). However, conflicts may arise between these different objectives. For example, the environmental performance of green housing may not always be compatible with users' comfort. Some studies reveal that in green buildings, there are overheating risks since they rely on natural ventilation during the summer periods (Oropeza-Perez and Østergaard, 2014; Zuo et al., 2015). On the other hand, some research doubts the effectiveness of green housing. For example, Newsham et al. (2009) presented an interesting result that about 30% of the Leadership in Energy and Environmental Design (LEED) certified buildings consume more energy than traditional buildings despite a higher average level of energy efficiency. These arguments may increase the feeling of uncertainty that housing market actors have about green housing.

Although there are some doubts about green housing development, in general, its benefits and value are generally acknowledged. Many studies outline the benefits of green housing from environmental, social and economic perspectives, such as its contribution to energy savings and carbon mitigation (World Green Building Council, 2013; Johansson, 2012; Darko and Chan, 2017), higher market value (Hyland et al., 2013; Heinzle et al., 2013), and more comfortable living standards for users (Rashid et al., 2012). In terms of carbon emissions, data revealed that the life cycle carbon emissions of green housing is lower than traditional housing (Wu et al., 2017). As a consequence, designers, developers and other housing professionals have sought to construct green housing with a range of green housing design and operation features such as minimising energy consumption, minimising the environmental impact of housing materials; minimising construction waste; and maximising the indoor environmental quality (Keeping and Shiers, 2009).

3.3 Policy instruments for promote green housing development

Currently, there is serious political pressure for actions on decarbonisation in the housing sector in both developed and developing countries addressing climate change. Government involvement has been considered as an undeniably effective approach to promote the green housing development (Li and Yi, 2014; Nurul Diyana and Abidin, 2013; Enker and Morrison, 2017; Nguyen et al., 2017; Abidin and Powmya, 2014). Some key policy instruments normally adopted by States to promote green housing development are reviewed in the following section, which can be possibly learned by China.

3.3.1 Mandatory vs. Incentive policies

Zhang and Wang (2017) carried out a Global Status Report and the data indicate that almost 144 countries had implemented carbon reduction policies at the national levels by 2014. They found that in the early stages of policymaking, the States mainly used mandatory instruments, for example, setting mandatory targets or standards for the key carbon emission industries (Zhang and Wang, 2017, p.120). However, lately, more governments tend to use incentive approaches to promote low carbon development. Most recently, many countries are tending to explore possibilities for low carbon pathways and seek a mix of various policies in order to achieve the best carbon reduction outcomes. This

policymaking trend also depends on the level of income which affects states' carbon reduction level (Han et al., 2015). The study (Zhang and Wang, 2017) shows that high-income countries mostly depend on demand-side incentive policies to encourage markets to change their ways of activity by providing strong financial support; while lower income economies mainly achieve carbon reduction goals by the implementation of supply-side policies such as policies setting mandatory regulations and carbon reduction targets.

In terms of green housing sector, many countries and cities offer policy incentives to make green housing more attractive (see Enker and Morrison, 2017; Edmondson et al., 2018) which can be regarded as important external incentives (Abidin and Powmya, 2014) for green housing development. However, it is important to note that although market actors can benefit from government incentives, external incentives are characterised as special conditions or requirements from governments that must be fulfilled by the market actors (Olubunmi et al., 2016). It means that the market actors such as housing developers are the beneficiaries but also faced a forced choice of achieving specified requirements of green housing to benefit from incentives provided by the governments.

Generally speaking, government incentives can be divided into forms of direct financial investment and non-financial incentives (Darko et al., 2017). Direct financial incentives include tax incentives (Gou et al., 2013), discounted development application fees, or direct funding (Nurul Diyana and Abidin, 2013). These monetary incentives are the most common incentive approach used by governments. Market actors, as beneficiaries, can get financial gains from these direct financial incentives.

Shazmin et al. (2016) summarised three types of housing tax assessment incentive models provided by several countries in regards to green housing, namely: rebate incentives, exemption incentives and reduction incentives. As an example, in the United States, housing tax assessment incentives have been provided since 2009 to promote green housing development (Shrimali and Jenner, 2013). Clement et al. (2011) reveal that housing tax assessment is the most provided incentive approach for encouraging green housing development at local levels. Pablo et al. (2013) support that providing housing tax assessment incentives can be seen as an adequate approach, which involves a significant reduction on cost during green housing development.

Non-financial incentives generally include expedited permissions, floor-to-area density concessions (Shapiro, 2011; Aiello, 2010), technical assistance, and dedicated green management teams in design and construction departments and marketing assistance (Choi, 2009; Olubunmi et al., 2016). In terms of non-financial incentives, a government normally grants market actors rights (or additional rights) beyond normal rights if certain conditions can be fulfilled. As could be expected, governments mostly prefer providing non-financial incentives rather than financial incentives since no direct costs are involved (Choi, 2009).

More specifically, the Floor-to-Area density incentive allows housing developers to build more floor space than allowed by the usual density. For example, the Green Mark Gross Floor Area incentives scheme issued in Singapore provides developers with an additional floor area of up to 2% of the total project floor area if they achieve the highest Green Mark Platinum or Green Mark Gold Plus rating (Gou et al., 2013). In addition, this non-financial incentive also allows developers to recover some or all of their green housing development expenditure through increased rentable/saleable space resulting from Floor-to-Area bonuses (Choi, 2009). Therefore, developers can be indirectly financially rewarded through non-financial incentives.

In addition, other benefits of non-financial incentives, such as technical assistance or marketing assistance, could save developers' time by mitigating development risk and process issues (Choi, 2009). This is even more significant since time is crucial for developers in getting the project ready for marketing and selling and is another cost reduction for green housing development (Perkins and McDounagh, 2012).

These incentives provided by governments have been criticised, mainly in relation to the operation and administration of incentives. First, once these incentives are provided, there are lack of standard procedures to ensure that government requirements of green housing development are delivered by the developers as permitted (Olubunmi et al., 2016). Especially in case of default, there is a lack of enforceability mechanisms when offering green housing incentives (Webert, 2010). Shapiro (2011) also supports this argument and points out that if a housing project receives the incentives from government but fails to meet green housing requirements, there is lack of effective mechanisms for recovering the invested resources and the resources (either financial or non-financial support) invested by

the government 'amount to waste' (Olubunmi et al., 2016, p.1617). The lack of enforcement has negative effects on the fiscal reputation of governments (Rainwater and Martin, 2008). This is especially serious in developing countries since their green housing market is largely undeveloped and financial incentives to green housing development are considered as a high cost contribution by governments (Ghodrati et al., 2012).

Secondly, the issue of lack of enforceability is associated with the optimal level of green housing incentive required (Fletcher, 2009). If the incentive level is too low, it cannot achieve the desired outcomes. In contrast, if the level is too high, it will cause resources wastes and as a result, become an unnecessary drain on government finances (Retzlaff, 2009). As a result, mismatches between incentives and perceived costs hinders the effectiveness of some green housing incentive instruments and limits the numbers of green housing projects that could be developed (Dator, 2010). Therefore, for policymakers, matching the perceived value of incentives to perceived cost increases associated with green housing remains a challenge (Fletcher, 2009).

3.3.2 Green housing standards and rating systems

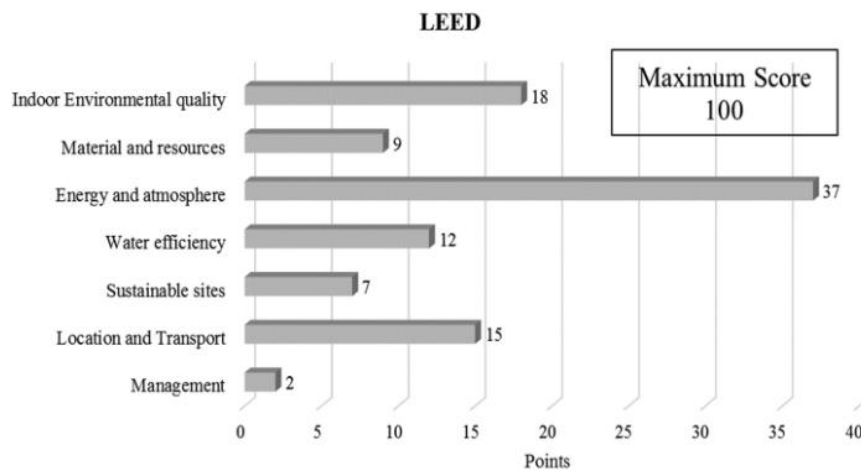
According to Adler et al. (2006), green housing is often developed under rating system guidelines, which provide principles and codes for the evaluation of green housing development and can supply recognition and validation of achievement of green goals. Generally, a rating system for green housing is a comprehensive framework developed by government departments, international organisations, or third-party organisations with the intention of verifying and assessing the greenness and efficiencies of housing (Lee et al., 2013; Nguyen et al., 2015). It normally contains a range of well-defined performance thresholds that housing must meet to get the green housing certificates, as well as development guidelines that help developers to meet or exceed those performance thresholds (Wu et al., 2017; Mattoni et al., 2018).

Rating systems have become increasingly essential for governments promoting green housing development. For example, rating systems can: establish preliminary metrics to calibrate future performance to provide support on base-lining; establish the basis for selecting different solutions; provide a basis for comparison with competitors to do the

benchmark; and produce evidence of compliance with regulations (Park et al., 2017; Eisenstein et al., 2017).

Further evidence for the important role of a rating system in relation to building energy performance can be found from the International Energy Agency (Laustsen, 2008). The energy efficiency requirements in a rating system are the most important determinants of a building's energy efficiency. An analysis of the Fifth Assessment Report of the International Panel on Climate Change (IPCC) in terms of their implications for buildings found that well designed and implemented rating systems for green buildings were among the most effective emission reduction instruments in the building sector (Chalmers, 2014).

Globally, there are various types of certifications that provide different definitions and requirements for green housing, for example, the Leadership in Energy and Environmental Design (LEED) standard in the U.S., the Building Research Establishment Environmental Assessment Method (BREEAM) standard in the UK, the Comprehensive Assessment System for Built environment Efficiency (CASBEE) standard in Japan, and the Green Star in Australia (Figure 3.2). In the UK, this BREEAM rating system contains nine categories: energy and carbon dioxide emissions, water, materials, surface water run-off, waste, pollution, health and well-being, management and ecology (DCLG, 2010); In the US, LEED-home rating system contains eight categories: location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and regional priority.



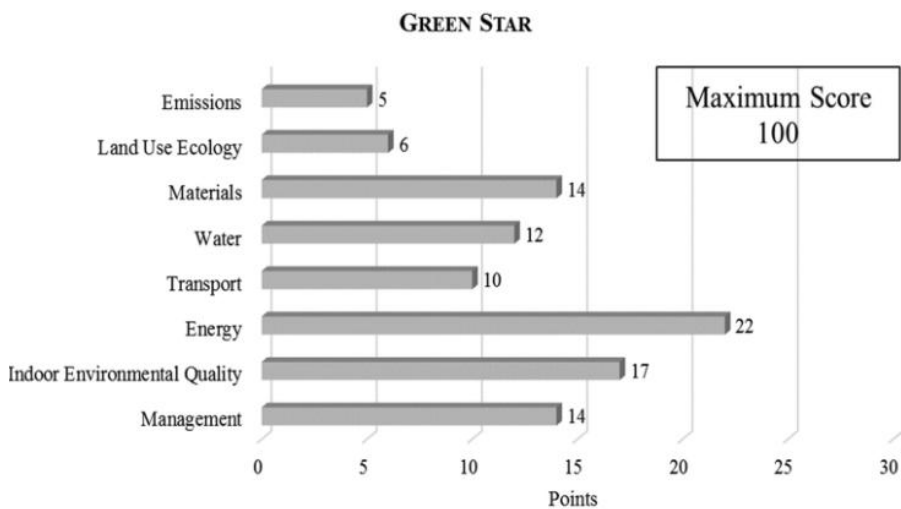
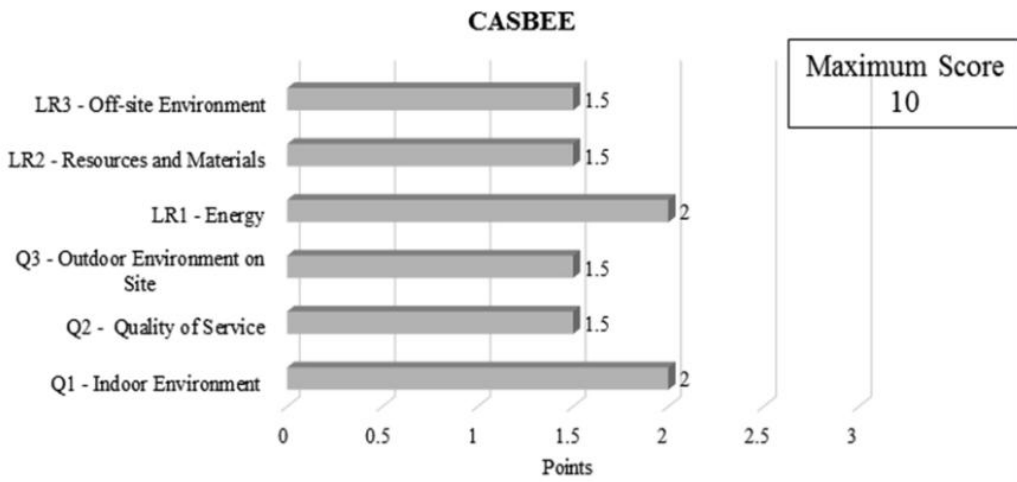
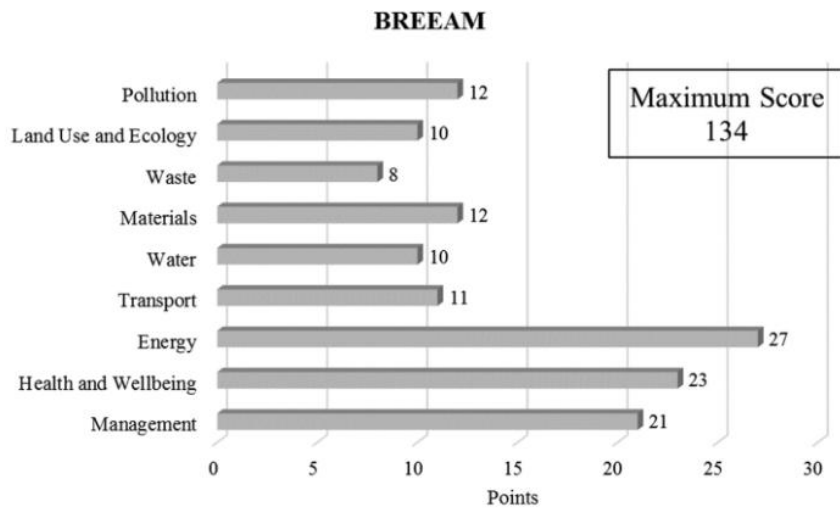


Figure 3.2 Green building rating systems comparison (Source from: Mattoni et al., 2018, p.956)

The rating systems of different countries have been systematically studied or compared (Doan et al., 2017; Ding et al., 2018). These studies showed that the categories in the rating systems are not simply the technical requirements for green housing, but also rely on interpretations of the concepts of green housing. For example, the 'energy' criterion mainly focuses on to what extent housing could reduce energy use. It includes a range of items such as energy-saving equipment and systems, energy monitoring and reporting, the use of renewable energy and energy efficient appliances (IBEC, 2014). The criterion of 'energy' has the highest consideration in most existing green building rating systems (Illankoon et al., 2017). A similar finding by Shan and Hwang (2018), who did a global review of current green building rating systems in 15 countries/regions, found that the average weighting of 'energy' in those 15 systems was much higher than the average weighting for all the other identified criteria such as site selection or indoor environment; and ten of the rating systems allocated the highest weighting to 'energy'. The results indicate that energy factors carry the most weight with policymakers when they evaluate green building projects.

However, there are also some criticisms related to green housing rating systems and standards. The key argument is that the costs of achieving green certificates within most of the rating systems are expensive, and such costs are not offset by the subsidies provided by governments (Shapiro, 2011). For example, in Australia, the costs of achieving Green 5 Star and 6 Star ratings awarded by the Green Building Council of Australia (GBCA) was found to significantly increase the cost of green building (Zuo and Zhao, 2014). Aliagha (2013) provides similar evidence for Malaysia and shows that the Green Building Index (GBI) contains additional incidental costs such as registration fees or consultancy fees. Such costs are not included as additional capital expenditure incurred in obtaining the certification, and are therefore not covered by government incentives. Overall, the extra high costs for getting green housing certificates nullify the incentives provided by governments (Qian et al., 2012).

Moreover, most green buildings obtain green certificates only for the design phase but not for operation (Kibert, 2016). For instance, the Department of Technology and Industrialisation of the Ministry of Housing and Urban-Rural development (2016) in China carried out analysis of green building labels. They found that the construction area of LEED O&M (Operation and Maintenance) occupies a mere 4.51% of the total area of LEED-

certified projects in the United States. Similarly, the construction area for the BREEAM In-Use only occupied 3.04% of the total area of BREEAM-certified projects in the United Kingdom. China has a similar result as the projects which got the green operation certifications merely accounts for 6.35% of total certified green buildings (ibid.).

Overall, many of scholars focus on exploring the best way for governments to motivate green housing transitions (Moore et al., 2014; Edmondson et al., 2018; Kesidou and Sorrell, 2018). Although approaches are developed in a western context, these policies can be appraised by the Chinese context and can throw light on policy-making in the Chinese green housing transition. In other words, reviewing western literature and research on green housing policy instruments can provide ‘inspiration’ (Warren, 2017) in the Chinese context. This may lead to policy transfer by the ‘copying of ideas from the implementation of policies in other countries/states in the past, or through observing the performances of policies that are currently active or currently being implemented in other countries/states (Warren, 2017 p.758). However, it is still important to note that different countries may introduce significant divergence in policy approaches when considering their own market situations, political environments and stages of economic development (Chan et al., 2009).

3.4 Policy review: green housing strategies, policies and regulations in China

The Chinese government has recognised the carbon challenge in the housing sector and as a result, since the 1990s China has adopted the concept of ‘green housing’. After providing a review of government authorities for green housing policy-making, the following sections review current green housing policies in China including national strategies, policies, regulations and evaluation standards.

3.4.1 Government authorities

Two major national level government authorities for building energy conservation are the National Development and Reform Commission (NDRC) and the Ministry of Housing and Urban-Rural Development (MOHURD). Other relevant government authorities include the Ministry of Industry and Information Technology (MIIT), the National Energy Conservation Centre (NECC) and the Ministry of Finance (MOF). These government departments are

responsible for making policies, and supervising and managing different aspects of green housing development activities in accordance with their respective responsibilities given by the State Council.

More specifically, the NDRC is a macro-control department that formulates comprehensive economic and social development policies, and guides development at the national level. The NDRC covers a wide range of responsibilities, one of which is to organise and draft plans and policy instruments for the comprehensive utilisation of energy resources and reduction of carbon emissions in order to coordinate China's energy conservation and emission reduction work (SCNPC, 2014). The MOHURD is directly responsible for promoting green building development and urban emission reduction. Its main activities include formulating green building policies and development plans and supervising the implementation of such documents, organising and implementing major green building projects, guiding construction materials reform, and strengthening urban and rural planning (SCNPC, 2008).

3.4.2 Key national strategies

China published China's Agenda 21 in 1994 (State Council, 1994). This policy document indicated requirements and measurements to improve living standards. From 1986 to 1995, the Chinese government published and implemented a variety of regulations, standards and policies for green housing, for example, Housing Design Guidelines, Housing Energy-saving Design Standards (Li and Shui, 2015). From 2001, the Housing Promotion Centre in the Ministry of Construction published Technical Guidelines for Green Eco-communities, and Evaluation Methods and Index System for Commercial Housing Performance (Cao, 2015). The concept of green housing in China was developed from 'Energy-Saving and Land-Saving Residential Building' requirements issued by the central government in 2004 (ibid.). In 2006, the Evaluation Standard for Green Building produced by MOHURD provides the official definition of 'green housing'.

China's 12th FYP (2011-2015) has been a remarkable strategy since the document is 'not only the first Five-Year Plan that mentions climate change, but it is mentioned at the top of the environmental section' (Bapna and Talberth, 2011, p.3). During the 12th FYP period, the

'Green Building Action Plan' reached 20% of newly-built urban buildings to meet the requirements of the green building standard by the end of 2015 (MOHURD, 2013)

Currently, the 13th FYP (2016-2020) (NPC, 2016) continues to promote green building development by clearly requiring the promotion of building energy efficiency and develop the entire industrial chain of green buildings. The requirements include:

- a. Implementing the assessment and management of green building promotion targets, establishing a regular report and assessment system for the progress of green buildings;
- b. Strengthening the compulsory promotion of green building standards;
- c. Strengthening the quality management of green buildings; encouraging localities to adopt green building standards; carrying out reviews and approvals of construction plans; and gradually incorporating green building standards into project management procedures;
- d. Improving the green building evaluation system and strengthening the guidance contained in green building operation certificates;
- e. Promoting the construction of green ecological urban areas and concentrated demonstration areas in green buildings;
- f. Promoting the development of the entire industrial chain of green buildings, and using green building design standards as the starting point for promoting the application of new technologies and products for green buildings;
- g. In the construction sector, increasing the use of green construction technology and the promotion and application of green building materials and promoting the green operation mode.

The latest goal for urban new buildings in 13th FYP period requires 50% of urban construction to be green buildings by 2020. The plan provides a green building development strategy at the national level and aims to comprehensively promote the development of green buildings in China. To achieve the targets, the MOHURD (2017) subsequently issued 13th FYP for Building Energy Efficiency and Green Building Development which proposed a mitigation action plan of improving 20% of China's urban housing energy performance by 2020 based on the level of 2005 (Huo et al., 2018b). In addition, the Chinese government has recognised the critical role of green housing development in China's future urbanisation processes. China's New-style Urbanisation Plan (2014-2020) also strengthens green housing

development and aims to ‘incorporate the concept of ecological civilisation into the construction of cities to conserve land, water and energy, and promote green buildings’ (NDRC, 2014, section 18.1).

More details of national strategies over the past 10 years are outlined in the following Table 3.1. The table shows how green housing policy has become more stringent over the past 10 years and presents Chinese housing developers with a significant policy switch to respond to. For example, in 2013, the Green Building Action Plan stipulates that by the end of 2015, 20% of the new construction needs to meet green building requirements. This target has since been increased to 50% by 2020, as required in the 13th Five-Year Plan for Building Energy Conservation and Green Building Development in 2017.

Year	Strategies/Policies	Key points
2008	Regulation of Energy Conservation in Civil Buildings (State Council, [2008] No.530)	This marks the beginning of legalisation of building energy conservation. It imposes mandatory requirements on energy conservation in new buildings, energy-saving renovation of buildings, and energy-saving operation of building energy systems. It encourages and supports new and existing buildings to use renewable energy sources such as solar and geothermal energy.
2012	Implementation Opinions on Accelerating the Development of Green Building in China (MOF and MOHURD [2012]No. 167)	The first national level policy document to propose incentive policies for promoting green building development and eco-city development. It supports the scale development of green buildings and sets the subsidy standard at the 2012 level of 45 Yuan/m ² for two-star green buildings and 80 Yuan/m ² for three-star green buildings.
2013	Green Building Action Plan (NDRC [2013]No.1)	This guides China's future green building policies, goals and development principles. It stipulates that by the end of 2015, 20% of the new construction needs to meet green building requirements. It requires local level governments to establish their green building development plans and systems based on the local conditions; regulates market actors' behaviours by using policies, planning regulations and building standards. It uses comprehensive financial instruments to create market conditions for green building development.
2014	National Plan on New Urbanisation (2014-2020) (State Council [2014]No. 4)	This Plan integrates the concept of ecological civilisation into the urbanisation process, focusing on promoting green development, and promotes the formation of a green and low-carbon production lifestyle, urban construction and operation model. Green building is one of the key tasks of new urbanisation, and the Plan requires implementing a green building action plan, improving green building standards and certification systems, accelerating energy-saving renovation of existing buildings, vigorously developing green building materials, and promoting industrialisation of buildings.

2017	13th Five-Year Plan for Building Energy Conservation and Green Building Development (MOHURD [2017]No.53)	This document aims to develop an energy-saving, low carbon, intensive and efficient building energy system during the 13 th FYP period, and promotes a supply-side structural reform in the construction sector. It promotes the implementation of green building standards in key areas, key cities and key building types, and actively guides the improvement of green building evaluation standards. By 2020, urban green buildings will account for more than 50% of new buildings nationally, and the newly-added green building area will be more than 2 billion square meters.
2017	Outline of the 13th Five-Year Plan (2016-2020) for Housing and Urban-Rural Construction (State Council [2017]No.19)	The Plan states that by 2020, energy efficiency requirements for new building implementation standards will be 20% higher than at the end of the '12 th Five-Year Plan' period. It promotes the development of new technology research and development and demonstration applications, establishes an industry, science and technology innovation platform; implementation of assessment mechanisms for green building targets; It establishes a regular reporting and assessment system for green building progress and increases the mandatory promotion of green buildings.

Table 3.1 Key national level policies and regulations of green housing development in China (summarised by the author)

3.4.3 Local level policies

Like climate governance in China (see section 2.3.2), green housing monitoring also displays a degree of flexibility at the local level. Every province has their MOHURD provincial and municipal branches, also known as the Construction Management Departments of provincial and municipal governments. They are charged with assisting in the implementation of national green housing policies at local levels. Under delegation from the central government, they are also responsible, for developing their own green housing policies in accordance with local conditions, and supervising and managing green housing projects within their administrative regions (Li and Shui, 2015).

At the local level, the survey by Zhang et al. (2018a) found a total of 102 provincial green building policies and regulations in China. Amongst these, many of the green housing policies and regulations target market actors, encouraging them to adopt green housing development. Such 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., 2018a).

- a. 'Land supply' indicates that the government stipulates the proportion of green buildings in the sale phase of land-use rights sale, or provides additional points in the evaluation of proposals by developers who promise to develop green buildings;
- b. 'Additional floor area' indicates additional increases in the permitted floor area for green building projects, usually between 0.5%-3%;
- c. 'Monetary subsidy' indicates subsidies for developers who promise to develop green buildings based on how big the green buildings are;
- d. 'Urban infrastructure facility fee reduction' indicates reduction of fees which developers should pay towards the provision of urban infrastructure, usually between 20%-100%;
- e. 'Preferential loan policy' indicates lower interest rates or higher loan amounts charged by banks on loans to developers of green buildings;
- f. 'Tax reduction' indicates tax rebates for developers of green buildings;
- g. 'Expedited approval process' indicates quick processes to approve green buildings in construction and pre-sale phases;
- h. 'Priority in building awards' indicates priority for green buildings in applying for building quality awards;
- i. 'Priority in enterprise qualification inspection and upgrade' indicates that green building developers can be exempted from or receive additional points in inspection and enterprise qualification upgrades (Zhang et al., 2018a).

Table 3.5 shows the supply-side policies for promoting green building in 31 provinces. (●) means that the provinces have issued clear implementation rules for the supply-side green building policy, while (○) means there are no clear policy implementation rules. No circle means the policy has not been adopted by the local authorities. In contrast, demand-side policies, such as incentives to increase consumers' demands of green housings, are relatively limited. Some demand-side approach has been outlined such as provide direct or indirect subsidies for consumers, including lower interest rates, higher loan amounts, and directly monetary subsidy (Shi et al., 2014).

Provinces	Supply-side policies						Preferential policies for projects				Preferential policies for enterprises				
	Land-related policies			Direct or indirect subsidies			Expedited approval process	Priority in building awards	Priority in enterprise qualification inspection and upgrade	Tax reduction	Preferential loan policy	Urban infrastructure facility fee reduction	Monetary subsidy	Additional floor area	Land supply
	Land supply	Additional floor area	Monetary subsidy	Urban infrastructure facility fee reduction	Preferential loan policy	Tax reduction									
Beijing	<input type="radio"/>		<input checked="" type="radio"/>						<input type="radio"/>						
Tianjin			<input checked="" type="radio"/>						<input type="radio"/>						
Hebei			<input type="radio"/>						<input type="radio"/>						
Shanxi	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input checked="" type="radio"/>			<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inner Mongolia			<input type="radio"/>						<input type="radio"/>						
Laoning			<input type="radio"/>						<input type="radio"/>						
Jilin	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>						
Heilongjiang	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>						
Shanghai	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>						<input type="radio"/>						
Jiangsu	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Zhejiang	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Anhui	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Fujian		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Jiangxi		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Shandong		<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Henan	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Hubei		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Hunan		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Guangdong	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Guangxi	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Hainan		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
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Sichuan	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Guzhou	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Yunnan	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Tibet			<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Shaanxi	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Gansu			<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Qinghai	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Ningxia		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						
Xinjiang	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>					<input type="radio"/>						

Table 3.5 Provincial supply-side policies for promoting green building in China (Source from: Zhang et al., 2018a)

3.4.4 Evaluation standards for Green Building (ESGB) and supplementary guidance

Evaluation Standards for Green Building (ESGB) is one of main technical bases for evaluating and guiding green building activities in China and the majority of green housing practices are driven by this evaluation standard (Ye et al., 2013). The Chinese national standard was started from scratch, and developed western standards such as BREEAM in UK and LEED in US (Zhang et al., 2017). In 2006, the MOHURD issued ESGB as a voluntary environmental assessment scheme for building, and revised it in 2014 (abbreviated as ESGB 2014) with the purpose of addressing seven indicators (see Table 3.2). In addition, the evaluation system also includes an extra indicator called ‘Innovation’ in order to encourage technology innovation of the green housing. The indicators cover a scale of 0 to 100 points and each indicator contains control items and score items. In order to be certified, it is compulsory for projects to meet all the control items. The green building label has three levels (one-star, two-star and three-star level) based on their performance against seven indicators. The level of green housing label is defined by the total points (50, 60 and 80 points) which are the sum of weighted scores (MOHURD, 2006). Developers are also encouraged to meet the requirements of score items and innovation indicators if they want to get higher level labels.

	Land saving and outdoor environment	Energy saving and energy utilisation	Water saving and water resource utilisation	Material saving and material resource utilisation	Indoor environment quality	Construction management	Operation management
Design stage	0.21	0.24	0.20	0.17	0.18	–	–
Operation stage	0.17	0.19	0.16	0.14	0.14	0.10	0.10

Table 3.2 Weightings for green housing evaluation in ESGB 2014 (Source from: MOHURD, 2014).

Much literature focuses on discussing the differences between ESGB 2006 and ESGB 2014 (Ding et al., 2018; Ma et al., 2016): Table 3.3 shows the major differences. The 2014 version is more than just a continuation of the 2006 version because it adds two new indicators – Construction Management and Operation Management to cover the life cycle of a building project. The indicator of Energy Saving and Energy Utilisation in 2014 still contains the highest weight (0.19), which indicates that with the global carbon issues, China has paid additional attention to energy saving and emissions reduction (Ding et al., 2018). Moreover, it is worth noting that the green building labels are divided into two categories in ESGB 2014 (Figure 3.3): 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 operation of the building (MOHURD, 2014).



Figure 3.3 Green building design label and green building label (Source from: MOHURD, 2014)

	ESGB 2006	ESGB 2014
Evaluation phase	Design phase	Design phase Operation phase
Evaluation objects	Residential buildings and public buildings (office, shopping mall, hotel)	Residential buildings and public buildings (unlimited)
Index categories	1. Energy, resources and environment load and indoor environment quality 2. Operation management	1. Energy, resources and environment load and indoor environment quality 2. Operation management 3. Construction management
Structural system	Control items general and preferences items	Control and score items
Evaluation methods	Counting the number of provisions	Total score rate
Additional items	No additional items	Set additional items 'Improvement and innovation': 'improvement' provisions have specific indicator requirements, focussing on the improvement of technical performance such as energy saving and environmental protection. 'Innovation' does not require specific indicators, but focuses on encouraging the adoption of innovative technologies or management methods.

Table 3.3 Differences between ESGB 2006 and ESGB 2014 (Source from: Zhang et al., 2017)

Figure 3.4 shows the procedures for green building evaluation of design phase in China which are: application submission, formal examination, expert committee evaluation, public scrutiny and public notification. Application documents and proofing materials are prepared by developers and are submitted to an evaluation agency for formal examination, followed by expert committee evaluation. After an application passes the formal examination and expert committee evaluation, the MOHURD takes over public scrutiny of 30 days, and finally, public notification. A project may fail during the evaluation procedures. However, re-

examination and re-evaluation is applicable after applicants improve the documents or provide missing materials. A project can also be objected by the public during a public scrutiny period. Before public notification, the MOHURD takes these objections into consideration, and make a judgment. After a public notification, a green building label certificate is issued for the project (Ye et al., 2013).

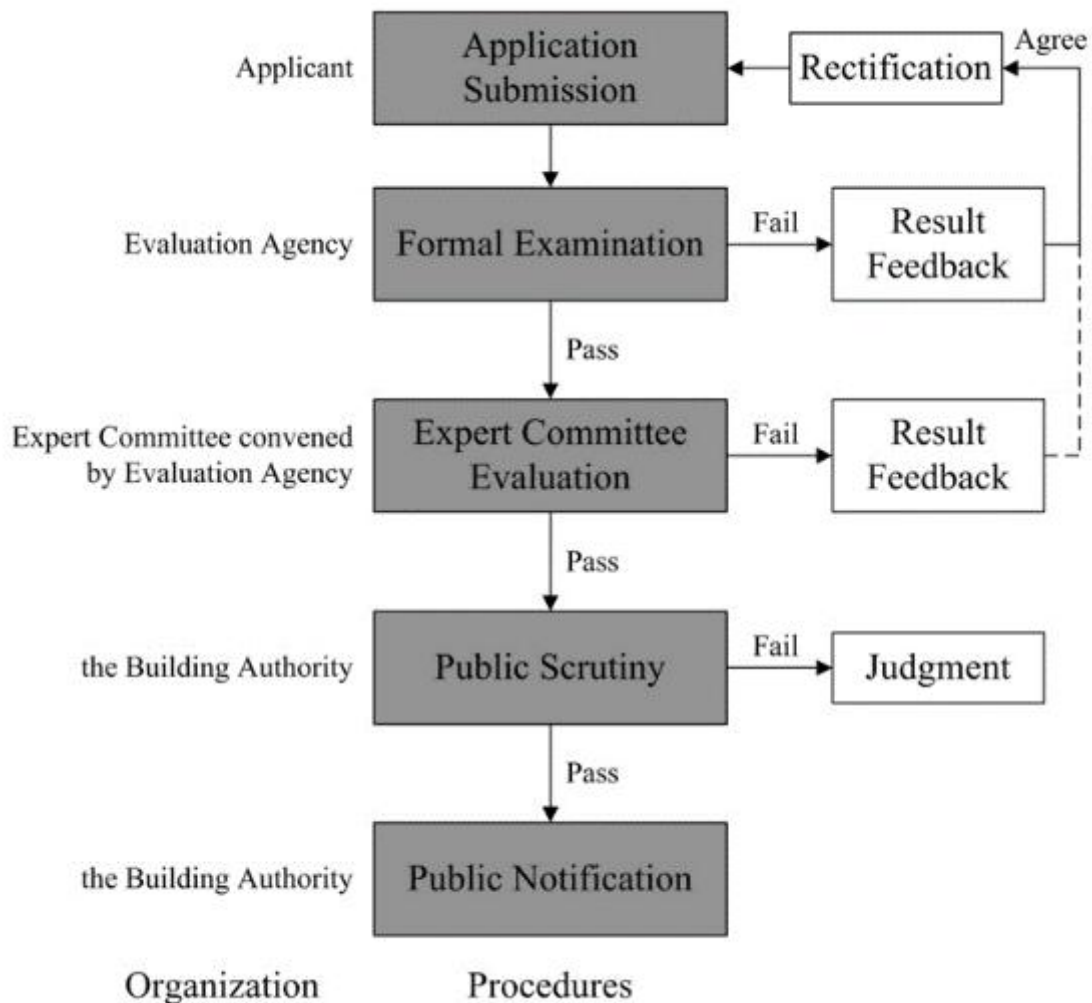


Figure 3.4 Procedures for green building evaluation of design phase in China (Source from: Ye et al., 2013, p.221)

In addition, in order to help market actors to better understand how to meet the requirements of ESGB, a series of supplementary guidance and codes (Table 3.4) has been introduced. These documents address efficient energy management and carbon reduction through the housing lifecycle (Brøgger and Wittchen, 2018).

Year	Guidance	Key points
2011	Code for Green Design of Civil Buildings (JGJ/T229-2010)	This document guides green design requirements for civil buildings; defines the whole life cycle of buildings and passive measures; proposes that green design should consider the technical and economic characteristics of the whole life cycle of the buildings; and specifies that planning, construction, engineering, indoor departments should cooperative with each other in the design process.
2011	Code for Design of Sound Insulation in Civil Buildings (GB 50118-2010)	The code introduces the standard level of sound insulation and noise reduction design for civil buildings; it provides guidance for sound insulation and noise reduction design and noise measurement methods.
2013	Standards for Daylighting Design of Buildings (GB/50033-2013)	The document introduces the standard values for daylighting: daylighting quality, daylighting calculation and daylighting energy saving methods for civil and industrial buildings.
2014	Standards for Lighting Design of Buildings (GB 50034-2013)	Proposes green lighting applications. It introduces the quantity and quality of lighting, lighting standard values, lighting energy conservation, lighting distribution and control for civil and industrial buildings.
2014	Code for Green Building Construction (GB/T 50905-2014)	The code provides the definition of green construction and sets out requirements for green building, covering new construction, expansion, reconstruction and demolition. It covers the respective duties of the construction sector, design sector, supervision sector and engineering sector in green construction processes.
2015	Technical Guideline for Passive Ultra-Low Energy Consumption Green Buildings (Trial Implementation in Residential Buildings)	This guideline draws on the experience of international cases of passive housing and near-zero energy buildings, combined with China's conditions; defines passive ultra-low energy residential buildings; provides technical indicators of different climate zones and technical points for residential building design, construction, operation and evaluation.
2017	Technical Code for Operation and Maintenance of Green Buildings (JGJ/T 391-2016)	This is the technical guidance for the operational phase of green buildings, including comprehensive performance commissioning, delivery, operation and maintenance, and operation and maintenance management of green buildings.
2017	Thermal Design Code for Civil Buildings (GB/T 50176-2016)	The code introduces the basic parameters and methods of thermal calculation for civil buildings; the principles of thermal building design; the design of thermal insulation of enclosures; the moisture-proof design of enclosures; the design of natural ventilation; and the design of architectural shading.

Table 3.4 Key supplementary guidance and codes for green housing development (summarised by the author)

3.4.5 Evaluation of green housing policy in China

Government policies and regulations in China play a crucial role in improving low carbon perceptions in the housing market and the performance of developers (Zeng et al., 2011).

However, some scholars have argued that there is a 'lack of policy rationality' in green housing policies and carbon regulation in China (Li and Shui, 2015; Shen et al., 2017b) and the efficacy and validity of current Chinese carbon regulation and green housing policies have been questioned (e.g. Zhao et al., 2014; Li and Shui, 2015) for a variety of reasons. First of all, the legal framework is inappropriately applied at the operational level of green housing policies (Li, 2017). Although the Environmental Protection Law and the Energy Conservation Law have been implemented, green housing-related contents are still missing. In addition, requirements for carbon reduction in the housing sector are not included in the current Construction Law. Besides, although there are some legal provisions related to housing, the content is relatively out of date and no longer in line with China's current conditions (Li, 2017). Consequently, Li and Shui (2015) argue that carbon regulations are designed and implemented to meet targets in the relatively short-term (e.g. a FYP period), and that there is still a absence of a coherent carbon regulation framework in the national level which would integrate multiple objectives in green housing development in the long-term.

Secondly, Huang et al. (2015) show that there is a shortage of post-policy supervision and evaluation for green housing. More than 80% of building energy consumption occurs during the actual operational phase rather than in the construction phase (Liang et al., 2016), which indicates that the post-occupancy performance of green housing largely determines the overall housing energy consumption level. However, current green building labels can be obtained through information supplied in the pre-construction phase. This shortcoming can be attributed to the lack of a participatory assessment scheme to assess the whole-life-cycle energy consumption of green housing (Li et al., 2018a).

Thirdly, green housing policies in China are still designed and implemented in a 'command-and-control fashion' (Li and Shui, 2015, p.336). There is a lack of incentives to foster market-based mechanisms to develop green housing. Besides, as Huang et al. (2015) argue, the procedures set out in these subsidy policies involve long and complex application processes and it may take more than a year for the subsidy to be approved. As a result, private investment for green housing development in the Chinese housing market is sluggish, except for government-led exemplary pilot housing projects (Li and Shui, 2015).

Fourthly, housing energy codes are not regularly institutionally updated. For instance, the first housing energy code for heating zones in China was issued in 1986, and updated in 1995 and 2010. This example indicates that there are long intervals between revisions of green housing codes and regulations, which reflect that China has not institutionalised the development of green housing on a regular basis (Li and Shui, 2015). Similarly, a United Nations' survey in 2010 also supports this point as it showed that many of the industry standards in China were out of date (Luchsinger, 2010).

Overall, although green housing development has been included in the national development strategy of the government, compared with developed countries, green housing policies in China are still less strict which hinders China's development of China in a low carbon direction (Wang and Chang, 2014). Thus, due to these inefficiency issues, such policies lack market attractiveness and many developers choose to continue with the traditional development modes rather than green housing development (Zhao et al., 2014).

3.5 Understanding 'green housing transitions'

Green housing transitions require innovations across multiple perspectives and are expected to challenge the status quo, representing a paradigm shift from existing norms toward a greener approach in the housing sector (Anzagira et al., 2019). Green housing transitions are multi-factor tasks and need to be achieved through the interplay of markets, technology and institutional changes (Geels, 2018). Moreover, these changes happen at various levels; for example, actors' behavioural change at the micro-level, institutional structure and rule transform the meso-level, or wider societal and cultural changes at the macro-level (Jiang and Payne, 2019).

As the previous chapters have shown, the pathway towards green housing development is not straightforward: it not only requires technological innovation and improvement, but more importantly, it requires the transformation of key market actors' behaviours and attitudes in order to apply low carbon technologies in practice (Nykamp, 2017).

Recent research (Rosenbloom, 2017; Payne and Barker, 2018; Jiang and Payne, 2019) indicates that the implicit ideas that underpin conceptualisations of green housing

transitions are based on state-market interactions. These scholars maintain that both the state and the market play important roles in successful green housing transitions and argue that current research ‘...neglects the complex interactions of institutional norms and market behaviour that characterise responses to regulatory change’ (Payne and Barker, 2018, pg. 470).

The previous sections have reviewed state policy instruments for green housing development across the globe, and specifically in China, and show there are transitions underway in climate governance and housing policy areas. However, transitions in the housing industry toward green housing development are complex and cannot be driven by states alone (Payne and Barker, 2018). Whilst many technologies exist for improving housing energy performance (Dent et al., 2012), key challenges remain in persuading developers to try out such green technologies. Thus, the market response to carbon regulation and the willingness of developers to utilise green technology and green building practices to achieve policy ambitions are a necessary aspect of analysing green housing transitions.

Therefore, this research focuses on the interactions between the state and the market (Rosenbloom, 2017) in green housing transitions and considers them to be long-term and non-linear processes by which housing development is changed from traditional development approaches towards ‘greener’ ways. In this research, ‘state’ represents the carbon regulation policy agenda that develops incentives to activate housing market changes and entrepreneurship in a green direction. ‘Market’ represents reactions to such incentives in the housing market, which this research investigates through developers’ perspectives.

In addition, three points need to be highlighted at this stage. First, transitions toward green housing are far from straightforward. It is due to the fact that markets often form ‘deep structures’ and ‘lock-in’ the whole system (Lachman, 2013), which is why carbon regulation targets can be difficult to achieve. Interactions within complicated systems in both policy and market fields are unpredictable and unstable, and make transitions more complex.

Secondly, green housing transitions contain significant time and spatial lags (Costanza et al., 1993). Carbon regulations are viewed as goal-oriented and 'purposive' in order to address climate change issues. Therefore, low carbon transitions are different from other transitions which may be largely 'emergent' (Smith et al., 2005). Moreover, climate protection is a public good, therefore private actors such as developers have little incentive to address it. As a result, State policy plays a crucial role in supporting low carbon innovations and transitions, and changing the economic conditions that incentivise industries.

Thirdly, although transitions are goal-oriented towards a green housing system, there are debates over the pathway of green housing transitions, principally because the green housing concept is ambiguous and contested (O'Neill and Gibbs, 2014). Put those dynamic interaction analyses into green housing transitions, and disagreement and debate are inevitable, since green housing transitions are ambiguous and contested concepts about which different actors hold different views and ideas. There is no single 'green housing' innovation around which opinions coalesce. Therefore, green housing transitions should not be regarded simply as a challenge for technocrats, but rather as a prudent social learning process (Stirling, 2007). Stakeholders' participation in 'green housing' experimental projects could 'stretch existing routines and stimulate reflexivity' (Geels, 2010, p.500), which is important for transitions (Bos and Grin, 2008).

3.6 Summary

Green housing has been seen as an effective approach for applying carbon regulation in the housing sector. This chapter has focused on ideas of green housing and policy instruments for promoting green housing transitions. It has also reviewed green housing policies in China and identified a range of specific issues around green housing transitions in the Chinese context. Overall, it has explored how and to what extent ideas of green housing have been introduced into China's carbon regulation and climate governance.

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 the efficacy of green housing policy and the overall success of societal transitions toward a low carbon future.

Therefore, governments need to find new ways of steering consumption and behaviour patterns through a combination of encouragement and enforcement. This means that the societal preconditions required for effectively promoting green housing policies and for achieving ambitious carbon reduction targets are an important research topic. Therefore, more attention is required to explore to what extent different groups in society, especially those key market actors needing to respond to carbon regulation, are willing to reconsider their traditional ways of operating, and make efforts to transit in a low carbon direction.

The next chapter focuses on the challenges for developers posed by green housing development.

Chapter 4. Challenges faced by developers in green housing transitions

4.1 Introduction

A housing developer is an entrepreneur (either public or private) who uses land to build residential units. Developers are part of the nexus of users, investment and market development (Antwi and Henneberry, 1995) and are often defined as '... the key coordinator[s] and catalyst[s] for development' (Healey, 1991, p.224). Developers orchestrate the development process by coordinating capital, land, material and labour resources, to 'create the right product in the right place at the right time' (Adams et al., 2012, p.2582). Thus, developers are significant actors in the housing sector since they combine resources to identify and exploit opportunities for developing houses to meet the demands of households (Seeliger and Turok, 2015). As Goldberg (1974, p.85) says, although 'a description of the decision-making process in urban expansion could begin almost anywhere ... that starting place seems often to be the developer...'

This chapter develops a narrative that explores the challenges that green housing transitions may pose for developers. It addresses RQ2: What are the potential drivers of and challenges faced by developers to the implementation of carbon regulation and green housing policies in China? In order focus on this question, this chapter first provides a picture of how the Chinese housing market operates and considers the status of green housing development in China. Secondly, it reviews the special characteristics of Chinese developers; and thirdly, explores how Chinese developers operate. Finally, it reviews the potential drivers of green housing development and the challenges faced by Chinese developers.

4.2 The Chinese housing market

4.2.1 Key characteristics of the Chinese housing market

When considering how to complete its carbon reduction commitment in the housing market, China is facing its own challenges such as rapid urbanisation, large-scale new housing construction every year and the importance of income from the housing sector to the local governments (NBS, 2015). For example, during the past three decades, the number of

building-related companies has increased tenfold in China, while the output value of the construction industry has increased 136 times (NBS, 2012; Wang, 2014). Li and Shui (2015) predict that by 2025, China will develop 40 billion square meters of floor space, and the urban population in 2030 will be almost twice that of 2000 (Woetzel et al., 2009). However, building-related economic growth is achieved at the expense of excessive carbon emission, and the various carbon mitigation strategies have not yet achieved their stated goals (Wu et al., 2018).

China has become one of the fastest developing economies worldwide. GDP growth rates have stayed around 8% even during the global financial crisis in 2008 (NBS, 2010), and the Chinese housing market is seen as a significant industry for the entire Chinese economic system. Since the Chinese government phased out of the 'welfare housing system' in the 1990s, the market has experienced sharp growth over the past three decades, and the current rapid urbanisation has provided another favourable opportunity for the Chinese housing market. At the same time, benefiting from land policies, financial support and local planning and development policies, the high rates of return in the housing sector have attracted large amounts of investment, and the Chinese housing market looks as if it will continue to grow in the near future (Zhang, 2014). Since it is the case that this rapid rate of growth looks as if it will continue and the built environment and especially housing have long life spans, the housing sector is an important factor in managing carbon emissions in China in the coming decades.

However, there is still an imbalance between supply and demand. According to statistics from the NBS (2015), housing completions in 2014 increased by about three times compared to 2000, while housing floor space sold more sharply, from 165.7 million m² to 1.21 billion m² (more than seven times) in the same period. In addition, from 2000 to 2014, the floor space completed exceeded the volume sold, but, since 2005 the level of sales has been higher than the completion amount. It indicates that this persistent imbalance between supply and demand is one of the essential reasons for the increases in house prices in China.

In China, the process of housing development is different from Western countries. Like developing countries, China can be described as an economy 'with missing markets' (Laffont,

2005, p.245), since the Chinese housing market's performance and activities are mainly affected by policy factors rather than by market factors (Wu et al., 2015). This indicates that nature of Chinese housing sector is not fully market-oriented (Zhang, 2014) since it has been transformed from a planned system in a short time. Chinese housing reform has been a complicated process, including many changes in policy area, such as housing policies, land policies, and monetary policies (ibid.). The housing reform is also a significant social change in China, which in turn affects policymaking.

Housing development in China does not involve the transfer of land ownership, which belongs to local governments. It only transfers the right to use for up to 70 years. In order to maximise revenues, local governments tend to charge developers high land leasing fees. In addition to selling land leases, local governments impose more than 30 types of taxes and fees relating to housing development and sales through development approval to final inspection and acceptance (Wei and Wang, 2007). All of these charges and costs account for 10% -20% of housing sale prices and can amount to over half the revenue from housing development (ibid). As Wang et al. (2012) point out, local governments are more interested in promoting the development of commercial housing, rather than providing social housing because developers need to pay much more to the local governments for land use and other fees when developing commercial housing.

However, after 40 years of reform, the Chinese housing system has gradually moved from a planned economy to a market economy (Zhang, 2014). Under the current housing system, market forces are creating a private housing sector (Lichtenberg and Ding, 2009) and a dual system of land allocation (Zhang, 2014); in other words, land use rights are allocated both through market mechanisms or non-market methods. This dual system of land allocation makes possible the long-term lease mechanism for land-use rights in the housing market.

4.2.2 The status of green housing development in the Chinese housing market

In the current political context of carbon regulation, much evidence reveals that green housing is becoming a dominant trend in the future Chinese housing market (Wu et al., 2018; 2015; Tan et al., 2018; Jiang, 2016). In a survey on housing carbon emissions in China during 1996-2012, Jiang (2016) found that the total housing carbon emissions increased at an

average annual growth rate of 6.9%, but the proportion of direct CO² emissions significantly reduced from 55.5% to 39%.

Based on information released by MOHURD, Table 4.1 represents the number of buildings receiving green building labels between 2008 and September 2016. The data reveals that the growth rate of green buildings has accelerated significantly in recent years. Nevertheless, the 1,092 green buildings only accounted for 12% of the building starts in 2015 (MOHURD, 2015; NBSC, 2015) which indicates that the market penetration of green building development is still low. The 13th FYP (2016) has set a green building target of 50% of new buildings by 2020. However, the current green building development level is still well below this target level. Additionally, according to Zhang et al. (2018a), promoting green development in the housing sector faces greater challenges than in the commercial sector. Among the housing projects successfully achieving green building labels, the proportion of 3-star projects was only 14.9% in 2015. The number was even smaller – 4.5% - for the projects with green building operation labels in the same year. These numbers were much lower than the proportions in the commercial sector.

	2008	2009	2010	2011	2012	2013	2014	2015	2016 (Sept)	Total
Total	10	20	82	241	389	704	1092	1533	444	4515

Table 4.1 Numbers of green building in China (2008 - September 2016) (Source from: MOHURD <http://www.cngb.org.cn>)

Usage (Sept 2016)	Occupation	No.
Commercial	53%	2380
Residential	47%	2134
Rating level		
One-star	41%	1865
Two-star	40%	1803
Three-star	19%	847
Rating stage		

Design stage	94%	4246
Operation stage	6%	269

Table 4.2 Usage, rating levels and rating stages of green buildings in China by September 2016 (Source from: MOHURD, 2017 <http://www.cngb.org.cn>)

Moreover, some scholars did surveys on the incremental cost per unit area of green housing development in China (Li and Cheng, 2008; Xu et al., 2017a). Generally, the incremental cost per unit area is respectively calculated based on different levels (One Star; Two Star and Three Star level) of green buildings. For example, Li and Cheng (2008) observed 20 green building projects in China and found that the incremental cost for these three star levels' building accounts for 3.05%, 7.93%, and 10.84% respectively of the overall cost. However, this result represents the incremental cost from green developments which contain both commercial buildings and housing. The latest evidence from a survey on green housing development in Hunan province in China (Xu et al., 2017a) revealed that the average incremental costs of Three Star schemes were 8.47 Yuan/m², 39.58 Yuan/m² and 201.3 Yuan/m², respectively. The incremental cost of One Star projects only accounted for 0.57% of construction cost, that is, nearly no difference from traditional construction, while the incremental cost of Three Star projects accounted for more than 10% of construction cost. These extra costs cannot be ignored by the developers.

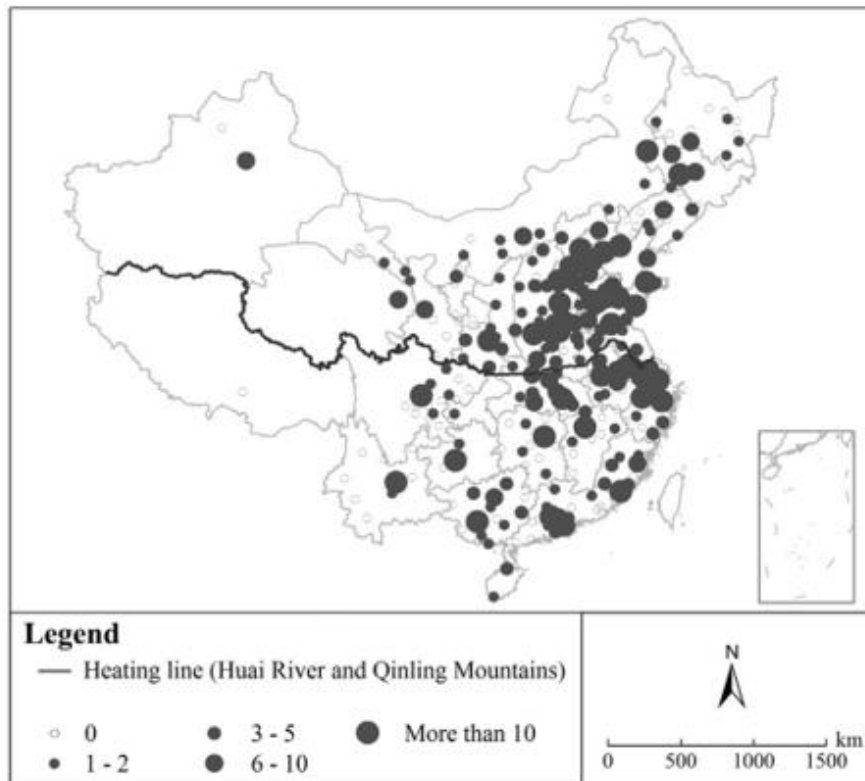


Figure 4.1 Numbers of green housing distributed in China (Source from: Zhang et al., 2018a)

Figure 4.1 shows the results of an analysis of green housing projects by cities (Zhang et al., 2018a) with the geographic distribution of green housing. 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 policies, including mandatory 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. (2018a) also reveal that, as of 2015, 80% of green housing projects were developed in 20% of cities, 70% of the green housing projects were occupied by 70% of the population in China.

Overall, the low penetration rate, high incremental costs and regional imbalances of green housing demonstrate the importance of investigating further what constraints hinder the development of green housing.

4.3 Chinese developers

4.3.1 The numbers of Chinese developers' and the scale of operations

In China, defining company size is complex, depending on the industry category and the numbers of employees, annual revenue and total assets. The latest official standard is the Standard Regulation of Small and Medium-sized Enterprises published in 2011 (NBS, 2011). The standards for the housing development sector are shown in Table 4.3 which outlines how the companies need to meet both annual revenue and total assets targets to stay in a particular size category.

		Large	Medium	Small
Housing development and management	Annual revenue (Y) (Million Yuan)	$Y \geq 200000$	$1000 \leq Y < 200000$	$Y < 1000$
	Total assets (Z) (Million Yuan)	$Z \geq 10000$	$5000 \leq Z < 10000$	$Z < 5000$

Table 4.3 Three sizes of housing development and management companies in China (Source from: NBS, 2011)

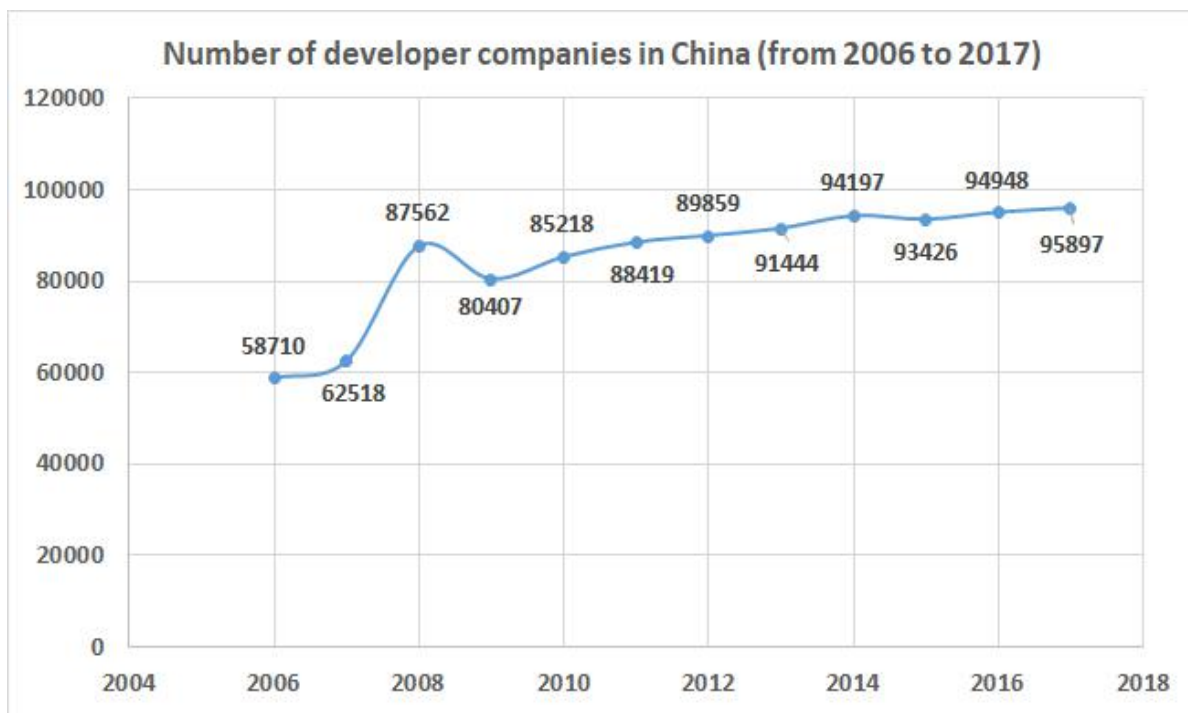


Figure 4.2 Number of developer companies in China from 2006-2017 (Source from: NBS, 2017)

As can be seen from Figure 4.2, there were a total 95,897 developer companies in China in 2017 (NBS, 2017). However, there are about 20,000 developer companies that currently develop or market real estate projects in China (CIHAF, 2017). Although the number of developers in China is relatively large compared with other housing markets, the Chinese housing market is highly monopolised (CREA, 2018). The sales volume of the top four developer companies increased from 6.61% of whole market volume in 2012 to 14.56% in 2017 (CREA, 2018). The market share of the top 10, top 20, top 50 and top 100 developers

calculated by sales volume was 24.05%, 32.21%, 45.29% and 55.24%, respectively, which increased by 5.34%, 7.38%, 12.20% and 15.49% respectively over the previous year (ibid.). The market share of the top 500 developers was 37.56% and 63.24% by area and volume respectively, increased by 4.51 and 9.89 percentage points compared with the previous year (ibid.). The market share of the larger companies has increased and the concentration of the share of housing development by large companies is accelerating: that is, the market is becoming dominated by large monopolies.

4.3.2 How Chinese developers operate

Generally speaking, the housing development process in China can be understood as ‘a linear process with sequential work routines and an isolated working pattern with different disciplines’ (Xie, 2015, p.50) which means that the different professions and trades involved do not communicate and are not integrated. Figure 4.3 shows the four stages of housing development in China. Li (2006) outlines how Chinese developers operate during these four stages which are shown below:

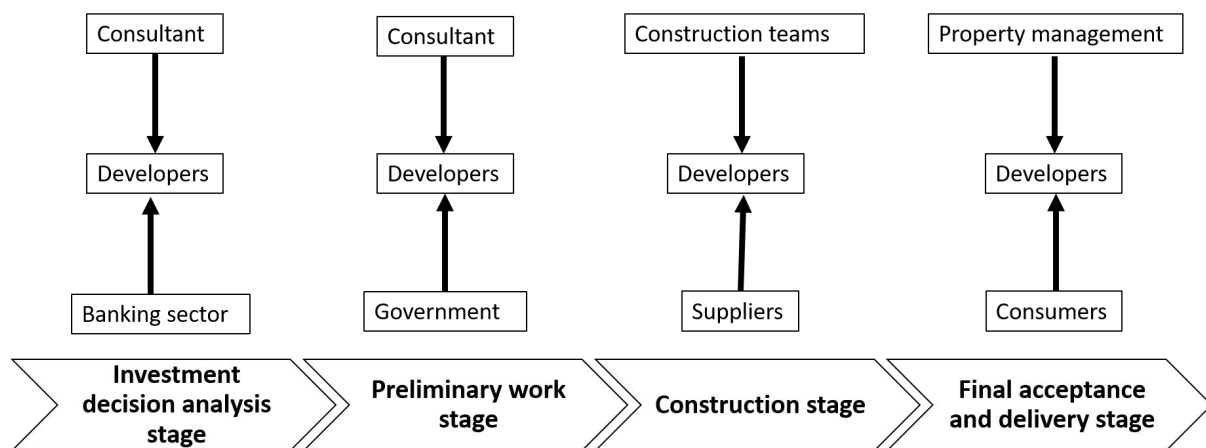


Figure 4.3 Four stages of housing development process in China (illustrated by the author based on Li, 2006)

a. Investment decision and analysis stage. The main content of this stage is selecting the project and completing project feasibility studies. Investment decision analysis throughout the development process is the most basic and most critical job in order to select the best, viable project development plan through a series of research and analysis;

b. Preliminary work stage. This stage includes: (a) obtaining land use rights; (b) the implementation of the financing plan (c) project design and planning; (d) obtaining planning

permission; (e) land acquisition, demolition, resettlement, compensation; (f) estimating development costs; and (g) negotiations with construction teams;

c. Construction stage. This stage includes: (a) implementation of contract; (b) organising the construction; (c) construction supervision; (d) public facilities;

d. Final acceptance and delivery stage. This stage includes: (a) housing pre-sale; (b) the completion and acceptance of housing; (c) housing sale; and (d) handover to property management companies.

Figure 4.3 also represents the relationships between Chinese developers and other stakeholders in the housing development process. The housing sector can be described as the dynamic relationship between three key participant stakeholders and the housing market itself: developers who build the house; consumers who use or consume the house; and government who regulate the building activities (Costello and Preller, 2010). In China the two key stakeholders with major influence on developers' building activities are the government and consumers.

In relation to government influence, Chinese developers have special conditions when they develop houses: first, there is a strong link between developers and local governments (Fu and Lin, 2013; Yang and Deng, 2013). Unlike Western countries, house sales in China do not involve the transfer of land ownership and the right of land use is only for 70 years (Yao et al., 2014), which means that local governments are not only policy makers but also market players. The main methods for the transfer of land use rights from local government to developers are tenders and auctions. More specifically, municipal government land administration departments issue a notice and invite specified legal persons or organisations to participate in state-owned land use rights bidding. Take land tender as an example: local governments are required to publish bid announcements 20 days before the tenders. The final decision on the bids is generally determined both by the evaluation criteria in the tender documents and the highest price offered (Yan et al., 2014).

In addition, China has a pre-sale system for its housing market (Deng and Liu, 2009) through which developers are normally able to benefit from the sale of housing before they

complete development. First, loans from the banking sector are transferred to developers in one up-front transaction. Secondly, consumers and developers can agree on the price at the sales day before housing is completed. Because housing can be sold before completion and occupation, the forward contract is generally referred to as a pre-sale or pre-construction transaction (Deng and Liu, 2009).

There are many differences in operations between state-owned developers and private developers in China. For example, Chinese state-owned developers' operation approach differs from private developers for at least two reasons: first because there are more development opportunities from the government, different types of resources, different business motivations, and lower efficiency (Monkkonen et al., 2019). Most Chinese state-owned developers have multiple goals, not only maximising their profits, but also social goals, including social stability, and in some cases, maintaining their commitment to providing inexpensive housing (Zhang and Rasiah, 2014; Xing and Chen, 2016). Li and Xia (2008) argue that state-owned developers are more likely to seek to expand market share in the long term, while private companies focus more on immediate capital returns.

The second difference between state-owned developers and private developers is that the former have a closer relationship with the government. For instance, there are greater political ties between state-owned developers and the government because of their natural political relevance (Yang and Deng, 2013). One manifestation of these closer relationships is access to loans. A survey by Zhang and Chen (2015) found that, between 2002 and 2012, state-owned developers were more likely than private developers to obtain long-term loans. Some scholars found that state-owned developers get lower bank loan rates and better tax rates because of the political association with governments (Yang and Hughes, 2017). These closer connections in the Chinese housing market may also lead to preferential regulatory treatment (Cai et al., 2017).

4.3.3 Chinese developers' green housing strategies

Developers' visions for green development are to reduce carbon emissions, promote energy efficiency, and educate the society on green practices (Gou et al., 2013) and green companies and institutions can be innovators to 'do the right thing' for the society and lead

the market (Mulligan et al., 2014). Much research confirms that ideas of carbon emission reduction and environmental protection are important in promoting green buildings. It has been shown that reducing carbon emission and thus, environmental impacts, provides an impetus for market actors to participate in green building development (Abidin and Powmya, 2014; Love et al., 2012). As Olubunmi et al. (2016, p.1616) argue: ‘...in [the] quest for balanced outcomes, stakeholders are incentivised by the responsibility to meet the need for environmental protection without neglecting social and economic aspects’ This indicates that social beliefs, especially in the context of environmental protection, are important internal incentive factors for green building development.

International literature on green housing development identifies strategic dilemmas for developers since they have to balance the risks and opportunities (Geels, 2010). In order to gain the first mover advantages, many developers, especially large ones, produce their own green business strategies. Thus, there is a growing focus on corporate social responsibility (CSR) within the building industry in many economies (Osmani and O'Reilly, 2009). Importing green strategies can lead to competitive advantages in Chinese housing development (Zhang et al., 2011b). Jiang and Wong (2016) carried out a survey to investigate the key factors or activity areas of CSR in the Chinese construction industry. They found that the idea of CSR in the Chinese construction industry is still vague and there is much still to be done by the developers (ibid.). However, they also found that the most significant factors were ‘environmental protection’, and ‘construction quality and safety’.

Since the China International Real Estate and Architectural Technology Fair (CIHAF) in 2011, CIHAF has conducted a series of follow-up studies on the green transformation of Chinese property development, and has released an Annual Report on Green Real Estate Development in China every year since then. CIHAF (2017) developed the PRIMB model (P: policy; R: responsibility; I: innovation; M: market; B: benefits) for evaluating the green development competitiveness of Chinese developers. In 2016, there were 23 developers with an annual output value of over 50 billion Yuan. From CIHAF calculations, the top 10 companies have an average green development competitiveness index of 0.9459, and 23 companies have an average of 0.5434. These two data far exceed those companies with

much lower output values of 15-50 billion Yuan (0.1729) and of 15 billion Yuan or less (0.1421).

In addition, existing studies (Chang et al., 2018; 2016; Enkrt and Morrison, 2017; Abidin, 2010) have suggested that green performance and green strategies may be associated with company size. Large companies may be more concerned with green innovations and relationships with other market stakeholders than smaller companies are (Chang et al., 2018). Small and medium-sized developers tend to have fewer technological options, lower turnover, fewer large investments, and fewer opportunities for obtaining benefits from implementing green strategies, and therefore, face greater capability barriers to adopting green transitions (Moore and Manring, 2009; Kostka et al., 2013; Torugsa et al., 2012).

However, Du et al. (2014) investigated the barriers to adopt energy-saving technologies in the Chinese housing industry, their research indicated that, surprisingly, large developers perceive greater challenges than smaller developers. This is due to large developers' businesses which lead them more likely to encounter operational barriers (ibid.). The 2017 CHIAF Report further indicates that although large developers have advantages of scale for obtaining maximum points in the PRIMB model, this does not mean that they are enthusiastic about developing green technologies and green innovations, nor do they have influence over the adoption by others. Instead, some medium-sized companies are active in promoting green technologies and green innovations and some have set up green technology companies and exported technology to some large developer companies (ibid.).

In addition, research conducted by CHIAF has shown that in 2011, fewer than 10 companies (in mainland China) had developed their own green development strategies. But by 2016, more than 40 developers had formulated green development strategies or emphasised their green competitiveness. More than a hundred companies mentioned 'green' and/or 'energy conservation' in literature about their developments. The 2017 CHIAF Report summarises four ways in which developers set their green development plans and goals:

- a. A green development strategy based on the national green building evaluation standard;

- b. A green development strategy based on national industrial policies, such as prefabricated buildings, passive house policies;
- c. Reduce operational energy consumption and indicate social responsibilities;
- d. Highlight technical and innovation systems.

However, although there are about 20,000 companies in China that are currently developing or selling green buildings (CIHAF, 2017), fewer than 80 companies are actually developing green projects; and fewer than 15 developers clearly formulate corporate green development strategic plans and publicise green development goals to society. This number of companies accounts for less than 0.1% of the building development sector. Therefore, the green strategic transformation of Chinese development companies is still in its infancy, and most enterprises are still in the 'wait-and-see stage' of China's green housing transition. It is also important to note that for all groups of developers, social and environmental factors are generally ranked lower than economic factors (Chang et al., 2018).

The effectiveness of government regulations can be assessed by the attitudes of developers towards regulation, such as their opinions of the impact and appropriateness of regulations on developers (Qi et al., 2010). Previous literature has reached similar conclusions about the relations between government environmental regulations and companies' environmental attitudes (Qi et al., 2010; Liu et al., 2012). As expected, government environmental regulations are positively correlated with companies' environmental attitudes. For instance, Fergusson and Langford (2006) found that government regulations were generally the main driving force for adopting green innovation strategies. Companies tend to show more respectful environmental attitudes because of the fines and penalties for non-compliance with environmental regulations (Fraj-Andres et al., 2009). Zhang and Zhou (2016) indicate that government carbon regulations have great impacts on changing actors' carbon reduction awareness, including the carbon reduction values and knowledge.

In contrast, the existing literature also reveals that although many companies are aware of green development and carbon reductions, implementation is another matter. Liu (2009) found that companies' behaviours towards the prevention of environmental damage and enthusiasm for greenness are less likely to be driven by government regulatory pressures. Liu and Ye (2012) also argue that financial subsidies provided by government are inefficient

instruments to improve companies' environmental behaviour. Moreover, government carbon regulations are found to have greater impacts on contractors' carbon reduction awareness rather than carbon reduction behaviours in the Chinese building industry (Zhang and Zhou, 2016). That is, government carbon regulations can lead to contractors' increasing their awareness of carbon reduction, but at the same time, the change in carbon reduction behaviour in housing projects is not obvious. It is a slow and expensive process to translate companies' carbon reduction awareness into actual practices (ibid.).

Developers are the major group of participants in mediating and responding to market transitions to green building, and in turn, their attitudes and behaviours in relation to construction have major influences on the extent to which the housing market could be changed. Developers' attitudes and behaviours in relation to green housing transitions may be 'cautious and conservative or enterprising and innovative' (Seeliger and Turok, 2015, p.322). In order to better influence developers' activities towards being enterprising and innovative in promoting green housing development, it is essential to explore and understand how developers make their decisions (the motivations, behaviours and modes of operation of developers). However, the role of developers has often been overlooked in popular accounts of persisting urban patterns of development (Dent et al., 2012).

4.4 Potential drivers of green housing development for Chinese developers

Over the past decade, more and more research has focused on examining the drivers of green building development (Darko et al., 2017). For example, a survey in Singapore and Hong Kong found that government intervention and economic factors were two strong forces for encouraging green practices (Chan et al., 2009); while Qi et al's (2010) survey of construction contractors identified managerial concern, government regulations and company scale as the most important drivers for green building development. This section reviews the drivers of green building development from financial, market, policy, technical perspectives. Examples and research from other economies may also become potential drivers of green housing development for Chinese developers too.

4.4.1 Financial factors

Whether in Western economies or in China, the major motivation of development companies is to seek profits (O'Neill and Gibbs, 2014; Qian et al., 2015; Zhang et al., 2018b). In other words, they seek to accumulate profits by designing and constructing buildings whose realised value is higher than the development costs. In order to exploit opportunities for gaining higher profits, developers often pay attention to market trends and consider their implications for profitability (Henneberry and Rowley, 2002). Thus, there are two crucial factors influencing developers'. The first is the broad market environment, for example, green development as a trend in the housing market. The second is the way that developers perceive and respond to the opportunities and challenges presented by the market environment. The link between these influences is the residual valuation, which is the valuation technique normally used by developers to formulate their expectations of development costs, values and financial viability (Guy and Henneberry, 2008).

In other words, if the economic returns are high enough to offset incremental cost, developers will be more likely to construct green building (Fuerst and McAllister, 2011). More specifically, economic returns depend mainly on the base economic returns of developing buildings and the green price premium (Juan et al., 2017). Fesselmeyer (2018) found that in Singapore, green labels increased the prices of building products by around 3%. Zhang et al. (2018b) identify four benefits of green buildings which could increase the green premiums: environmental consciousness (environmental benefits); improved comfort, health and productivity (consumers' benefits); cost savings through reduced energy and other resource consumption (financial benefits); enhanced corporate reputation (market benefits).

4.4.2 Market factors

The market prospects of green buildings are persuasive for developers focused on profit making (Nurul Diyana and Abidin, 2013). Green buildings potentially have greater market demand and willingness to pay (Gou et al., 2013). For example, McGraw-Hill Construction (2013) carried out a survey on world green building trends and revealed that market demand for green buildings has increased.

Moreover, building up a good reputation is another crucial reason for developers to change their building behaviours towards green development (Nurul Diyana and Abidin, 2013). How to establish a positive corporate image and reputation has become a necessary condition for enterprises to survive, and developer companies are not exceptions. Corporate image reflects the values of companies and defines their attractiveness and their products in the market (Andelin et al., 2015). Thus, the desire for positive corporate image and reputation influence developers' commitments to develop green housing. As the result, developers who wish to build good reputations and gain competitive advantages have begun to incorporate green strategies into their business (Zhang et al., 2011b).

More specifically, reputation-building through green housing development can be achieved in two ways: recognition through green building awards; and green certification through green building evaluation systems (Nurul Diyana and Abidin, 2013). To developers, on the one hand, awards can lead to a sense of gratification and their reputation can be increased (Nurul Diyana and Abidin, 2013). On the other hand, recognition through green building evaluation provides benefits for improving market competitiveness (Azis et al., 2013; Shi et al., 2016).

4.4.3 Policy factors

Government intervention has been considered as an influential factor in stimulating the adoption of green building development and supply (Qian and Chan, 2010; Murtagh et al., 2016; Wong and Abe, 2014). Government intervention can be either mandatory (e.g. legal sanctions) or voluntary (e.g. incentives or policy support). For example, Fuerst et al.'s (2014) research shows the positive effects of compulsory requirements for LEED certification in the US commercial building sector and Zou et al. (2017) found that fiscal subsidies could stimulate Chinese green building development. Research by Udawatta et al. (2015) and Windapo (2014) indicates that developers do not always consider green building development unless they are required to comply with green building evaluation systems. However, whatever form the intervention approach might be, it is considered as an independent force that supports and influences the developers' green building activities.

Once government mandatory or voluntary policies and standards are in place, developers are driven or constrained by the rules for the development of green buildings (Onuoha et al., 2018). Green building policies and standards are reflections of government interests and the seriousness of carbon issues (Nurul Diyana and Abidin, 2013). In other words, policies guide developers' motives, perceptions, and behaviours towards green housing development and their building activities are shaped by government policies and standards such as evaluation and certification systems and award programmes for green housing development. Government regulation can be considered not only as an external or top-down driver, but also as market-led or bottom-up drivers because developers may seek opportunities to mitigate market-side risks related to future policy changes (Darko et al., 2017).

4.4.4 Technological factors

The development of green building technologies is another important driver for developers to build green housing, because developers can reduce their extra costs when adopting green technologies, such as reducing purchase costs of green equipment or green materials or reducing the maintenance costs (Zhang et al., 2018b). From the perspective of cost-benefit analysis, the application of energy efficiency technology in green building in China can bring incremental economic benefits and environmental benefits (Liu et al., 2014). In addition, the more employees having green technology skills, the more likely the developers are to adopt green housing development: green building experts place much emphasis on motivation-driven capacity such as green skills (Gilley et al., 2010). This suggests that green housing development companies should have the proper design skills and capability to design, interpret, and construct green housing.

Overall, although many existing studies have focused on the sorts of drivers which could become the potential drivers of green housing development in China, several limitations exist in the research. First, only a few of the studies explored the drivers for green development in the housing sector, which may differ from those in the public building sector or commercial sector. Secondly, most of the studies focused on exploring the drivers of green practices in developed countries. However, the contexts of green housing development in China are different due to political and market differences (Zhou, 2015). This research gap needs further investigation.

4.5 Potential challenges of green housing development for Chinese developers

Although a variety of drivers towards green housing development have been generated and discussed in academic and political arenas such as greater return on capital (Fesselmeyer, 2018) or increased company reputation and competition ability (Zhang et al., 2011b), the effectiveness of these drivers are actually questionable due to many barriers and constraints. A better understanding of potential constraints is necessary for formulating proper pathways to overcome barriers (Chan et al., 2016). Therefore, it is vital to investigate what developers in other economies find challenging about building green housing and what the main constraints are on them in transforming their building behaviours.

Recently, many studies have focused on key barriers facing the developers of green housing development worldwide (Chan et al., 2018; Sharma, 2018; Hurlimann et al., 2018). Nguyen et al. (2017) argue that although there are differences in green building development contexts between developed and developing markets, the adoption of green building in the two situations generally faces similar problems. Therefore, this section provides a review of the existing research on the key barriers faced by developers from four perspectives: financial; market; policy and technology, which may also be potential challenges to Chinese developers.

4.5.1 Financial factors

Many studies argue that the economic dimension remains a major constraint on green building development. Higher costs, especially initial costs, associated with the high levels of uncertainty about return on capital for green housing development are often seen as major barriers to developers adopting green housing practices (Choi, 2009; Ying et al., 2012; Marker et al., 2014). In the building construction industry, it is widely believed that green building development is more expensive than traditional building development (Dwaikat and Ali, 2016; Rehm and Ade, 2013; Zhang et al., 2011a). 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 green materials or green equipment) (World Green Building Council, 2013). Moreover, the complexity of building design to meet

certification standards are also considered to be important factors affecting green housing project costs. For example, Zhang et al's (2018b) research on the incremental costs of green building based on industrial reports and academic studies, found that the range of incremental costs for buildings with green certifications was from 0.4% to 11%, depending on the certification system and the buildings' rating level.

Arguably, although green housing contains the benefits of cost reduction in its operation stage (Kesidou and Sorrell, 2018), the concept of whole-life-cycle costing is actually absent from the developers' point of view. In contrast, green building is usually considered to increase the cost of development due to the high upfront investment disregarding the whole-life-cycle (Mousa, 2015).

'Time cost' is another important factor in housing development crucial to developers (Ofori and Kien, 2004): delays caused by developing green projects have serious economic impact with increased costs (Lam et al., 2009) A number of factors can cause delays in green building projects, such as the length of waiting time for new green technologies (Hwang and Ng, 2013) or the long application processes to get green building subsidies (Huang et al., 2015).

In addition, developers' profit expectations are greatly influenced by current and past trends (Fuerst and Grandy, 2012). Due to the uncertainty of future trends in green housing development (e.g. government policies, consumer demand and emergence of green housing market), postponing investment in green practices may be a rational strategy by the developers (ibid.) Overall, these cost issues complicate the implementation of cost control in green housing projects, and therefore make it problematic for developers to keep within project budgets. As a result, the perception that green construction costs are too high has been widespread among developers and undermines interest in green development. Developers are stimulated to develop green buildings only when the capital returns, including both government subsidies and price premiums, exceed the incremental costs (Zhang et al., 2018b).

4.5.2 Market factors

Consumers' awareness of green housing products are crucial for the development of green housing (White and Gatersleben, 2011). For developers, sales to buyers are the major and sometimes the only chance for them to recoup capital returns from green housing investments (Zhang et al., 2018b). However, consumers' awareness can be difficult to change since 'society is often 'locked in' by ... unsustainable systems of consumption and production' (Lachman, 2013, p. 269). In addition, green housing, which provides a more comfortable built environment, is seen as a 'luxury good' that is more likely to be purchased by high-income groups (Hu et al., 2014). Environmental awareness is indicated by education level and the level of education is assumed to have positive effects on environmental concerns since people with higher education are more aware of the risks and long-term implications of climate change (De Silva and Pownall, 2014; Dippold et al., 2014). However, previous studies show that ordinary house-buyers do not have the specialised knowledge to assess the 'greenness' of buildings (Eves and Kippes, 2010).

Another explanation for why consumers do not choose green housing projects is because the economic viability of green housing is not as great as the energy savings (Zhang et al., 2018b). For instance, energy savings for LEED-certified buildings were about 34% on average, while energy cost savings were just about 8.5% (Sabapathy et al., 2010). This is because energy costs have a component of fixed demand charges, which do not only depend on energy consumption. In addition, the benefits of energy savings may not be passed to the consumers - the investor-user-dilemma or split incentive issue (Jakob, 2006; Kahn et al., 2014). However, some research argues that consumers' low awareness of housing energy efficiency may be because the energy costs are too low or lack of flexibility (Brounen et al., 2013).

Moreover, information asymmetry leads to a sense of uncertainty for consumers when purchasing green housing. For example, although green certifications have been shown to assist consumers to make better choices (Kahn and Kok, 2014), nevertheless, Davis and Metcalf's (2014) survey reveals that the information provided by green certifications is often too crude for consumers to make efficient decisions. This information asymmetry issue is more noticeable in China since the information transparency in the Chinese housing market is insufficient and consumers' incentives for purchasing green housing are limited (Li and

Shui, 2015; Deng and Wu, 2014). For example, a survey of consumers' willingness-to-pay for green housing in Beijing found that 68.3% of the respondents did not heard about the official green building label (Zhang et al., 2016). The lack of consumer awareness and knowledge about green housing means there is little incentive for developers to supply green housing (Davis and Metcalf, 2014).

4.5.3 Policy factors

Investors and developers are keen to have more information about the likely policies and future development plans for different areas because such plans can introduce more stability to the housing market (Adams and Watkins, 2014). However, much research shows that policy resistance is one of the major obstacles to green housing development (Darko and Chan, 2017; Chan et al., 2016). Although many developed areas in the world have published their green housing policies or regulations, policy often fails to achieve the desired outcomes. One explanation is that society consists of a variety of actors with their own goals.

‘Suppose a government intervenes in such a system with a strong policy that actually moves the state of the system towards the government's goal. That will open up greater discrepancies for other actors with different goals, which will cause them to redouble their efforts’ (Meadows, 1982, p.104).

In terms of green housing development, incentives - usually provided by government - serve as important motivators for promoting market adoption (Olubunmi et al., 2016). Some governments, such as the UK, the US and Canada, provide various incentives to drive the changes, however, studies have shown that many other countries are still lacking incentives for green housing (Luthra et al., 2015; Häkkinen and Belloni, 2011). In addition, another political barrier is lack of codes and regulations for green housing development. The review here reveals that although some countries' governments have introduced green housing policies and regulations, the efforts to implement those policies and regulations are either inadequate or absent (AlSanad, 2015; Luthra et al., 2015).

Furthermore, most governments in developing countries, regardless of whether they have a loose or firm grip on political life, are unable to identify priorities and plan strategically (Mousa, 2015). In this case, unbearable and probably non-transparent activities materialise the housing market. Therefore, it is not surprising that developers' building practices cannot be regulated due to the lack of clear and efficient housing codes. In addition, in developing countries, although some developers are interested in new green technologies, governments normally cannot offer credit resources to them and lack incentives for developers to improve their knowledge and practices. Indeed, much building activity may be conducted without any governmental monitoring (ibid.).

Moreover, in China, there are conflicts of interest between central and local governments (Fu and Lin, 2013). Local leaders rely on strong GDP performance for their career progression. Since carbon regulation is not linked with monetary returns, local governments lack a motivation to implement it. As a result, local governments are active and innovative in supporting housing development, rather than applying policies to slow down house building activities. This local state 'marketism' (Fu and Lin, 2013, p.6) emphasises the power imbalance between the central and local governments, and developers; and 'a paradoxical network at the disposal of local governments' (ibid.). As a result, the local state marketism acts as a constraint on developers implementing the carbon reduction requirements of the national government.

4.5.4 Technological factors

The utilisation of advanced technologies is crucial for developers to achieve green housing project outcomes. However, some studies show that the lack of technical knowledge could be another important barrier (Tagaza and Wilson, 2004; Hwang and Ng, 2013). At the early stages of a development proposal and making an application for government permission to construct, the lack of professional knowledge of developers is obvious (Mousa, 2015). Especially in developing countries, the existing technologies needed for green housing development and green material applications appear to be inadequate (ibid.). The developers would have to adopt new green technologies when they develop green instead of traditional housing, but the inability to determine the potential performance of green housing technologies increase their uncertainties and risks (Zhang et al., 2011a), and this

issue may push developers back to traditional design and construction methods (Shi et al., 2013).

Additionally, there is a lack of skilled employees. If a designer or an engineer cannot make effective decisions about how to integrate green equipment into a housing development, the housing design might be jeopardised, causing delays (Shi et al., 2013) and increasing costs for the developers. The need for skilled employees not only refers to green housing technical employees, but also includes the housing constructors. Compared with traditional housing construction processes, green housing developers are more interactive with constructors in order to facilitate effective communication and management in green housing development. However, barriers to these interactions include the low level of industrialisation of green construction methods, lack of coordination and lack of knowledge and trust (Alashwal et al., 2011; Menassa and Baer, 2014). In addition, in the operation stage, insufficient knowledge, lack of skills training and qualified experts for green facility management are considered to be the main problems for developers (Deng et al., 2018).

Many developers believe that carbon issues have exceeded their considerations and think that climate change is an academic pursuit for scholars (Mousa, 2015). The fear of the unknown due to lack of awareness is closely related to the unwillingness to replace traditional housing practices (Du Plessis, 2002). Although some developers are aware of this issue, they lack a sense of urgency, which forms the second layer of barriers (ibid.). Thus, although the main focus of green housing is its environmental benefits, studies show that developers' decisions about the extent they are willing to move towards green housing construction is still rooted in considerations of financial viability (Robichaud and Anantatmula, 2010; Fuerst and Grandy, 2012). In other words, most developers consider that unless green units are marketable for a reasonable price, they would choose profit over greenness as their business priority (Nurul Diyana and Zainul Abidin, 2013; Abidin, 2010).

Overall, although the government has employed a variety of approaches to encourage the adoption of green technology in the housing sector, green housing still accounts for only a small proportion of the total housing stock in China (Zhou, 2015). In order to promote the green housing market, developers must be persuaded that 'green can become gold' (Zhang et al., 2018b, p.2235). However, existing research shows that developers are facing a variety

of challenges to developing green housing. When considering green housing development, these challenges interact making the situation even more complex which may lead developers to continue with traditional housing construction rather than moving to green housing development.

4.6 Summary

In summary, this chapter has targeted RQ 2: What are the potential drivers and challenges faced by developers in implementing of carbon regulation and green housing policies in China? The key points which have been made in this chapter are: first, developers play an essential role in green housing development since they interpret the requirements of the government (e.g. carbon emission targets in housing sector) and consumers (housing demands) and translate them into the built form. Secondly, there are a variety of drivers and barriers faced by developers in developing green housing from a range of financial, market, political and technological perspectives. Thirdly, in relation to current research and policy in Western contexts, developers in China have their own characteristics and face special challenges in green housing development.

Factors	Sub-factors	Key literatures
Financial factors	Greater return on capital	O'Neill and Gibbs, 2014; Qian et al., 2015; Zhang et al., 2018; Juan et al., 2017
	Attract more investment	Qian et al., 2015; Heffernan et al., 2015; Bretschger and Zhang, 2017
Market factors	Increases customers' demand	McGraw-Hill Construction, 2013; Gou et al., 2013
	Increases company reputation and competitive ability	Nurul Diyana and Abidin, 2013; Andelin et al., 2015; Zhang et al., 2011b; Azis et al., 2013; Shi et al., 2016
	Improves chances of successful land bids	Zhang et al., 2013; Fu and Lin, 2013
Policy factors	Government mandatory regulations and policies	Fuerst et al., 2014; Zhang and Wang, 2017
	Government incentive regulations and policies	Zou et al., 2017; Qian and Chan, 2010; Murtagh et al., 2016; Wong and Abe, 2014
Technological factors	Introduces greener technologies	Gilley et al., 2010; Liu et al., 2014

Table 4.4 Potential drivers of green housing development for Chinese developers (summarised by the author)

Factors	Sub-factors	Key literatures
Financial factors	Higher material costs	World Green Building Council, 2013; Mousa, 2015
	Higher technology costs	World Green Building Council, 2013; Mousa, 2015; Hwang and Ng, 2013
	Higher costs to training	World Green Building Council, 2013; Mousa, 2015

	employees	
Market factors	Lack of consumer awareness	Hu et al., 2014; Eves and Kippes, 2010; Brounen et al., 2013; Davis and Metcalf, 2014
Policy factors	Unclear building regulations	Chan et al., 2016; Darko and Chan, 2017; Luthra et al., 2015; AlSanad, 2015
	No uniform green housing standards	Mousa, 2015
Technological factor	Insufficient technical knowledge and tools	Mousa, 2015; Zhang et al., 2011a; Shi et al., 2013
	Lack of availability of green technologies	Hwang and Ng, 2013; Tagaza and Wilson, 2004
	Lack of skilled employees	Shi et al., 2013; Alashwal et al., 2011; Menassa and Baer, 2014; Deng et al., 2018

Table 4.5 Potential challenges of green housing development for Chinese developers (summarised by the author)

Table 4.4 and Table 4.5 respectively show the summaries of potential drivers and challenges of green housing development for Chinese developers based on the existing studies. In reviewing the potential challenges faced by Chinese developers, it is worth noting that many of these constraints are institutional constraints. This is to say, the constraints on green housing development are largely the result of the imperfect institutions. The next chapter provides the conceptual framework of this research by outlining an institutional analysis of China's green housing transition.

Chapter 5. The conceptual framework: institutional analysis

5.1 Introduction

The main aim of the research is to investigate the institutional constraints on the green housing transition in China by evaluating the capacity of Chinese developers to deliver green housing in the Chinese housing market. After reviewing the literature on government carbon regulation in the housing sector (Chapter 2 and 3) and the market challenges this poses for developers (Chapter 4), it can be seen that carbon regulation in the housing sector is a multi-actor task especially requiring actors in both state and market fields to interact with one another. Reducing carbon emissions in the housing sector has challenges but also great potential and may require a dramatic improvement in the institutional framework of the built environment in China.

The conceptual framework for this research, therefore, needs to be able to identify the Chinese house building industry's ability to deliver green housing by being sensitive to the institutional changes in which the developers' decisions are embedded, in particular policy changes that provide the context for house building decisions. This chapter develops a conceptual framework that is designed to examine the institutional changes taking place in developers in response to state-led carbon regulation and green housing policy change, with a particular focus on examining developers' ability to deliver green housing. This chapter also suggests how new institutionalism theory can throw light on the general processes involved in the green housing transition in China.

Although institutions have been recognised for their importance in shaping the nature of socio-technical transitions, a relatively small proportion of the literature applies institutionalism theory to socio-technical transition analyses in a systematic and detailed manner (Andrews-Speed, 2016). In addition, according to Hawtrey (2012), the interaction between institutions has a major impact on housing futures, and different historical pathways lead to different institutional characteristics in different housing systems. In the case of China, there is even less institutional analysis research into the housing system or carbon regulation.

This chapter addresses the second research objective: to evaluate the contribution of new institutionalism theory to the understandings of green housing transitions and to develop a conceptual framework; and RQ 3: ‘What research theory and methods are most appropriate for analysing developers’ capacity, state-market relations and institutional constraints during green housing transitions?’ The structure of this chapter is as follows: first, it provides an overview of institutionalism theory/institutional analysis and identifies the key characteristics of the theory. Secondly, it reviews the existing literature on the application of new institutionalism to housing markets and state-market relations. Thirdly, it provides a justification of why institutional analysis has been chosen as the key theory for this research. Fourthly, it explains how new institutionalism/institutional analysis has been applied to the research problems set out in the first half of the thesis; i.e. how it will help to better examine and understand the constraints on the Chinese green housing transition and developers’ capacities to deliver green housings. In conclusion, the chapter narrows down the thesis towards an institutional analysis of the green housing transition in China by examining developers’ capacity to deliver green housing in the Chinese housing system.

5.2 Research theory: New institutionalism

5.2.1 Institutions

First of all, it is essential to define an ‘institution’: institutionalists provide a range of definitions. However, there are some debates about how to define ‘institutions’. For example, March and Olsen (2006, p.3) define an institution as ‘a relatively enduring collection of rules and organised practices, embedded in structures of meaning and resources that are relatively invariant in the face of turnover of individuals and relatively resilient to the idiosyncratic preferences and expectations of individuals and changing external circumstances’. Bathelt and Gluckler (2014, p.346) define institutions 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’. North (1991, p.97) provides a well-used definition of institutions which are ‘the humanly devised constraints that structure political, economic and socio interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights).’

In relation to both formal and informal institutions, '...individual habits ... when they are shared and reinforced within a society or group... assume the form of socio-economic institutions ... not in the narrow sense of formal organisations, but in the broad sense of socially habituated behaviour' (Hodgson, 1993, p.697). The 'institutional turn' in research (Cumbers et al., 2003) led to the new institutionalism which focuses on informal customs and conventions, relationships and interactions (Adams and Watkins, 2008). In this sense, institutions develop ' ... in relation to rules, in response to them, or even against them' (Bathelt and Gluckler, 2014, p. 346), where actors act according to certain goals, rationalities and purposes (ibid.) and are embedded in the structures of social relations that influence their actions and decisions (Granovetter, 1985). Due to the limited rationality of humans, policy paradigms in the institutional environment level are necessarily incomplete (Eggertsson, 2009; North, 2012). Thus, not all institutions are perfectly designed and despite dysfunctional and inappropriate systems, imperfect institutions still persist (Andrews-Speed, 2016).

Scott (2008, p.48) recognises three pillars of institutions as 'comprising regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life'. Regulative institutions are based on the development and enforcement of rules, such as formal laws that regulate behaviour; Normative institutions are rooted in a collective moral understanding of legitimate behaviour; Cognitive institutions are institutions based on recognised definitions of the situation and worldviews (ibid.). Empirically, institutions are underpinned by all these three pillars to some degrees (Jackson, 2010). Institutions place constraints on, but also, create opportunities to actors in the institutions through a range of regulative, normative and cognitive pressures (Powell and DiMaggio, 2012).

Jackson (2005) states that the definition of institutions are ambiguous instead of uncertainty or vagueness. It means that empirically, institutions can take more than one specific meanings depending on the research context (ibid.). However, this is argued that ambiguous meanings are also highly problematic and presents major obstacles when trying to integrate and interpret research findings from different research areas (Bathelt and Glückler, 2014). For example, in the existing literature on housing markets and related disciplines,

institutions are often defined differently or almost become a 'black box' (Bathelt and Glückler, 2014, p.340).

Williamson (2000) develops an integrative program that identifies three levels of institution (see Figure. 5.1): embedded institutions, institutional environments and institutions which govern transactions. The top level, 'embedded institutions', are normally seen as the informal characteristics or the prevailing culture of the society, such as traditions, norms, beliefs and ideas. The middle level, 'institutional environments', are those formal institutions in the society that are consciously designed by humans; for example, governance and legislation systems, government structures and economic systems. This level also includes the establishment and operation of inter-organisational networks, the creation of new systems and transformation of existing systems, and the production and implementation of incentives or/and constraints in the form of plans, policies and regulations (Alexander, 2005). The bottom level is the institutions which govern transactions, such as markets, government departments, networks and policy instruments. This level is where the housing market is. Traditional transaction cost economics focuses on this bottom level of institutions (Andrews-Speed, 2016).



Figure 5.1 Three levels of institution (Source from: Andrews-Speed, 2016, p.219, modified base on Williamson, 2000, p.597)

In addition, the changes of individual's attitude and behaviour, which are the actual transactions to determine outputs, can be collectively influenced by all the three levels of institution (Andrews-Speed, 2016). One of the commonly used interpretive devices in new institutionalism is that the policy paradigm not only refers to ideas as explanatory variables, but also reveals how ideas are embedded into formal and informal governance practices over time (Hall, 1993). However, once sets of ideas are embedded into formal political processes, they can mediate between institutional actors with different interests and influences influencing which voices are 'heard' in debates and which are not (Kuzemlo et al., 2016).

It is important to highlight that institutions have a constant feature which is 'change' and existing arrangements affect the emergence and reproduction of institutions (March and Olsen, 2006). Institutional arrangements can stipulate or prohibit, accelerate or delay changes. Both informal and formal institutional factors such as norms, rules and social identities are regarded as instruments for social and economic stability and at the same time, for social and economic change. The key to understanding the dynamics of change is to clarify the role of institutions in the standard processes of change (March and Olsen, 2006). The acknowledgement of the importance of change led to the study of transitions as dynamic processes which include design elements, competitive choices, and the external shocks (Goodin, 1996).

5.2.2 New institutionalism

Early forms of institutional theory was developed by Western economists in the early 20th century (Adams and Watkins, 2002), such as Veblen (1919), Commons (1934) and Ayres (1944) (Hodgson, 2000). These theorists agree that humans have socially constructed habits and that institutions, as social norms, have the power to shape human behaviours. However, the old institutionalists saw institutions from an atomistic conception of economic interactions, and believed that economic behaviours and activities in their cultural context combine with some social and political factors such as values, social identity, and economic and political power (Rutherford, 1996).

However, Adams (2008, p.486) makes an argument that 'markets are regarded much more as a social construct, [and] basic tenets of neo-classicism such as profit-maximising behaviour are more likely to be challenged, while customs and conventions in the form, for example, of trust, honesty and decency in making business deals, are regarded as more important.'

Thus, new institutionalism provides another explanation of how institutions shape the behaviour of humans or organisations (Scott, 2008; DiMaggio and Powell, 1991) from a socioeconomic point of view. New institutionalism '... relies on the more mainstream assumptions about human agents and explains the existence of political, legal and social institutions with reference to the role of individualistic behaviour and its consequences for human interactions' (Adams and Watkins, 2002, p.7). Thus, the existence of institutions '...affects the behaviour of individuals in terms of the choices and constraints they face but does not mould the preferences of the agents in the way old institutionalists would expect' (ibid.).

New institutionalism moves beyond old institutionalism as atomistic conception of economics, to involve other socioeconomic components. In other words, new institutionalism is an interdisciplinary enterprise that combines economics with other social disciplines such as sociology, political science, market, psychology and organisation theories. Compared with old institutionalism, new institutionalism seeks to analyse markets as economic, political and social relations and provides a way of viewing how the behaviour of market actors and market outcomes are shaped by institutions (Hawtrey, 2012).

New institutionalism perceives institutions as having been designed and shaped by humans in order to create social order and reduce uncertainty in production, exchange and distribution (North, 1991). They establish the rules and basis for regulating economic activities. From this perspective, the limits and frameworks set by institutions and economic standards can determine the choices set such as transition costs and engaging feasibility in institutional activities (ibid.). Therefore, it is essential for market actors to follow established rules, norms, and belief systems to gain legitimacy for their economic activities and mobilise their economic, political and social resources in order to fit into specific institutional environments and enhance their performance (Yang et al., 2012). In addition, new

institutionalism explores current institutions through a perspective of institutional evolution, in which the historical performance of an institution is seen as a part of a sequential story. The evolution of institutions can also shape the direction of economic and social change towards 'growth, stagnation, or decline' (North, 1991, p.97).

There are three parallel strands of new institutionalism, namely rational choice institutionalism, historical institutionalism and organisational institutionalism (Hall and Taylor, 1996). Rational choice institutionalism emphasises the economic gains from institutionalisation and attributes the origin of institutions to deliberate design and voluntary agreement among individuals (Hall and Taylor, 1998). This school of thought believes that humans have limited information sources which lead to a bounded rationality which frames preferences when making choices. As a result, humans strategically use a calculus approach to maximise their benefits and reduce risks of transition costs (March and Olsen, 1998; Hall and Taylor, 1996).

Historical institutionalism emphasises power asymmetries and historical institutionalists see institutions as the enduring results of political struggles (Thelen, 1999). This school of thought believes that institutions provide 'scripts' for political and social actions and their interpretation. These political and social actions are in turn, determined, influenced and constrained by institutional frames such as ideas, symbols, and routines (Hall and Taylor, 1996).

Organisational institutionalism highlights the importance of culture. Institutionalisation is 'a historic accretion of culturally specific forms and practices with their origins and diffusion related to their specific contexts: sectors, societies and subcultures' (Alexander, 2005, p.212). As opposed to the rational choice institutionalists, organisational institutionalists believe that the institutionalisation of organisations is the result of legitimacy adoption, in a 'logic of social appropriateness' rather than result of strategic searches for maximum economic gains in 'a logic of instrumentality' (Campbell, 2006, p.926). In contrast to historical institutionalists, organisational institutionalists tend to conceptualise governance as a dynamic and changing over time (Paulsson and Von Malmborg, 2004).

Organisational institutionalism focuses on the influences existing between different organisations, and takes into account the state and the development of rules. It also identifies mechanisms to achieve a growing orientation of interactions between different organisations (DiMaggio and Powell, 1991). Initially, many differences exist between organisations. When the organisational fields become well established, the actors within the fields can become homogenised (ibid.). Organisational fields are normally generated in the same market or regions (ibid.) and can be observed as 'an increase in the extent to which certain organisations interact, an increase of the information load they share and the development of mutual awareness that they are involved in a common debate' (Paulsson and Von Malmborg, 2004, p.212). One of the core analytical focuses of the study of institutionalism is that organisational fields sometimes emerge around new challenges, and the fields are important factors that influence actors' behaviour towards these challenges. Based on the earlier work of DiMaggio and Powell (1991), Scott (2013) highlights the usefulness of organisational fields for analysing market activity. An organisational field consists of a set of organisations that interact across the entire system that spans the full range of different actors. It is framed by a variety of institutional logics, includes rules, relations, habits and meanings (Andrews-Speed, 2016).

According to Hall and Taylor (1996), it is arguable that although organisational institutionalists believe that, in some cases, institutional practices arise from interactive processes, in which actors within the organisational field share ways of interpretation. These organisational institutionalists still believe that individuals are rational and goal-oriented when making choices. However, the rational action is socially constituted and bound up with interpretation, in which actors' behaviours are influenced by their values and beliefs (ibid.).

Moreover, the most central argument in the institutionalism is 'the structure versus agency debate' (Hirsch and Lounsbury, 1997) about whether organisational behaviour is primarily 'the product of macro social forces or of organisational agency' (Heugens and Lander, 2009, p.61). Some scholars have analysed urban governance transformation processes (Healey, 2007; Gonzalez and Healey, 2005), and emphasise the interplay between the exogenous and endogenous forces, in which the exogenous forces are structural 'arising from economic

dynamics, political changes or environmental pressures' (Healey, 2007, p.67); while the endogenous forces refer to the agency's active role in changing institutions through social interactions and contra-indications (Giddens, 1979).

To address this conceptual duality of structure and agency, Barley and Tolbert (1997) describe the structure-agency relation as resembling the relation between language and speech. While language is 'virtual, timeless, and without subject', speech is 'situated in space and time' (Bathelt and Glückler, 2014, p.350). This language and speech metaphor supports Giddens' (1984) ideas in which institutional analysis are neither the experience of individuals nor the existence of any form of society as a whole, but are social practices across space and time. Structure only exists in social interactions (Held and Thompson, 1989). Although social structure has virtual existence and individuals constitute social interactions, structure consists of rules and resources and agency conducted in a regular manner around these rules and resources. In other words, social interactions are structured and social structure is continuously reproduced (Giddens, 1984).

A relational perspective on institutions emerged in order to incorporate social structures when doing institutional analysis. On the one hand, institutions provide the necessary context and conditions for making continuous interaction possible (Hodgson, 1988). On the other hand, they constrain the space for alternative actions (North, 1991). Since the institution can only become a reality through processes of social interactions and practices, this relational perspective on institutions argues that the interactions between institutional actors are the most suitable analytical unit for understanding the basis of institutions. In other words, economic practices conducted by institutional actors are situated within institutional contexts and relations which provide relatively stable social orientations to motivate economic relations. In turn, institutional contexts are recursively reproduced through economic relations and transitions (Bathelt and Glückler, 2014).

5.2.3 Institutional analysis

The applications of new institutionalism theory are generally in the form of institutional analysis. This analytic framework focuses on the dynamic (change in processes, modes of governance and practices through time) and multi-actor (market actors, state actors)

characteristics of new institutionalism (Cars et al., 2002). Cars et al. (2002) outline some of the key focuses of institutional analysis:

- It focuses on the dynamic interaction between particular actors, how they operate and the wider institutional contexts of which they are involved.
- It examines how governance contributes to shape or constrain social and economic opportunities generally based on a perspective of state-market relations.
- It highlights that actors' capacity is embedded in the dynamics of institutional context within which collective action takes place.
- It should be capable to recognise the complexity and dynamic changes of institutions.
- It should recognise the institutional differences between in particular places and times.

Based on Williamson' (2000) three levels of institution (Section 5.2.1): embedded institutions, institutional environments and institutions which govern transactions, the institutional analysis can be undertaken to examine the bi-directional influences between the different levels of institution and actors' capacity (Kucharski and Unesaki, 2018; Andrew-Speed, 2016). As Gonzalez and Healey (2005) state, institutional analysis is not focused on a one-way relation but interactive processes that are 'both shaped by their institutional inheritance and help shape it, in mutually constitutive and generative processes' (Healey, 2005, p. 2058).

5.2.4 Actors and Institutions under the perspective of institutional analysis

Beyond institutions, actors are another major focus in institutional analysis 'in their roles as collective actors, subject to wider institutional constraints and also as arenas within which institutional rules are developed and expressed' (Lowndes, 2001, p.1958). Based on the understanding of 'the structure versus agency debate' (Hirsch and Lounsbury, 1997), the relation between actors and institutions is also seen as mutually interdependent, rather than one having primacy over the other by institutionalists (Jackson, 2010).

Within institutions, Powell and Colyvas (2008) portray actors as either 'cultural dopes' or heroic 'change agents'. In other words, actors may play as 'rule makers' or 'rule takers'

which often depends on the particular case study and research questions (Jackson, 2010, p.2). More specifically, some actors may play as 'rule makers', such as take existing institutional rules as a starting point for defining their own interests. These 'rule makers' seek to stretch the boundaries of existing institutions, make the institutions to adopt new contingencies, or avoid some institutional rules through deviant behaviours (Oliver 1991, Clemens and Cook 1999; Battilana et al., 2009; Lawrence et al., 2009). Other actors may play as 'rule takers' and passively adopt the existing rules.

In addition, to what extent an actor could become a 'rule maker' depends on their capacities in the institution. To explain, if actors learned new skills to act within an institutional setting (Fligstein, 2001), they have more capacities and may create opportunities for them to emerge the innovation of institutional change (Jackson, 2010).

However, it needs to be highlighted that institutions dynamically change. Institutional rules are devised by actors, but institutions are shaped or reshaped by collective actions. As Jackson (2010, p.2) state 'Institutionally defined situations influence the interests and even identities of actors within the boundaries of an institution, and conversely institutions are rules defined in relation to stable configurations of actors with particular (institutionally defined) identities and interests.' Thus, it is conceptualised that actors and institutions are 'mutually interdependent and reflexively intertwined with one another' (ibid., p.2).

Moreover, institutions not only constrain actors, they also create opportunities for actual transactions. First, institutionalists argue that an institutional infrastructure is basic for actual transactions (Khanna and Palepu, 2006). Secondly, institutions also provide modes of governance over transactions, for example, hierarchies, state regulations, networks or markets (Hollingsworth and Boyer, 1997). Therefore, many scholars reveal that different economies may have comparative institutional advantages for different types of economic activity (Hall and Soskice, 2001; Amable, 2003).

5.2.5 What institutional analysis requires researchers to examine?

One of the core assumptions in institutional analysis is that institutions create orderly and predictable elements of society (Powell and Bromley, 2013). They shape or constrain the attitudes and behaviours of actors within a logic of appropriate action (March and Olsen, 2006). Institutions, seen as the 'rules of game' can largely influence actors' attitudes and

behaviours by 'defining what is seen as the 'natural' way to act (conventions), the right way to act (norms), and/or the sanctioned form of behaviour (the law)' (Aasen and Vatn, 2018, p.106; Vatn, 2015). In new institutionalism, actors are seen as multi-rational (Hodgson, 1988, 2007) and their rationalities are understood to be influenced by their institutional context. Thus, institutions create expectations and provide meaning for actors' attitudes and behaviours.

In new institutionalism, how the situation is defined can inform actors about what institutions apply. Actors' attitudes may be important for actors' interpretations of information in situations and for defining institutional contexts (Schwartz, 1994). The differential attitudes between actors may affect which interpretations they attend to, and to what extent the interpretations are given to (Weber et al., 2004). Different actors may adopt different expectations and meanings since they face different institutional contexts such as markets, social groups or family (Scott, 2013). Such institutional contexts are interactive and create complex rationalities. Actors' attitudes and behaviours are also dependent on their own characteristics like values and social positions which partly formed by their 'institutional history' (Vatn, 2015). By providing connections between institutions and actors' behaviours, institutional analysis provides 'a bridge between macro-/ structural perspectives and more micro-/ process approach (Thornton and Ocasio, 2008, p.99).'

Moreover, institutional analysis also emphasises the relations and the dynamic interactions between particular actors within wide institutional environments (Cars et al., 2002; Payne, 2019). State governance is an important institutional element which is embedded in the social and economic history of a society. How governance contributes to shape or constrain social and economic opportunities is generally examined in institutional analysis based on a perspective of state-market relations (Payne, 2019; Payne and Barker, 2018).

Furthermore, when considering the role of institutions in economic geography, it is natural to start from the consideration of incentives and constraints that influence economic behaviour and interactions from a spatial perspective (Bathelt and Glückler, 2014). Although existing spatial systems (e.g. locational distributions of resources and materials, customers and suppliers) determine a framework for economic behaviour and interactions, actors tend to act according to their rationalities with certain goals and objectives. In economic contexts,

compared with individual actors, such incentives-constraint concerns are more influential on collective actors (Maskell, 2001), such as companies, government departments and other economic organisations. For example, the operation systems are different between companies and individuals. While individuals may play a specific role when participating in complex negotiation and decision-making processes in their businesses; companies operate through structures and procedures that are, to some extent, independent of individuals within the companies (Lawson and Lorenz, 1999).

Therefore, applied spatially, institutional analysis emphasises the conditions of the wider institutional environment in which actual transactions of particular actors is performed and enables researchers to examine the actors' capacity in response to institutional change (Cars et al., 2002). This line of work is guided by an effort to understand how actors 'locate themselves in social relations and interpret and respond to their institutional context' (Powell and Bromley, 2013, p.4).

5.2.6 A summary of research theory

Table 5.1 shows a summary of new institutionalism theory and the key features within institutional analysis. In summary, institutionalism is 'a big tent' (Powell and Bromley, 2013, p.3), in which researchers share a general conception of institutions as 'having normative, cultural, and regulative elements' (ibid.). It is concerned with both the capacity of actors and how they operate within the broader institutional context and relate to other actors (Marsh and Stoker, 2002).

<p>1. What institutions are?</p>	<p>Institutions are 'the humanly devised constraints that structure political, economic and socio interaction' (North, 1991, p.97). They are 'rules of game' (Vatn, 2015) and contain both informal and formal rules (Hodgson, 1993).</p>
<p>2. The key definitional characteristics of new institutionalism</p>	<ul style="list-style-type: none"> - It is an interdisciplinary enterprise that combines economics with other social disciplines such as sociology, psychology, political science, market and organisation. - It focuses on relationships and interactions between different actors within institutions (Adams and Watkins, 2008). - It emphasises that institutions are dynamic and emerge around new challenges which influence actors' response towards these challenges (DiMaggio and Powell, 1991).
<p>3. The key features of institutional analysis</p>	<ul style="list-style-type: none"> - It is the analytical approach of institutionalism theory which focuses on investigating mutual interdependence between different institutional elements (Powell and Bromley, 2013). - It should be capable to recognise the complexity and dynamic changes of

	<p>institutions.</p> <ul style="list-style-type: none"> - It should recognise the institutional differences in different cases (Cars et al., 2002).
<p>4. The relations between actors and institutions under the perspective of institutional analysis</p>	<ul style="list-style-type: none"> - There is a 'structure-agency' debate within the institutional analysis (Hirsch and Lounsbury, 1997) about whether actors' behaviour is primarily 'the product of macro social forces or of organisational agency' (Heugen and Lander, 2009, p.61). - Institutional environments influence actors to make response to the changes (actively or resistively) within the institutions. - Institutions shape actors' activities but actors also seek to change institutions in order to favour their own interests (Boyd, 2012; Pan, 2010).
<p>5. The key lines of enquiry of institutional analysis</p>	<ul style="list-style-type: none"> - Institutional analysis enables researchers to examine the capacity of actors in response to institutional changes (Cars et al., 2002). - How governance contributes to shape or constrain social and economic opportunities is generally examined in institutional analysis based on a perspective of state-market relations (Payne, 2019; Payne and Barker, 2018).

Table 5.1 A summary of institutionalism/institutional analysis (summarised by the author)

However, under institutionalism theory, scholars differ in both their conceptualisation of institutional context and in which actors are seen as being fundamentally shaped or constituted by the institutional context (Powell and Bromley, 2013). The next section reviews how institutional analysis has been apply in related research fields.

5.3 Institutional analysis in related research fields

A number of researchers have drawn on new institutionalism to interpret phenomena in the fields of the housing market and the state-market relations. This section reviews studies in these related research fields in order to critically understand how institutional analysis can be applied into such studies to shape the conceptual framework of this research.

5.3.1 Institutional analysis in housing market research

'Conventional economic approaches for the analysis of property markets lack institutional or behavioural context and tend to ignore many of the defining characteristics of property, such as high transaction costs, illiquidity and information problems'(D'Arcy and Keogh 1998, p.1220). A developing interest of institutional analysis in housing market research has emerged. For example, Payne (2013, 2019) examines institutional change to understand the behavioural practices of speculative developers in the UK and, in particular, evaluates their response to state-led policy initiatives seeking to influence their business practices.

Zhang and Rasiah (2014) investigate the institutional change in China's housing market driven by market reforms from a state-owned enterprises perspective.

At a general level, the institutional perspective argues that the housing market operates as part of a broader institutional environment, which includes political, economic, social and legal elements (Dent et al., 2012). Housing markets are influenced by these elements through urban policies and regulations, financial structures and market demand and supply. The institutional quality of a housing market significantly affects its economic outcomes (Payne, 2019). However, the status and the range of institutional factors influencing housing-related activities indicate the level of complexity involved in housing market changes (Dent et al., 2012). Institutional patterns lead to path dependency of the economy over time, and the sequence of market changes depends in part on institutional history and external forces (Foo and Wong, 2014). Institutional factors will also have significant impacts on the costs of market transitions (Hawtrey, 2012).

Among other things, housing market activities are regulated by the institutional environment, which sets the principles and rules as the basis for market production. It is important for the industry to follow these principles and rules to gain legitimacy in specific environments and mobilise their resources to maximise the efficiency (Yang et al., 2012). In contrast, some scholars investigating from an interactive perspective (Yang and Wang, 2011) consider how actors accommodate strategic responses to handle institutional constraints and benefit from institutional capital (Grewal and Dharwadkar, 2002).

Adams et al. (2008) identify three main institutional features of the housing market: (1) formal rules within transactions which are determined by governance processes; (2) informal 'rules of the game' which are also affected by policy decisions; (3) actor-networks within and between market and state. They also develop the concept of a 'political economy of institutionalism' (PEI) which explains the use of institutions in British housing research. In addition, they use PEI to analyse the influences of public policy on the determination of housing values, investment returns and levels of development activity, and the behaviour of, and interactions between, different stakeholders such as governments, developers and users (Adams et al, 2008). In the PEI perspective, institutions are regarded as social constructs, and the approach recognises the political, social and cultural factors

underpinning the activity of the housing market, emphasising context, process and social relations. PEI considers the development process as highly social, in which the study of the character, personality and cultural perspectives of the different stakeholders is very important (Adams et al., 2008). '...Theoretical pluralism should prevail and the explanatory power of mainstream economics should be reinforced by an appropriate institutional framework' (ibid., p.53).

New institutionalism recognises that different actors may have very different values and each of them has its validity (Jenkins and Smith, 2001). These values underpin decision-making and should not be ignored in researching housing market transitions. Because actors will seek to change institutions in order to favour their own interests (Hall, 2010). Their success depends on their capacity to influence collective action and this depends, in turn, on the distribution of power within the prevailing institutional framework (ibid.).

In addition, buildings are complex entities and the qualities of buildings, such as 'sustainability' and 'greenness' are difficult to identify and agree on because they are rooted in value judgments (Sedlacek and Maier, 2012). This has significant implications for state-market relations and for transactions in market institutions (ibid.). Therefore, research on developers' attitudes and behaviours can be used to investigate why transitions towards sustainability are unlikely to be smooth and automatic in the housing market and why regulation might be needed (Sedlacek and Maier, 2012).

5.3.2 Institutional analysis in state-market relations research

Some institutional analysis literature focuses on exploring transitions especially in state-market relations (Rosenbloom, 2017). State-market relations show the multiple and complex dynamics of the relations between public and private actors (Healey, 2007) and the limited value of seeing a dichotomy between state and market. 'Planning versus markets is a fallacy... comparing their merits is the wrong question: in theory and in reality it is impossible to separate them' (Alexander, 2001, p.1). The public and private sectors are not opposing forces in institutional analysis, but instead, they are institutionally intertwined (Eisner, 2011). In land and housing development, Adams et al. (2008) believe that any state-market relations analysis is largely dependent on the theoretical view of the operations of

the particular market. They consider that there is no priority between state and market when analysing housing development but rather, suggest adopting an appropriate institutional framework to better understand the relationship between them.

As a result, the state-market dichotomy has been replaced by a state-market dialectic in institutional analysis (Eisner, 2011). Market operations are not only governed by self-adjusting price mechanisms and supply-demand policy instruments, but also characterised by a wide range of formal and informal institutions (Chang, 2002). The state is also composed of institutions, where rules, roles and procedures define its organisational operations and therefore, influence policy-making decisions and shape the interaction between state and market actors (Eisner, 2011). Institutional analysis, therefore, helps in understanding the institutional complexity of state-market relations, as well as the complexity of public-private interactions (Chang, 2002).

This state-market relations perspective explores how companies 'accommodate strategic responses to handle institutional constraints and take advantage of institutional capital' (Yang and Su, 2014, p.721). In other words, companies tend to 'strive for legitimacy while maintaining efficiency' (Yang and Su, 2013; 2014; Yang et al., 2012) depending on the balance of their institutional liabilities and capital. Different institutional pressures and procedures, such as monitoring and habituation, could evoke business strategic actions and affect company performance (Grewal and Dharwadkar, 2002). However, institutional environments may influence companies' decisions through a variety of mechanisms. As a result, a company's strategic responses aim to cope with the institutional pressures they perceive (Oliver, 1991).

A question raised at this stage is: Do institutional environments place constraints on, or function as promoters of company competitiveness? Some scholars argue that institutional environments provide both challenges and opportunities (e.g. Suchman, 1995; Scott, 2008). On the one hand, the state places legitimacy pressures on companies (Martinez and Dacin, 1999; Scott, 2008). Companies must gain legitimacy in order to stay in the market and to build trust and cooperation with other actors (Yang and Su, 2014). However, institutional responsibility has an adverse effect on efficiency due to the distrust and market ambiguity (Yang et al., 2012). On the other hand, companies tend to make adaptive efforts to mitigate

institutional responsibility: for example, by improving connections with other actors in order to gain social acceptance. They also take strategic actions such as lobbying, membership, standardisation and influence in order to promote cooperation (Oliver, 1991). Such adaptive efforts can help companies build institutional capital that provides competitive advantages (Suchman, 1995). In this way, the accumulation of institutional capital creates obstacles for new entrants (Bresser and Millonig, 2003).

When it comes to the institutional persistence faced by companies, another question raised here: why do some conventions continue to exist, even if they are clearly not optimal or counterproductive to some positive technological or social change. Setterfield (1993) provides some possible explanations, such as, if the inefficiencies of institutions help to avoid conflicts such as the redistribution of resources or outputs, they may persist. Campbell (2006) provides another explanation: the potential costs of changing institutions may cause economic sanctions to the actors. In addition, institutions systematically interact with each other; changes in one institutional field may lead to extensive costs in other institutional fields (Frankel, 1955). This is why conventional institutions persist, and slow down or prohibit technological or social change.

5.4 Justification for the application of institutional analysis in this research

As reviewed in Sections 5.2 and 5.3, new institutionalism in social science research has multiple lines of thought and a broadly defined theoretical orientation but with a common interest in structure-agency relations. The previous section has also shown that in recent years, new institutionalism has received considerable attention in conceptualising state-market relations and housing market studies in sustainable transitions (Payne and Barker, 2018; Rosenbloom, 2017). Other scholars argue it offers a valuable conceptual framework to identify power structures (Kuzemko et al., 2016) and explain changes in housing systems.

In addition, within the frame of new institutionalism, scholars have flexibility to decide how to conceptualise institutions in their research, in what way they present their causal arguments (e.g., top-down or bottom-up), and what levels and features of institutions they choose to focus on (e.g., formal structures, informal practices or behaviour) (Powell and Bromley, 2013). The robustness of institutional analysis therefore provides a valuable lens

for understanding different levels and perspectives of institutional contexts of green housing transitions.

Putting the institutionalism lens on this research, we can see that Chinese housing system are embedded within an institutional context which has significant implications for how the system changes in a transition to green housing. If the Chinese green housing transition represent the new 'rules' designed to fundamentally 'change the game' for the Chinese housing sector, the question is to what extent and how are Chinese developers adapting to the new rules in the institution? Are these new rule changes actually changing the game? And if they are, how are Chinese developers of the Chinese housing sector evolving in response to such new rules?

Indeed, every housing market is institutionally unique and the diversities of institutional arrangements for housing across countries need to be highlighted, and in turn, these institutional diversities lead to different outcomes of market transitions (Hawtrey, 2012). In contrast to Western economies where market mechanisms provide the main mode of coordination (Dent et al., 2012). The non-market characteristics of housing sector in China generally involve many informal relationships which lead to complexity in the institutional environment of China's housing market (Wu et al., 2015). Since most of the existing empirical studies applying new institutionalism are from Western economies, an institutional analysis of green housing transition in the Chinese housing system is urgently required. This research attempts to assess its relevance by looking at the experience of China, where the institutional environment and developers' interests and principles are distinctly different from a Western context.

Transitions are perceived in terms of 'differing and competing institutional logics, which change due to actors' agency or 'institutional work' and vice versa' (Jehling et al., 2019, p.111). In this conception, developer agency represents the 'ability or capacity [...] to act consciously' (Lowndes and Roberts, 2013, p.77). Previous research (e.g. Darko and Chan, 2017; Chan et al., 2018; Häkkinen and Belloni, 2011) has shown that examination of the adoption and implementation of green building from the perspective of key market actors can help in understanding the institutional context of green building development in various economies (Wuni et al., 2019). Zhang and Rasiah (2014) also argue that new institutionalism

theory can be used to examine the changing roles and strategies of Chinese housing developers.

The key task in using an institutional analysis approach in this research is to consider to what extent new institutionalism adds to an understanding of market responses to China's state-led green housing transition. Assessing Chinese developers as key market actors in the green housing transition can elucidate 'locked-in' issues that may be holding back change (North, 1991) toward greener development practices. Further, since the 'regularised practices' (Kuzemko, et al., 2016, p. 99) of developers are formed by institutions, they are highly relevant to empirical applications since this strand of new institutionalism sees actors (developers) and institutions forming 'dialectic relationships' (Lowndes and Roberts, 2013, p. 10).

However, how developers gain agency leads to further questions about institutional constraints within housing systems consisting of 'multiple and interconnected regulatory levels' (Goldthau, 2014, p. 138). Thus, how institutions are constituted and change over time, and how they influence Chinese developers' capacities to undertake the green housing transition can be usefully examined through an institutional analysis. In turn, the investigation of developers' responses through institutional analysis can offer invaluable insights into understanding 'how modes of constraint combine to produce stability over time, and how gaps and fissures open up to create instability - and possibilities for change' (Lowndes and Roberts, 2013, p. 69). In other words, what aspects of the wider institutional environment constrain or enable developers in transitioning to greener development practices; and, what kinds of development or reforms to policy and regulation may be required to encourage the housing market to deliver low carbon goals (Adams et al., 2008).

5.5 Conceptual approach to applying institutional analysis in this research

In the first half of the thesis, a range of research problems and gaps have been set out. These research problems and gaps are related to the broader research areas which have emerged out of a literature review in line with the research aim and objectives. The main research areas developed from the literature review include: developers' roles in response to the green housing transition; developers' capacity to deliver green housing; the

institutional context of the Chinese housing system; regulation of the green housing transition; and state-market relations in delivering green housing. The following empirical research addresses these areas by employing an institutional analysis of the green housing transition in China through an investigation of Chinese developers' capacities.

The conceptual framework for this research draws on the work of Payne and Barker (2018) and Jiang and Payne (2019) and is based on the principles of new institutionalism. In this research, institutions are the stabilisations or correlations of the interactions between individual and collective actors, associated with specific economic and social processes, rather than with specific outcomes or measurable characteristics (Bathelt and Gluckler, 2014). Developers are 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 (Jiang and Payne, 2019, pg. 4). Thus, the conceptual framework of this research focuses on the level of the developers, rather than the level of the housing market or individual, in order to link developer behaviour to the green housing transition taking place. The approach enables multi-factor, multi-actor and multi-level aspects to be identified whilst retaining the empirical and conceptual focus on developers (*ibid.*).

Many exist research show that market actors' capacities to develop green building can be examined through their attitudinal and behavioural studies (Rashid et al., 2012; Hoffman and Henn, 2008; Zuo and Zhao, 2014). Thus, how developers' attitudes and behaviours change with changes in the institutional context, in this case, the Chinese green housing transition, are investigated. The attitudes of Chinese developers towards green housing transitions need to be examined in order to investigate the internal and hidden factors that drive/constraint developers' behaviours. The attitudinal research can also partly reflect the embedded institutions (values and beliefs) from the developers' perspectives. The importance of attitudes in policy adoption processes has been explained by proposing them as the connection between institutions and behaviours, or as part of the 'why' of analysing behaviours. Responses to carbon regulations usually start from attitudinal transitions and end in behavioural transitions (Zhang and Zhou, 2016). However, more generalised common goods like carbon emissions reduction and environmental protection are not prioritised in

developers' minds (Mousa, 2015). Thus, the effect of institutional contexts on green attitudes are particularly interesting in an era of socio-technical transitions.

But also, the behaviours of Chinese developers towards the green housing transition need to be examined in terms of the actual transactions and 'market outcomes' (Hawtrey, 2012) of the green housing transition. Behavioural research can also provide empirical evidence for how institutions shape developers' behaviours and may in turn, be changed by them. Although some research shows that developers' attitudes to carbon reduction is improving (Osmani and O'Reilly, 2016), there is still a research gap about their attitudes and behaviours towards green housing development in China (Liu, 2012). Thus, what and how Chinese developers believe about and behave towards green housing transition should be examined.

Moreover, institutional constraints on green housing transition in China are explored through a lens of state-market relations. That is, although a series of green housing policy instruments has been attempted in the Chinese housing market, there is not much empirical research to prove these instruments' effectiveness and acceptance by developers. In institutionalism, humanly devised constraints structure human interaction, and these constraints are 'made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behaviour, conventions, and self-imposed codes of conduct), and their enforcement characteristics (North, 1994, p.360). In the Chinese housing market institution, how government actors (policymakers) and market actors (developers) interact, and the particular institutional constraints on promoting green housing transitions in China need to be investigated.

5.5.1 Analytical framework

An integrative analytical framework developed in this thesis can be seen in Figure 5.3. The left column draws on Williamson's (2000) 'three levels of institution'. This model has been used to do the institutional analysis on similar urban transition studies (e.g. Andrews-Speed, 2016; Kucharski and Unesaki, 2018). Level 1 comprises the informal 'embedded' institutions such as traditions and beliefs which influence the Chinese housing sector. Level 2 is the institutional environment which has a preponderance of formal institutions consciously

designed by the Chinese government. For example, the Chinese governance system and the structures of the Chinese government departments, which influence carbon regulation and the green housing transition. Level 3 is made up of the institutions which govern transactions, in this case, developers, the housing market, Chinese government bureaus, and networks between key stakeholders involved in the green housing transition.

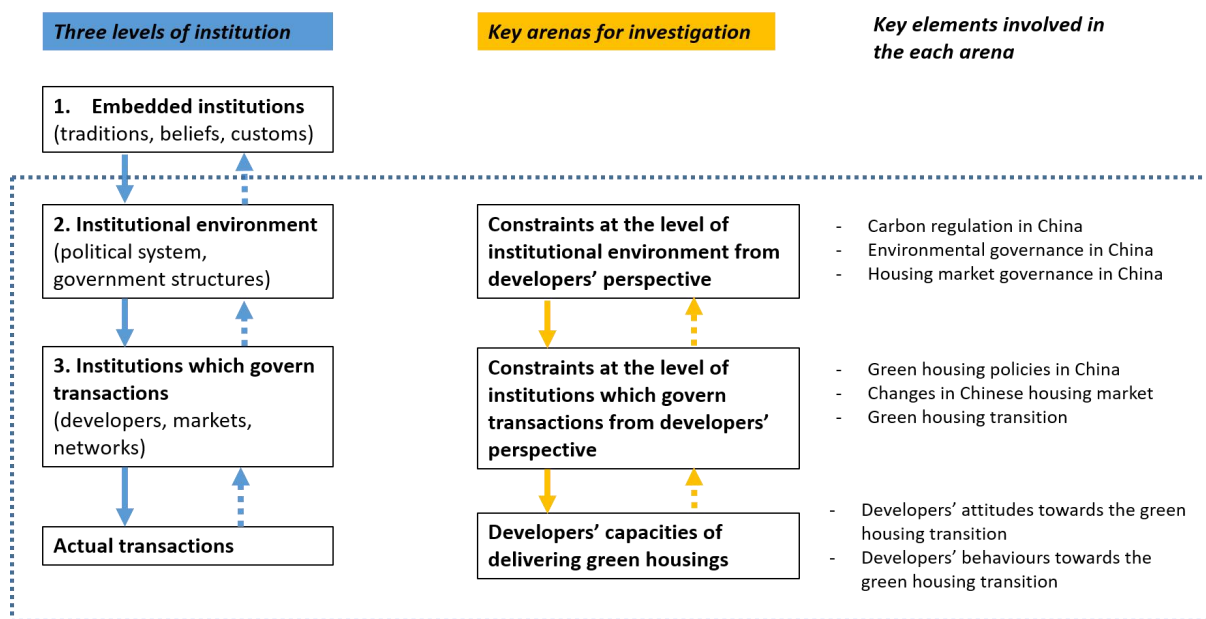


Figure 5.2 An integrative analytical framework (illustrated by the author)

More specifically, the institutional environment (Level 2) in China contains a range of rules to shape developers' attitudes and prescribe developers' behaviours. In the institution of the housing market, the institutional environment provides structures of meaning and common purpose - in this case, carbon reduction - which gives direction and meaning to developers' attitudes and behaviours, as well as providing explanations, justifications, and legitimacy for these attitudes and behaviours. The institutions which govern transactions (Level 3) also provide structures of resources that create developers' capabilities. In other words, the institution which governs transactions also empowers or/and constrains developers, and makes them more, or less, capable of acting according to prescriptive rules of appropriateness (March and Olsen, 2006).

The middle column provides a frame to address objectives of analysis in this research and the right hand column shows the key elements focused in each of the research objectives.

An institutional analysis has flexibility for the researcher to decide the scope of the research which also requires some limitation (Kucharski and Unesaki, 2018). As can be seen from Figure 5.3, the Level 1 'Embedded institutions' has not been focused on in this research. The main focuses are the level of the institutional environment; Institutions which govern transactions; and the actual transactions.

This research chose to investigate the Chinese green housing transition through a bottom-up direction. First, this research focuses on the examination of Chinese developers' capacities, in other words, attitudes and behaviours towards the green housing transition; following that, the institutional constraints on Chinese green housing transitions are addressed by evaluating Level 3 institutions governing transactions and the Level 2 institutional environment from developers' perspectives. It is worth noting that the framework described above implies bi-directional influences between the different levels of institution which are evaluated in the discussion of findings in Chapter 10 and taken into consideration in the policy suggestions arising from this research.

From the main research areas developed from the literature review and by applying new institutionalism to those research areas, a series of research questions were developed to fulfil the research aim and objectives and to address the next half of the thesis:

- RQ 4: What are Chinese developers' attitudes towards the green housing transition?
- RQ 5: What are Chinese developers' behaviours towards the green housing transition?
- RQ 6: What are the key institutional constraints faced by Chinese developers when delivering green housing?
- RQ 7: How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?

The analytical approach developed in this section is used to yield new conceptual insights into how Chinese developers 'play the new game' (Payne, 2019) of the green housing transition in China, when the new rules may not be completely introduced into the market,

or whether institutional inertia exists as they wait for new institutional forms to be defined (ibid.).

5.6 Summary

In conclusion, this chapter has addressed research objective 2 and the first half of RQ 3 ‘What research theory and methods are most appropriate for analysing developers’ capacity, state-market relations and institutional constraints during green housing transitions?’ The analytical approach used in this research builds on ideas from the literature on new institutionalism to construct a conceptual framework for the analysis of the institutional context of the Chinese green housing system. Institutionalism theory was adopted as the theoretical lens with which to interrogate the empirical findings of the research to afford a deeper understanding of developers’ capacities to meet centrally-determined carbon regulation targets. The institutional analysis is operationalised as a structuring framework for understanding the complex range of influences on the attitudes and behavioural changes of Chinese developers in relation to green housing development policies.

The research framework of institutional analysis of green housing transitions is considered to have purchase for consolidating the literature, as well as providing context for the complexities involved in the transition processes of housing development. However, this research area still awaits empirical validation. Thus, the next half of the thesis focuses on addressing this research gap. The next chapter, on methodology, provides an overview of the research design process and gives a justification for the methods adopted in this research.

Chapter 6. The methodological approach to the research

6.1 Introduction

The above review of existing literature has highlighted the limited attention paid to using institutional analysis to examine developers' responses to the green housing transition in China. As China has developed a series of green housing policies, there remains a fundamental gap in our understanding of how developers are responding to this emerging policy agenda and what institutional constraints exist on the market uptake of green housing projects. Therefore, this research focuses on examining developers' responses in order to investigate the institutional issues facing housing developers as China's housing market transforms into a green housing future.

The main aim of this research is to investigate the institutional constraints on the green housing transition in China by evaluating the capacity of Chinese developers to deliver green housing in the Chinese housing market.

The four main objectives of this research need to be reiterated here:

- Objective 1: To investigate the potential impacts on developers of current carbon regulation and green housing development policies in China;
- Objective 2: To evaluate the contribution of new institutionalism theory to the understanding of green housing transitions and to develop a conceptual framework;
- Objective 3: To examine developers' capacities for the implementation of green housing targets in the Chinese housing market; and
- Objective 4: To identify the key institutional weaknesses in the green housing transition in China.

In order to address the research aim and objectives, and in response to the research gaps identified in the literature review, seven research questions (RQs) were identified:

- RQ 1: What is the current status of carbon regulation and green housing policies in China?

- RQ2: What are the potential drivers and challenges faced by developers to the implementation of carbon regulation and green housing policies in China?
- RQ 3. What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?
- RQ 4: What are Chinese developers' attitudes towards the green housing transition?
- RQ 5: What are Chinese developers' behaviours towards the green housing transition?
- RQ 6: What are the key constraints faced by Chinese developers when delivering green housing?
- RQ 7: How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?

The literature review in the previous chapters was used to develop the conceptual framework of this research and outline the research gaps in this field. This chapter aims to address RQ 3: 'What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?' It is important that all the methods chosen in this research are appropriate to address the research objectives and questions. In order to achieve this, a mixture of quantitative and qualitative methodological approaches has been chosen and three main research methods have been adopted: a self-completion questionnaire survey; in-depth interviews; and work placement (see Figure 6.1). An explanation of these is provided in the following sections.

This chapter first explains the methodological selection of the research, and provides justifications for why each method has been chosen and how it connects with the conceptual framework and addresses the research aim, objectives and questions. Secondly, the chapter justifies the details of each method used by setting out the questions asked in the questionnaire and interviews, describing the data collection process, and the discussing issues around the validity and reliability of the data. Thirdly, it explains how the data has

been analysed by introducing the thematic development approach. Finally, it considers ethical considerations and limitations of the approach.

6.2 The methodological selection of the research

6.2.1 Quantitative vs. Qualitative

In order to choose the most appropriate research method, it is important to understand the different characteristics, strengths and shortcomings of quantitative and qualitative paradigms. Table 6.1 shows a detailed comparison and evaluation of the two different paradigms which is useful to understand the methodology implications in different research objective in this research.

Assumption	Quantitative	Qualitative
Ontological (the nature of reality in the research)	Reality is objective and singular, apart from the research	Reality is subjective and multiple as seen by participants in the research
Epistemological (the relationship of researcher to that being researched)	Researcher is independent	Researcher interacts with that being researched
Axiological (values and judgement in the research)	Value-free and unbiased	Value-laden and biased
Rhetorical (the language of the research)	Formal, based on set definitions, impersonal voice, use of accepted quantitative words	Informal, evolving decisions, personal voice, use of accepted qualitative words
Methodological (the process of the research)	<ul style="list-style-type: none"> - Aims to develop generalisations for application to some phenomenon. - 'Deductive logic': hypotheses chosen before research begins and tested in a cause-and-effect order. - 'Context-free': research does not venture beyond hypotheses. 	<ul style="list-style-type: none"> - Helps to explain phenomenon - 'Inductive logic': categories emerge during research rather than being a priori. - 'Context-bound': accurate and reliable through verification

Table 6.1 Comparison of quantitative and qualitative research paradigms (Source from: Creswell, 1994)

Quantitative methods, such as statistics or measurements, are ontologically and epistemologically grounded in positivism (Bryman, 1984, 2016): they have the characteristics of objectivity, causality, generality and reproducibility. In positivism, social science subjects can be examined in much the same way as natural science subjects, in which hypothesis are formed and tested. The quantitative data collected is generally considered to be 'warranted knowledge' (ibid.). The most commonly used quantitative

research tool is the questionnaire survey (ibid.). This allows the collection of large-scale, often numeric data, in an objective manner, as researchers are assumed to be value-free and unbiased (Creswell, 1994).

Qualitative methods are ontologically and epistemologically grounded by constructivism (Bryman, 2016). Constructivists attempt to understand the social world from the perspective of the research subjects. They are more interested in exploring meanings and meaning systems, consisting of default and informal practices, and the interactions between, and within, these meaning systems (Payne, 2009). Qualitative methods allow researchers to get as ‘close’ to their research subjects as possible, and facilitate understanding the ‘inside view’ (Byrman, 2016). In general, interviews and case studies are the most common methods in qualitative research. Compared with the mere description of causal relationships researched through quantitative methods, qualitative methods produce rich, in-depth data, to uncover patterns of interaction in the social world.

6.2.2 Research design

When choosing methods for this research, the approach was grounded in the conceptual framework developed in Chapter 5 which identified the key areas for investigation. These key research areas are shown in Figure 6.1 which include developers’ attitudes and behaviours in relation to green housing transitions; constraints at the ‘institutional environment’ level; and constraints at the ‘institutions which govern transactions’ level.

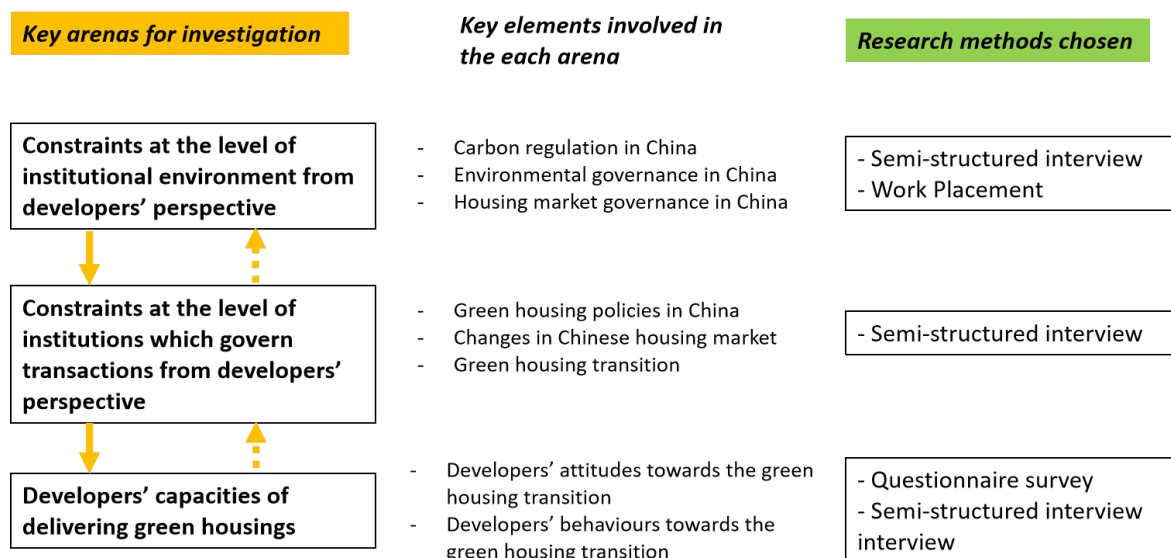


Figure 6.1 Key arenas for investigation and research methods chosen (illustrated by the author)

The methods need to ensure an adequate representation of Chinese developers' attitudes and behaviours in relation to the green housing transition, explore institutional constraints from developers' perspectives, and demonstrate how this research on developers' responses can help to evaluate and make recommendations about current green housing policies in China. The research methods aimed to facilitate the collection of information to provide a general overview of developers' attitudes, a detailed knowledge and understanding of Chinese developers' behaviours, and an examination of the institutional context of the Chinese green housing transition from a state-market interaction perspective.

A mixture of quantitative and qualitative methodological approaches has been chosen and three main research methods were adopted: a self-completion questionnaire survey; in-depth interviews; and work placement. Philip (1998) highlights various advantages of mixing methods that include allowing a broader range of research challenges to be addressed and minimising the risk of erroneous findings; and using quantitative research methods to establish research questions to be addressed by qualitative methods, or the other way around. Indeed, when using a mixed method approach, 'ideally one method should not be privileged over another and that to gain an understanding of a complex world, a variety of methods, in addition to a variety of subject areas, must be addressed' (Philip, 1998, p.252).

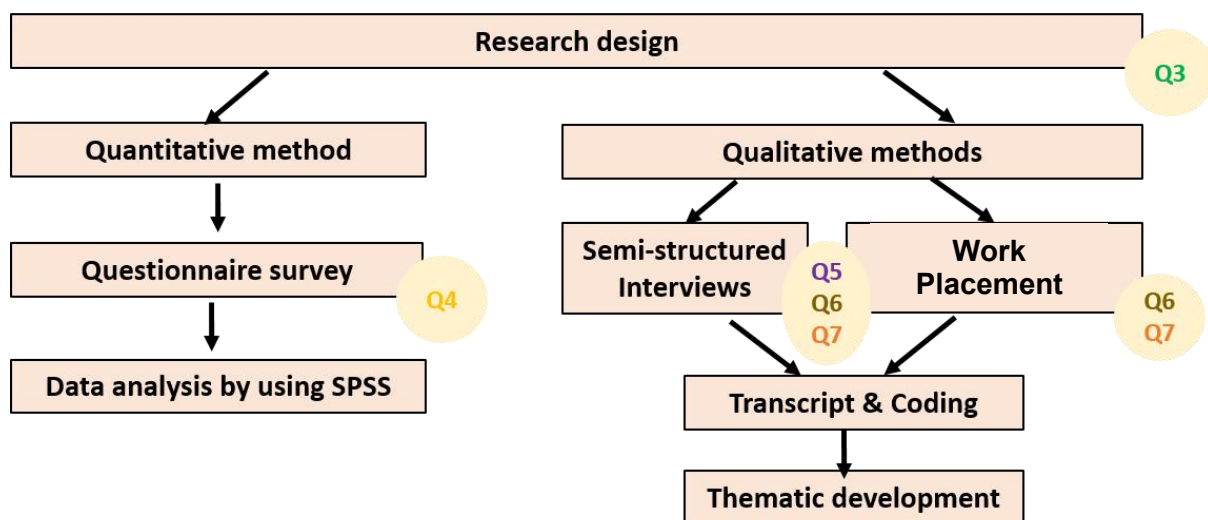


Figure 6.2 Logical structure of the research design process (illustrated by the author)

Figure 6.2 represents the logical structure of the research design process. Institutional analysis requires an understanding of institutional actors' capacities for responding to

institutional change, for example, their ways of thinking and ways of acting (Cars et al., 2002). First, based on the conceptual framework, an attitudinal research is required to overview the opinions of Chinese developers in relation to the green housing transition: what developers believe and what developers like/dislike. The self-completion questionnaire survey was chosen for gathering broader and more general attitudinal data from developers. The data from the survey method provided a broadly representative view of Chinese developers' attitudes to green housing development. In addition, a survey is an easy and quick approach to collecting data especially if the sample is large and geographically dispersed (Bryman, 2016). Moreover, the data collected from the questionnaire survey was used to establish research questions which were subsequently addressed with qualitative methods.

Secondly, detailed qualitative data were needed to capture some of the complexity and dynamics of developers' behaviours in relation to green housing in order to investigate actual transactions in the housing market institution. As Hakim (1987) stated, people's own definitions of a situation are important elements for understanding any social process. A fundamental advantage of qualitative research is that it is concerned with participants' own accounts of their behaviours, aiming to be richly descriptive and illuminating the motivations connecting meanings, attitudes and behaviours (Wagenaar, 2011). The ability of qualitative methods to capture people's perceptions, experiences and meanings make them well-suited for analysing developers' actions, narratives and discourses. Thus, in-depth interviews with developers has been used in order to explore developers' behaviours in relation to green housing in China, and their opinions of the existing institutional context for the green housing transitions. This method was used to target Research Question 5 'What are the Chinese developers' behaviours towards the green housing transition'; Research Question 6 'What are the key constraints faced by Chinese developers when delivering green housing'; and Research Question 7 'How can insights and knowledge from literature review and empirical analysis be used to provide potential policy recommendations on green housing transitions'.

Thirdly, the nature of institutional analysis requires an understanding of the system especially the state-market interactions (Cars et al., 2002). Therefore, although this research

is primarily about Chinese developers, data about the State and the market was gathered to verify, contradict or explain developers' opinions. Work placement was chosen as the method to understand State policy-making and to immerse the author in the milieu being observed (Silverman, 2006) to acquire a comprehensive understanding of the institutional environment of green housing transitions. Work placement allowed the study of institutional constraints on the green housing transition at the 'institutional environment' level since the researcher was able to investigate government workers' daily routines and understand how the organisation of the Chinese government operated closely and easily. The data collected from work placement also indicated possible conflicts of interests and values between developers and policymakers in the process of implementing green housing policies. The information collected by this method addressed Research Question 6 'What are the key constraints faced by Chinese developers when delivering green housing', and Research Question 7 'How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?'

In summary, in the research design, three different methodological approaches have attempted for framing an institutional analysis in this research and to understand the complexity of the green housing transition from different perspective. Developers' attitudes and behaviours, institutional constraints and public-private interactions with enabling action were examined in different ways.

6.3 Research Methods

After justifying why the three different methodological approaches have been adopted to address the different research objectives and questions of this research, the following sections provide more details on how the research was carried out, including timeline of the research, sample scales, questionnaire and interview design.

6.3.1 Timeline of the research

Table 6.2 shows the timeline of the data collection and data analysis processes of this research. The questionnaire design started in September 2016 and was modified several times to ensure all the information required from the developers was covered and the

structure was appropriate for developers to follow and answer. In order for the targeted developers to understand the questionnaires more easily, the forms were designed in English and translated into the local language of Chinese. The final version was finished and translated in November 2016. The questionnaire survey was carried out through the combination of: (1) an editable Word document attached to a cover email; and (2) an online version to be filled in through a professional Chinese questionnaire design website called *Wenjuanxing*, to maximise developers’ engagement and thus, achieve an effective response rate. Sending and collecting of the questionnaires took place between December 2016 and March 2017 with a short break because of the Chinese New Year. After collecting the questionnaire, a preliminary analysis of the questionnaire results was conducted in order to inform and provide data support for the following phase which was the interview question design.

	2016		2017				
	Sep/Oct	Nov/Dec	Jan/Feb	Mar/Apr	May/June	Jul/Aug	Sep/Oct
Part A: Data collection							
Questionnaire Survey							
Questionnaire design							
Sending and collecting							
Semi-structured Interviews							
Interview question design							
Interviews							
Participant Observations							
Placement in the national government institution							
Part B: Data Analysis							
Quantitative analysis: Questionnaire results analysis							
Qualitative analysis: Transcription and translation							
Qualitative analysis: Coding and thematic development							

Table 6.2 Timeline of the research (illustrated by the author)

The interview questions were designed in February 2017. After that, interviewees were contacted in the same month. Interviews were carried out through the combination of phone interview and face-to-face interview in order to maximise developers’ engagement. Interviews were conducted during March to April 2017.

Work placement was conducted through a 7-month placement in the Ministry of Housing and Urban-Rural Development (MOHURD), Technology and Industrialisation Development Centre which is the major national level government institution responsible for producing and managing green housing policies. The placement took place during October 2016 to April 2017. Work placement in the Centre and the interviews with the developers were

processed simultaneously, and these two approaches interacted with each other to a certain extent but were independent of each other. More details will be provided in Section 6.3.4.

6.3.2 Self-completion questionnaire survey

The self-completion questionnaire survey provided the opportunity to collect quantitative and generalisable data pertaining to developers' attitudes and thus, a large-scale and representative sample of Chinese developers from differing specialisms and various sizes of companies operating all over the China was required. Another important reason for conducting a self-completion questionnaire survey is that it is relatively efficient, cheap and fast to collect data from respondents over a large geographical area (Vogt, 2007; Alasuutari et al., 2008).

For the survey, the required sample size was calculated with following equations (Crano and Brewer, 2002):

$$n = Nn' / (N + n')$$

$$n' = p(1-p) / (SE)^2$$

n: the required sample size

N: the population size (the number of developers in the Chinese construction industry is about 93,000 in 2015. However, it is noteworthy that any further change in population size would have limited effect on the results (Cohen et, al., 2007)

n': the first estimated sample

p: the estimated proportion of participants (it was assumed as 0.5 for getting the maximum sample size)

SE: the standard error (assumed 5%)

The sample size required for this survey was calculated to be about 100 respondents. In order to get more responses and effective data collection, the questionnaires were sent to large, medium and small developers to gauge their attitudes. Subsequently, 180 questionnaires were equally distributed (60-60-60) amongst the three different sizes of developer companies in the Chinese housing industry covering the whole country. The respondents were randomly chosen through the official statistics list provided by the China Real Estate Association (CREA, 2016). This meant the results were representative of a wide

spread of developers and enabled comparative analysis to provide a broad understanding of developers' attitudes.

The response rates for these three groups (large, medium and small development concerns) are illustrated in Table 6.2. Out of the total of 180, 96 questionnaires were returned and 4 were discounted due to being incomplete. Excluding the invalid questionnaires, the final response rate was 51.1% (92/180).

Company size	No. of questionnaires	No. of respondents	Response rate
Large size	60	35	58.3%
Medium size	60	26	43.3%
Small size	60	31	51.7%
Total	180	92	51.1%

Table 6.2 Different size companies and their response rates (summarised by the author)

This response rate is acceptable as being representative of the housing industry in China, because it is more difficult to acquire data for organisational research compared with, for example, large-scale surveys of the public (Baruch and Holtom, 2008). This is due to the commercial sensitivity of the information in market situations (Baruch and Holtom, 2008). In their research, Baruch and Holtom (2008) examined 490 different questionnaire surveys and found that the average response rate for individual research was 52.7% while this number was only 35.7% for organisation research.

In addition, some literature used similar sampling technique and got similar response rates. For example, Payne's (2009) questionnaire survey about the UK developers' response to brownfield development policy change got a response rate of 48% (48/100); Osmani and O'Reilly's (2009) questionnaire survey about English developers' response to zero carbon housing development got a response rate of 41% (41/100); and Davies and Osmani's (2011) research on low carbon housing refurbishment from an architects' perspective got a response rate of 45% (45/100). This research targeted similar groups and used similar approaches to collect questionnaire data. Therefore, the response rate of 51.1% in this research is considered acceptable and efficient.

The questionnaire contains six sections with each section dealing with particular aspects of Chinese developers' attitudes towards the green housing transition:

(1) Background information. The first section was designed to capture basic information from respondents, such as their location, company size and to what extent they understand and had been involved in green housing development.

(2) Trends of green housing development. This section aimed to collect data on to what extent the respondents believe that green housing has or will become the main trend in the Chinese housing market. The questions asked developers to what extent their company has or will change their business strategies towards building green housing, both in the past 10 years and in the future 10 years. It also asked whether developers thought that green housing development would become a main trend in the future.

(3)/(4)/(5) Key drivers of/barriers to/incentives for green housing development.

Figure 6.3 shows an example of the layout of the questions about key drivers of / barriers to / incentives for the development of green housing. The 5-point Likert Scale was used and is commonly seen as a useful and effective method to elicit respondents' attitudes on the significance of different elements (Akintoye et al., 2000; Zhang et al., 2012). In this research, for example, Figure 6.3 shows each factor could be chosen from a scale 1 to 5, where 1 means respondents did not consider it as a driver at all; while 5 means respondents believed it was a very significant driver for delivering green housing. The lists of potential drivers of / barriers to developers adopting green housing development were summarised in Section 4.4 and 4.5. Moreover, the incentive elements were also developed based on the findings of potential drivers / barriers from the existing literature. Information relating to key incentives represents developers' attitudes on the one hand, and on the other hand, it provides support for addressing Research Question 7 aimed at providing potential policy recommendations for the Chinese green housing transition.

Section 3: Key Drivers of Green Housing Development

3.1 Current Drivers of Green Housing Development

To what extent has the following factors become a driver of green housing development to your company? (1: Not a driver/2: slight driver/3: moderate driver/4: significant driver/5: very significant driver)

		1	2	3	4	5
1.Financial factors	1.1 Greater return on capital					
	1.2 Attract more investment					
2.Market factors	2.1 Increased customers' demand					
	2.2 Increases company reputation and competition ability					
	2.3 More easier to get land from bidding					
3.Policy factors	3.1 Government mandatory regulations and policies					
	3.2 Government incentive regulations and policies (e.g. VAT)					
4.Technological factors	4.1 Introduced greener technologies					

Other (please specify)

Figure 6.3 An example of the layout of section 3/4/5 in the questionnaire (illustrated by the author)

The questions about what Chinese developers thought were the main drivers / barriers / incentives relating to green housing development were asked both about the current situation and about the next 10 years. Since the Chinese evaluation standard of green building was released in 2006 (see Section 3.4.4), the concept of 'green housing' has become an important feature of the Chinese housing market and therefore a 10-year time horizon was used to elicit developer views on these drivers/barriers/incentives. Their attitudes to what might happen in the next 10 years were also asked in order to investigate possible future attitudinal changes towards the green housing transition in China. Some interesting information was gained through comparing developers' current attitudes with their attitudes for the future green housing development.

(6) Your details. This part was optional for respondents to complete which was for contact purposes only.

The full questionnaire is attached in Appendix 1. The questionnaire included rating, multiple choice, and closed-end questions, relating to facts, opinions and knowledge. Additional space was included at the end of each section for respondents to elaborate on their responses.

The survey data for this research was statistically analysed with the Statistical Package for Social Science (SPSS) software. The respondents were asked to give their answers based on a 5-point Likert scale. For the 5-point Likert scale responses, the mean values of different factors were calculated in order to rank variables and to test the reliability of the results the data were entered twice to check for any major inconsistencies with the original data.

The quantitative analysis of the survey focused on the goal of the green housing transition as the basis for the qualitative approach to institutional analysis. The findings of questionnaire survey addressed Research Question 4 ‘What are the Chinese developers’ attitudes towards the green housing transition?’ and provided a rank of key drivers/incentives and barriers which could reduce the complexity of the material to a series of quantifiable metrics that could define the most significant factors of the changes for the policymakers. However, numbers (quantitative data) are not enough to meaningfully represent developers’ views from an institutional analysis perspective, and it is necessary to explore the story (qualitative data) behind the numbers. Thus, in-depth interviews were carried out. The findings from the survey provided some interesting points to be asked in the interviews, and therefore, helped to shape the interview question list.

6.3.3 Semi-structured interviews

Semi-structured interviews with developers were chosen as the most suitable method to collect the detailed and in-depth information needed to address Research Question 5 ‘What are Chinese developers’ behaviours in relation to green housing transitions’; Research Question 6 ‘What are the key constraints faced by Chinese developers when delivering green housing’; and Research Question 7 ‘How can insights and knowledge from literature review and empirical analysis be used to provide potential policy recommendations on green housing transitions’. Semi-structured interviews offered an adaptable open-ended, flexible and discursive way of gaining insight into developers’ views. In this research, the interviews were regarded as ‘conversations with purpose’ by which to gain multi-layered information. The function of the interviews with developers was mainly to explore the following points:

- Chinese developers' perceptions of green housing transitions, including current and potential impacts of green housing regulations and policies;
- the willingness of developers to change their current traditional construction skills and business strategies toward a greener future;
- major challenges faced by developers in making these changes;
- approaches and incentives that have been adopted, or are likely to be adopted, by developers and the extent to which these are envisaged or in operation.

Accordingly, interview questions were designed to ensure that these research areas were covered whilst allowing for flexibility in how the interviewees responded. The questions were divided into four parts. The full list of interview questions has been attached in Appendix 2.

(1) Company green housing strategy and future trends of green housing. Questions in this part were designed to discover developers' underlying business strategies toward green housing development as an entry point for understanding the extent to which the interviewees had changed their practices and strategies toward green housing development and how their enterprises' dynamically changed during this process. Developing a green business strategy has been seen as important during the transition process and the willingness of developers to change their traditional business strategies is crucial to green housing transitions (Zhang et al., 2011b). Starting with some topics the developers were with familiar with meant they were more willing to provide more detailed information and enabled the interviewees to talk about green housing projects their companies were conducting.

(2) Main drivers / barriers/ incentives. As this topic indicates, these questions were about the most important drivers / barriers / incentives interviewees considered when developing green housing. This part also connected with the quantitative data about main drivers / barriers / incentives gathered from questionnaire survey. Some questions raised in the survey results were asked in this part in order to elicit a deeper understanding behind why the attitudes were present. The survey results were discussed with the participants and they were asked to comment on them. For example, the most important features of green housing development the respondents focused on were: energy-saving and energy

utilisation (63 respondents); they were less concerned about how to achieve being 'green' during the housing construction stage (37 respondents) and operation stage (27 respondents). The reasons why developers placed more focus on the planning and design phase but overlooked the construction process and later operation stages were asked during the interviews.

(3) The challenges of green housing development and how to overcome them. This group of questions aimed to gather information about the challenges faced by developers in their green housing practices focusing on constraints from both 'institutional environment' level and 'institutions which govern transactions' level (Section 5.5.1). In addition, a question about 'how to overcome these challenges' was asked in order to deepen understanding of how developers could change their behaviours or provide solutions to those challenges.

(4) Policy obstacles and suggestions. These interview questions were focused on understanding the interactions and conflicts between policymakers and developers from the developers' points of view, and their suggestions for Chinese green housing policy-making. The policy suggestions provided by the developers helped to provide potential policy recommendations for the policymakers on how to promote green housing transitions in China (Research Question 7).

The selection criteria for interview participants were different from the questionnaire survey criteria. The questionnaire was devoted to obtaining a more general perspective of developers' attitudes towards the green housing transition in the housing market. Therefore, developer companies of different sizes were targeted. In contrast, in order to obtain more effective qualitative data, the interview questions were designed on the basis of the interviewees having a particular understanding of green housing development, green housing policies and the housing market. Interviewees were selected who exhibited the following characteristics: from green housing development lead enterprises (private or state-owned) in China; at least middle-level manager or director positions; possessing an understanding of their enterprise's green housing development strategy.

A formal sample scale was not set in the beginning of interview design. The primary idea was to get as many interviewees as possible. However, the author found that it was

extremely difficult to contact developers and ask for an interview in China if the researcher was not from an official institution or had *GUANXI* (personal relationship) with developers. This problem was overcome by using the contact channels mainly from the MOHURD Technology and Industrialisation Development Centre (the Centre) and the China Real Estate Association (CREA) since all the leading green developers in China have interactions with the Centre of the CREA. However, this contact approach should be taken into account as a limitation of the research since the Centre and the CREA were more willing to ask developers who had good and close relationships with them. Nonetheless, it was an effective way of gathering the necessary response rate to ensure the efficacy of the research design. Messages and information sheets were sent to 18 potential interviewees to introduce the aim and objectives of the research and the interviews. All the selected (a mixture of state-owned and private) developers responded and accepted interview requests. Therefore, eighteen developers were recruited to take part in the interviews.

The scale of interviewees can be determined to be acceptable to provide detailed qualitative data on the complexities of the Chinese green housing transition. First, existing statistics by the CREA (2018) shows 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, which indicates that the housing market in China is highly monopolised. Second, the sampling frame contained a range of leading green developers in China who had major influence in the Chinese green housing market: fourteen of the interviewees were from the top 50 green real estate enterprises in China and seven of them were from the top 10 (CIHAF, 2016).

No.	Company	Company type	Company size	Interviewees position
1	Developer A	Private	Large size	Director
2	Developer B	Private	Large size	Manager
3	Developer C	Private	Large size	Manager
4	Developer D	State-owned	Large size	Chief Engineer
5	Developer E	Private	Middle size	Manager/ Reviewer of green building
6	Developer F	Private	Large size	Manager
7	Developer G	State-owned	Middle size	Manager
8	Developer H	State-owned	Large size	Manager
9	Developer I	Private	Large size	Manager
10	Developer J	Private	Large size	Manager
11	Developer K	State-owned	Large size	Manager

12	Developer L	State-owned	Large size	Manager
13	Developer M	Private	Large size	Manager
14	Developer N	Private	Middle size	Manager
15	Developer O	Private	Large size	Director
16	Developer P	Private	Large size	Manager
17	Developer Q	Private	Middle size	Manager
18	Developer R	Private	Large size	Manager

Table 6.3 Interviewees' background information (Illustrated by the author)

Table 6.3 shows the interviewees' background information. The participants' names have been anonymised as 'Developer A', 'Developer B', 'Developer C' and so on, in order to afford the interviewees and their companies a full level of confidentiality. On the one hand, respondents are more likely to divulge detailed information if they remain confidential rather than 'be recorded' by name; and also because commercial sensitivity is an important issue for development companies, the use of real names and companies might have revealed commercially sensitive information, such as potential land acquisitions or profit margins.

6.3.4 Work Placement

A work placement in a government institution was undertaken to address the research objective 4 'To identify the key institutional weaknesses in the green housing transition in China, Research Question 6 'what are the key constraints faced by Chinese developers when delivering green housing', and Research Question 7 'How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?' The conceptual framework of institutional analysis requires a richer understanding of the organisational system and in particular, the interaction between alternative modes of operation and regulatory actors (Cars et al., 2002). However, environmental governance and green housing policy-making processes are extremely difficult to investigate unless a method is followed that immerses the researcher in the milieu being observed, that is, a relevant government department's day-to-day operations (Wan, 2013; Cheng, 2015). This method therefore allowed the gathering of information about the government's perspective and practices in order to verify, contradict or explain the developers' views and provide a richer understanding of the complexities behind the green housing transition taking place.

The work placement took place through a 7-month placement in the Ministry of Housing and Urban-Rural Development (MOHURD), Technology and Industrialisation Development Centre. The MOHURD is the national-level government department providing housing and it regulates state construction activities in the country. It is also responsible for producing and managing the operation of many of the national level green housing policies (see Chapter 3). The MOHURD Technology and Industrialisation Development Centre (the Centre) is the key research institution under the MOHURD and provides support and services including: research on relevant policies or regulations for building energy efficiency, green building, urban and rural carbon emission reduction and housing industry modernisation; research on institutional framework and evaluation methods; organises and manages the evaluation of green buildings and issues green building labels. The Evaluation Standard for Green Building (ESGB) and much of the supplementary guidance are also produced by the Centre which also carries out the role of evaluating green building applications at the national level.

The Centre was the most appropriate place to carry out a work placement for the research since it directly manages Chinese green housing development work at the national level. In addition, the latest green housing policy-making information could be acquired during the placement. Observation was both consciously and unconsciously used throughout the placement: for example, placement work provided a good opportunity to intuitively understand in detail at short range how government works day-to-day. As well, regular conversations with officers in the Centre about this research provided a range of valuable data. The data captured by using this method were mixed in form. On the one hand, the related conversations with government officers were recorded and have been quoted in the analysis. On the other hand, many observation memos were written during the placement in order to help record thoughts about the observations.

The work placement in the Centre and interviews with the developers were processed simultaneously, and these two approaches interacted with each other to a certain extent but were independent of each other: for example, some of the developers' responses and suggestions from the interviews were discussed with government officers. More generally, the government officers gave feedback from their perspective. In the following interviews, developers could be asked questions about government officers' opinions and provide ideas

from their perspective. In this way, the two groups expressed opinions about the same issues, and perspectives of both the government (the State) and developers (the market) were acquired in this research. The work placement also provided support for the final policy recommendations, so that they simultaneously considered and weighed the opinions of both developers and the government.

6.4 Thematic analysis

In the interviews, developers were asked to contribute their opinions, knowledge and experience on green housing development in a colloquial way. However, the information in these stories was not linked logically and so it was necessary to establish an analytical framework to organise and analyse them. Through the data analysis, the stories were reorganised in order to 'move from discussion of issues within one area to discussion of issues within another, with each area logically connected to the others' (Weiss, 1995, p.154).

This research adopted thematic analysis as a method for analysing and interpreting themes within qualitative data. Thematic analysis is flexible (Clarke and Braun, 2017) in terms of research objectives, sample size and approaches to the generation of meanings. It can be used for both inductive (data-driven) and deductive (theory-driven) analyses, and for capturing both manifest and latent meaning (Braun et al., 2019). In addition, thematic analysis does not simply summarise and reorganise the data content, but also connects it with research objectives and questions to identify and interpret key features of the data.

6.4.1 Transcription and translation

All the interviews were audio-recorded after which the first step was to transcribe them into written form. In addition to what was been said by the interviewees, the meanings of utterances are profoundly shaped by *how* they said (Sarangi and Roberts, 1999). Therefore, the author captured features of speech such as emphasis, speed and tone of voice which were crucial for interpreting the interviews. The final transcripts were scrutinised several times before analysis in order to familiarise the author with the data.

All the interviews with developers in this research were conducted in Chinese. Thus, after transcribing them into written form, they were translated into English. Linguistic issues were

inevitable since some Chinese vocabularies, expressions and idioms cannot be directly translated into English. As a result, part of the interviewees' original meanings might be lost in the compromise of using similar English vocabularies. However, such linguistic issues were reduced by providing detailed interpretations where the meanings could not be clearly expressed in English.

6.4.2 Coding

There are various understandings of 'coding' which have in common that it is a process of describing the relations of materials collected from the research, labelling and categorising data in the analysis (Boyatzis, 1998). In general, 'thematic coding' is seen as a form of qualitative analysis which involves recording information which is linked by common themes and thereby establishes a 'framework of thematic ideas about it' (Gibbs, 2007). The research aim, objectives and conceptual framework set out the key research areas and themes required to be investigated, and the interviews were conducted in a semi-structured way and shaped by the question list. Thematic coding was adopted in this research to develop a framework in which codes were grouped into different research themes.

The coding process in this research involved: (1) quickly browsing through all transcripts as a whole, making notes about the first impressions; (2) reading the transcripts carefully, one by one, line by line, word by word, to generate codes at different levels of complexity (from simple descriptions to conceptual categories); highlighting all relevant words or sentences; noting similarities with or differences from findings in existing literatures; noting points emphasised by interviewees or repeated several times; (3) trying to put all the codes into different research themes; (4) making a constant comparison between/within codes; and (5) producing a code list by identifying which codes are the most important, and bringing several codes together (Boyatzis, 1998). The coding development process was continued until no new codes were being generated. During the process of coding development, the research aim, objectives and questions were considered at all times.

6.4.3 Thematic development

After generating the codes, a code framework was developed. As the coding framework did not explain what the coding revealed about the views in the research field and how they linked with the broader views of this research, it was thus followed by a thematic development. Although the main research areas have been identified to address different research questions, a range of sub-themes in each theme was generated after coding. Thus, as can be seen from the Table 6.4-6.6, the results of the coding process have been grouped to create sub-themes.

Codes		Sub-themes
Companies' enthusiasm	Developers' concepts	Changing to green development concepts
'Fashion'	Active and passive enterprises	
Role of leaders	Far-sighted	
Future trend		
Priority of the business strategies	CSR	Producing green strategies for their enterprises
Developers' responsibility	Builders to operators	
Conflicts within the enterprise	Development costs	Balancing costs and benefits
Risks are not controllable	Incremental costs	
Enterprise standards are higher than national standards	Comfortable and healthy house	Balancing government requirements and consumer demand
Scale	Meet the targets	
Market competitiveness	'small but good'	Building brands
Advertising	Media exposure	
Responsible developer	Apply green labels	
Ability to coordinate resources	Technology is mature or not	Coordinating market resources
Form alliances	Green list and black list	
Do not follow the design	Different strands between national and local levels	'Cheating' in practices
'Fake green'	Operating costs	

Table 6.4 Code framework for shaping theme of 'developers' behaviours towards the green housing transition' (illustrated by the author)

Codes		Sub-themes
Demand over supply	Early, present, future	Supply-demand imbalance in the Chinese housing market
Commercial housing	Hard currency	
Speed up	Turing point	
Customers' buying behaviours	Attention to buyers	Lack of consumer demand for green housing
High-income groups	Extra costs	

Talent mobility	Procurement system	Fragmented structure of the supply chain for green housing transitions
Responsibility gap between developers and property management companies	Green financing	
'Bad deport Good'	'three-Nos'	
'punish'	Incentive to mandatory	Inefficiency of green housing policy instruments
Policy continuity	Black and white on the paper	
Ignore the later stages	Two-stages evaluation systems	Inefficiency of Evaluation Standard for Green Building (ESGB)
Quantity and quality	Central standard and local standards	
Concessions to consumers	Financial subsidies	Developers' suggestions
Tax	Training	
Green loans	Whole-life-cycle monitoring	

Table 6.5 Code framework for shaping theme of 'Constraints of the green housing transition at the level of 'institutions which govern transactions'' (illustrated by the author)

Codes		Sub-themes
Over control	Top-down system	Absolute power on decision-making and lack of public participation
Government-led	Political goals	
Policy-taker	Missing information	
'Walk on the old road'	Step by step	Lack of flexibility in the existing governance system
Non-green		
GDP	Political priority	Lack of long-term monitoring
Long-term interests		
Vertical and horizontal levels	Overlapped requirements	Conflicts within different government departments
Government investment system	Monopolistic supplier	Strong control over land resources
Corporations with local governments		
Public participation	Policy making process	Developers' suggestions

Table 6.6 Code framework for shaping theme of 'Constraints of the green housing transition at the level of 'institutional environment'' (illustrated by the author)

With a similar process, the sub-themes were grouped to create themes of this research. The codes and sub-themes were finally categorised into three different themes as they related to the research questions and the conceptual framework which can be seen from Table 6.7:

	Themes	Addressing question	Sub-themes
1	Developers' behaviours towards the green housing transition	5	Changing to green development concepts
			Producing green strategies for their enterprises
			Balancing costs and benefits
			Balancing government requirements and consumer demand
			Building brands
			Coordinating market resources
			'Cheating' in practices
2	Constraints on the green housing transition at the level of 'institutions which govern transactions'	6&7	Supply-demand imbalance in the Chinese housing market
			Lack of consumer demand for green housing
			Fragmented structure of the supply chain for the green housing transition
			Inefficiency of green housing policy instruments
			Inefficiency of Evaluation Standard for Green Building (ESGB)
			Developers' suggestions
3	Constraints on the green housing transition at the level of 'institutional environment'	6&7	Absolute power on decision-making and lack of public participation
			Lack of flexibility in the existing governance system
			Lack of long-term monitoring
			Conflicts within different government departments
			Strong control over land resources
			Developers' suggestions

Table 6.7 Summary of research themes and sub-themes for the following empirical analysis (illustrated by the author)

The first theme addresses developers' behaviours on green housing development (Research Question 5); the second explores the institutional constraints faced by the developers at the 'institutions that govern transactions' level (Research Question 6); the third assesses the institutional constraints faced by the developers at the 'institutional environment' level (Research Question 6); and the data in the second and third themes also include policy suggestions provided by developers (Research Question 7).

6.5 Ethical considerations

A variety of ethical issues were considered within the research. First of all, related to the value-laden and political nature of the research itself, Davies (1999, p.61) points out:

'research cannot be value neutral, ... the vast majority of research that does not have an explicit value commitment does in fact have an implicit value orientation and political position in support of the status quo of existing power relationships.' It is an important ethical consideration, therefore, that the research process was conducted with this in mind, and that any normative values are apparent in research findings and results.

Moreover, informed consent for their contribution to the research was gained from all the research participants by using participant information sheets and consent forms. The right of all participants to opt out of the research at any point was made clear in the documents. In addition, the views of interviewees were anonymous and were represented in a fair and accurate manner in the writing up of the thesis.

6.6 Summary

In summary, this chapter has addressed Research Question 3: 'What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?' A mixed methodology approach was adopted using both quantitative (questionnaire survey) and qualitative (semi-structured interviews and work placement) methods. Despite having markedly different functions, the overarching aspiration of analyses by both quantitative and qualitative methods was systemic in nature aiming to investigate developer responses in relation to the green housing transition by evaluating Chinese developers' attitudes (through the questionnaire survey) and their behaviours (through the interviews); and the transition constraints toward green housing development (through interviews and work placement). The following chapters provide the empirical analysis of data collected in this research, starting with the results of the questionnaire survey which mainly reflect Chinese developers' attitudes towards the green housing transition.

Chapter 7. Developers' attitudes towards the green housing transition in China

7.1 Introduction

This chapter focuses on analysing the data collected from the questionnaire survey in order to provide a broader view of Chinese developers' attitudes to the green housing transition in China. First, it provides the respondents' background information. Secondly, it analyses the developers' perspectives on market trends in green housing development in the Chinese housing market. Thirdly, it analyses their perspectives on the most important barriers /drivers / incentives relating to building green housing. The data on barriers / drivers / incentives is evaluated for both the current situation and in the future (the next 10 years) because these provide an indication of how developers' attitudes could be shifted towards the future green housing transition. The chapter addresses Research Question 4: 'What are Chinese developers' attitudes towards the green housing transition?' The findings from the questionnaire survey also provide support for questions asked in the interviews.

7.2 Respondents' background information

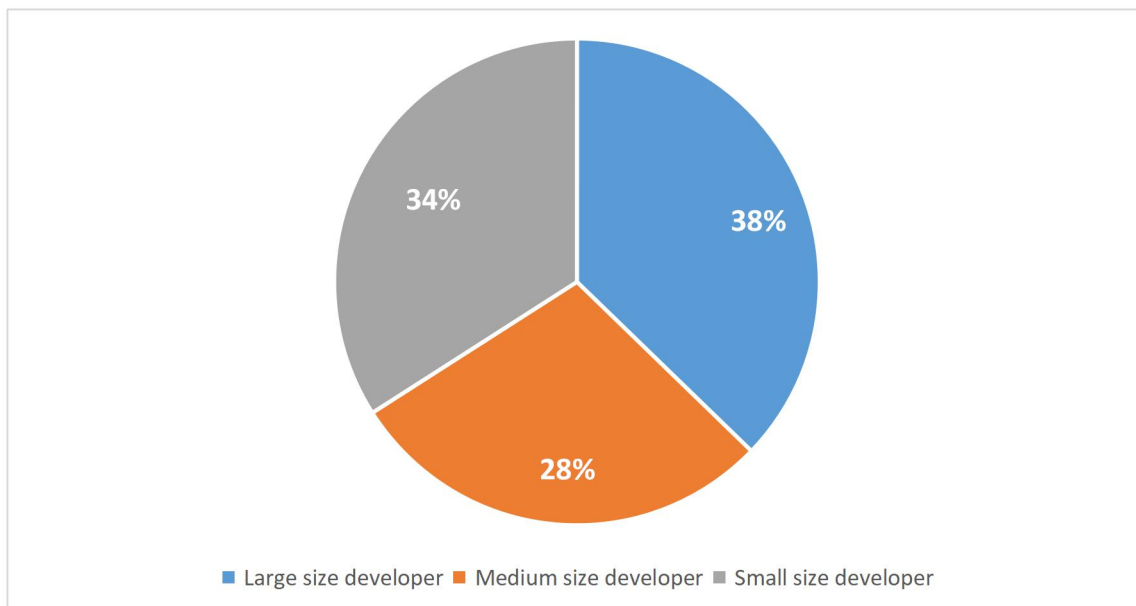


Figure 7.1 The percentage of different size companies in the survey (illustrated by the author)

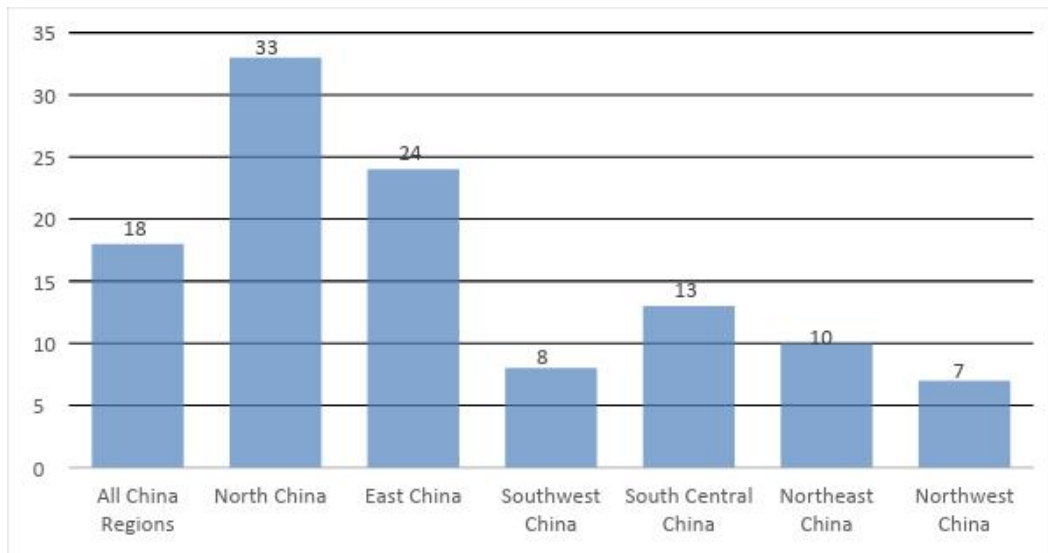


Figure 7.2 Geographical distribution of companies' operations in numbers (illustrated by the author)

A total 92 valid questionnaires were received from Chinese developers. Figure 7.1 shows the percentage of the sizes of respondents' companies: 35 from large size developers, 26 from medium size developers, and 31 from small size developers. These developers mainly operate their housing construction projects in North China, East China or All China regions (Figure 7.2), and shows that the housing market is more active in North and East China (Li and Shui, 2015; Li et. al, 2014).

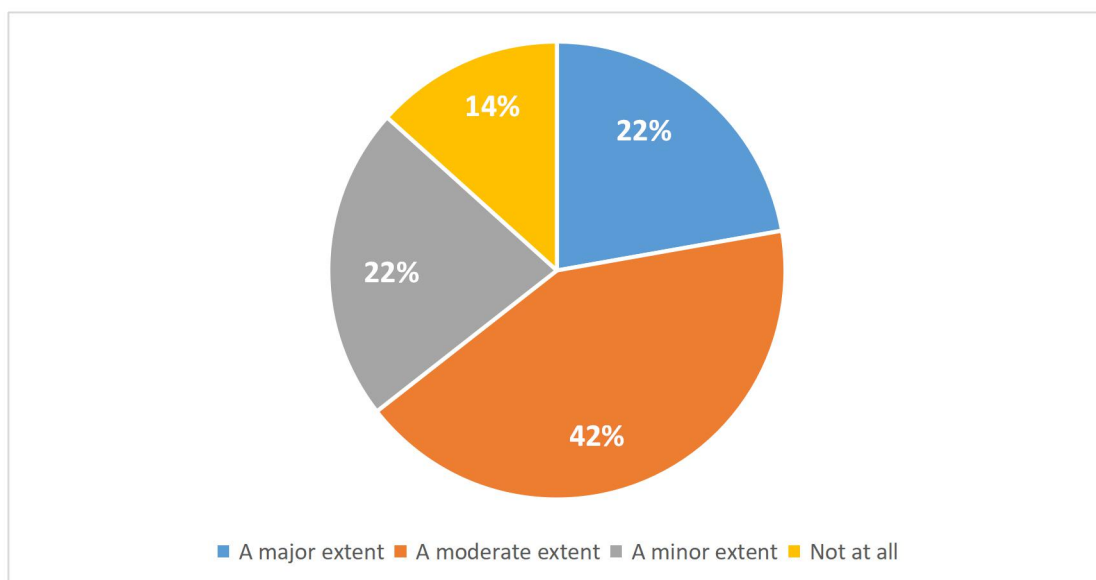


Figure 7.3. To what extent have respondents been involved in green housing development (illustrated by the author)

Respondents were also asked to what extent their companies had been involved in designing and developing green housing in the last 10 years. About 86% of respondents had some involvement in designing and constructing green housing projects. This might be because developers who had been involved in constructing green housing were more willing to complete the questionnaire, which needs to be taken into account as a limitation of the research (see Figure 7.3).

7.3 Market trend in green housing development

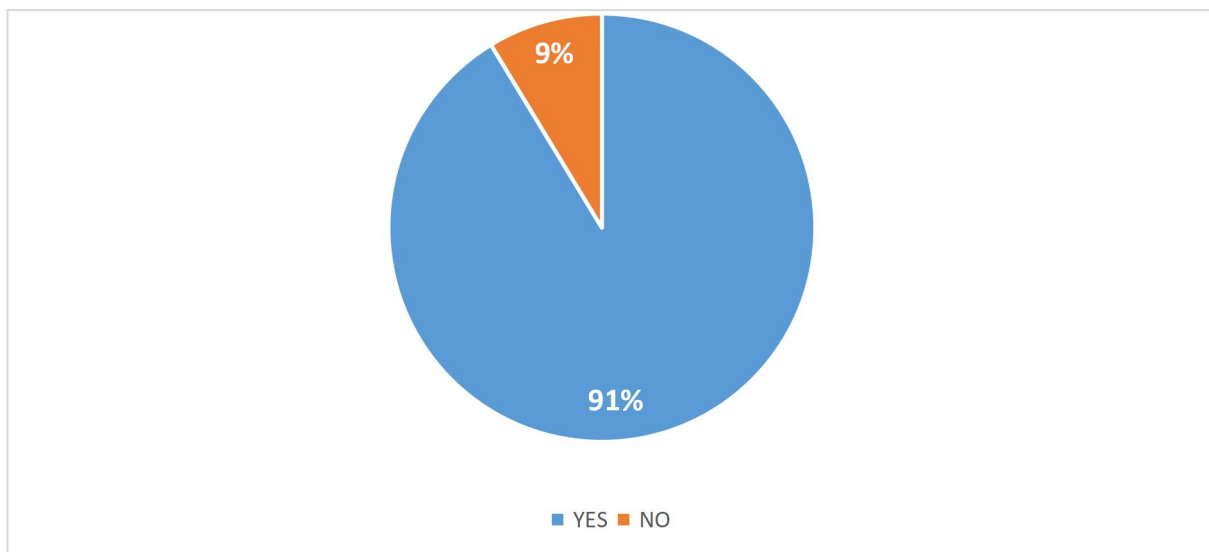


Figure 7.4 The percentage of respondents believing that green housing will become a main trend in the market (illustrated by the author)

Figure 7.4 shows that about 91% of the respondents believed that green housing would become a main building trend in China's future housing market. During the interviews, many of the interviewees also mentioned this future market trend, and some of them believed that green housing development had already become the main trend in the Chinese housing market. The reasons why the developers believed green housing would become a main trend and how they could achieve it will be discussed in more detail when analysing the interviews in the following chapters.

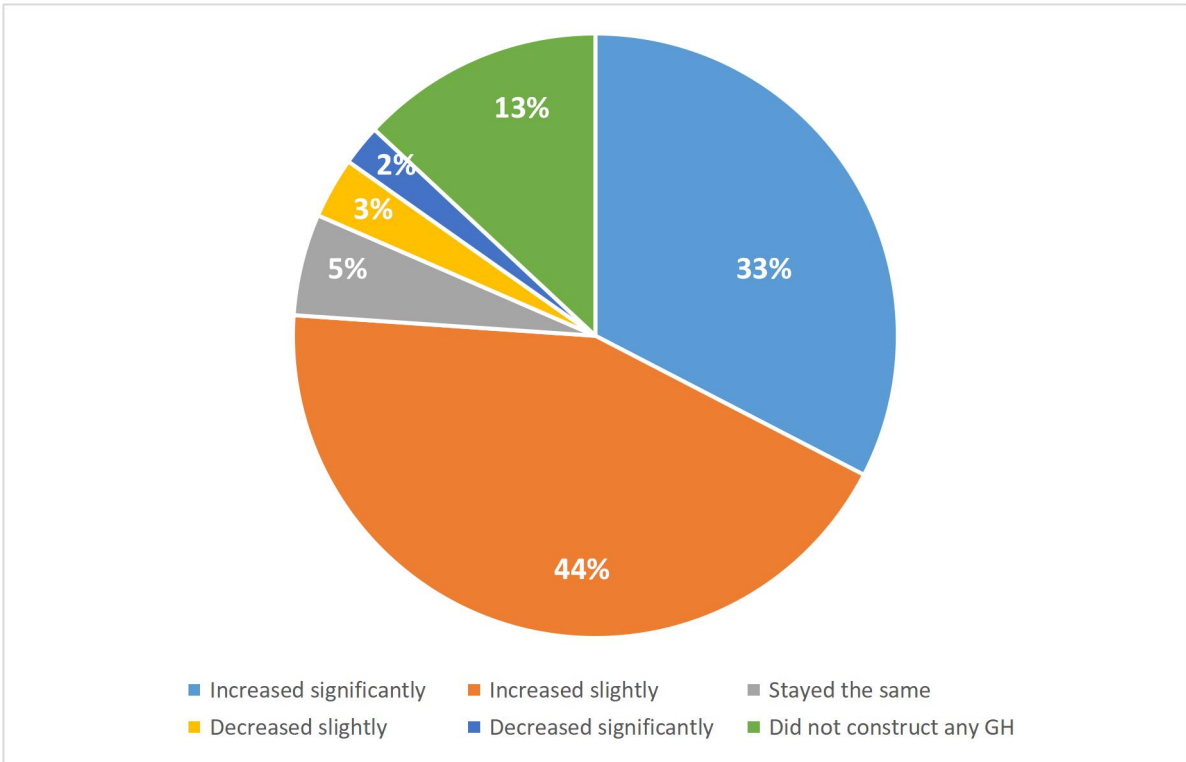


Figure 7.5 Trends in green housing development over the past 10 years (illustrated by the author)

In order to continue exploring developers' ideas on trends in green housing development, respondents were asked: 'Has the number of green housing units completed by your company changed over the past 10 years?'; and 'To what extent do you think the number of green housing unit completions by your company will change in the next 10 years?' Figure 7.5 and Figure 7.6 respectively show the results for these two questions. Figure 7.5 shows that about 33% of the respondents had chosen to significantly increase their green housing projects development over the past 10 years; while 44% of the respondents had slightly increased their green housing projects. However, about 5% of the respondents wanted to decrease their green housing projects slightly (3%) or even significantly (2%).

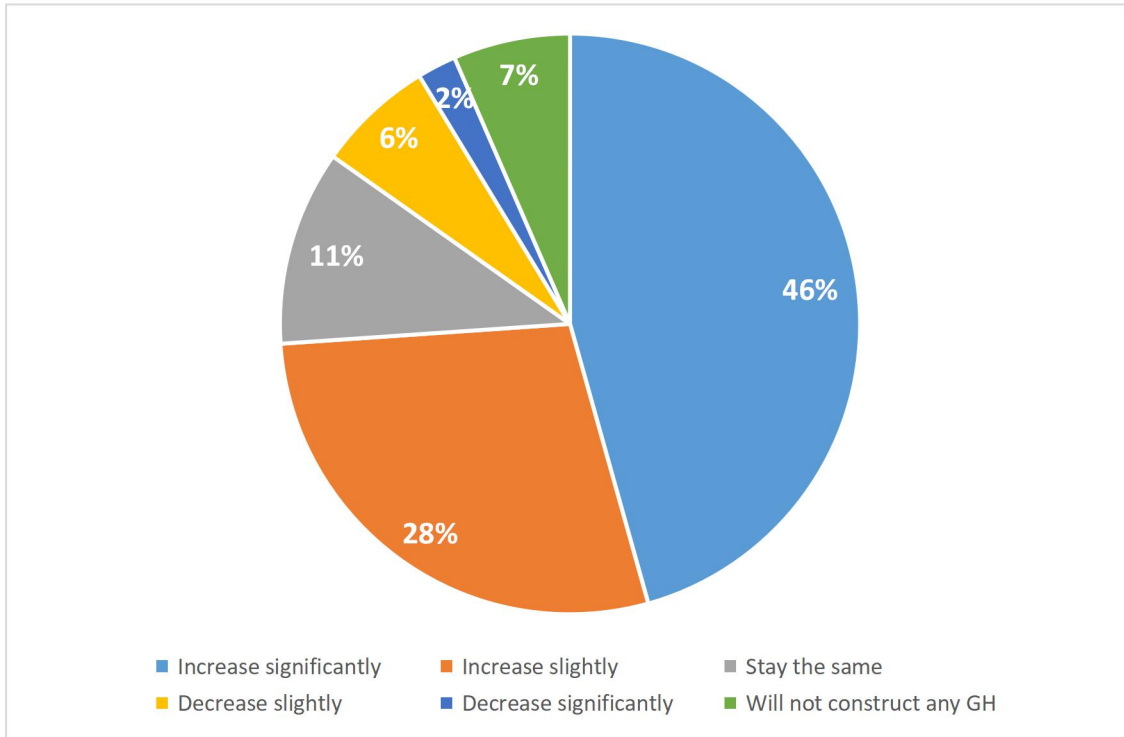


Figure 7.6 Trend in green housing development in the next 10 years (illustrated by the author)

These opinions were little different for the next 10 years (Figure 7.6). The percentage of developers who chose to significantly increase their green housing construction rose from 33% to 46% while around 28% would slightly increase green construction. This might be because, as developers improve their green housing development skills and knowledge, they may think that any further changes will only be ‘slight’ because they have already made ‘significant’ changes in the previous 10 years. The opposite situation appears to be true as well. The percentage of developers who chose not to construct any green housing decreased from 13% to 7% indicating that more developers think they will change their building activities from traditional development to green housing development in the next 10 years. However, it is interesting to see that 3% more developers wanted to decrease their green housing projects slightly or even significantly in the next 10 years, from 5% to 8%. If 91% of the respondents believed that green housing development would become a main trend in the future, why do more developers choose to give up on the transition? This question was asked during the interviews and will be discussed in the following chapters.

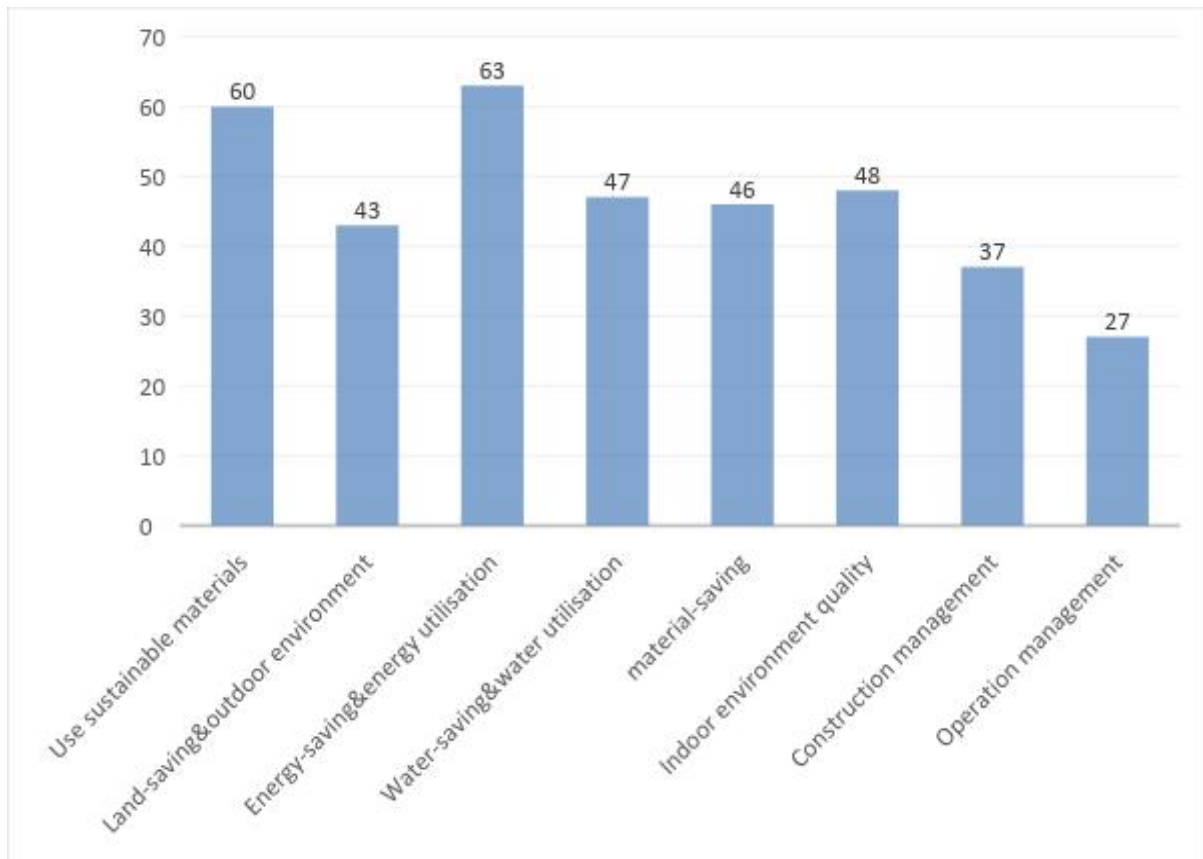


Figure 7.7 Key features of green housing development considered by developers (illustrated by the author)

Developers were asked what they perceived to be the most important features when developing a green housing project. Based on the ESGB (2014) settings, eight different features were chosen. Figure 7.7 shows respondents' attitudes to each feature. The most important features of green housing development they focused on were: energy-saving and energy utilisation (63 respondents); use of sustainable materials (60 respondents) and indoor environment quality (48 respondents). They were less concerned about how to achieve being 'green' during the housing construction stage (37 respondents) and operation stage (27 respondents). As can be seen from the data, the respondents only paid attention to physical 'housing' but did not see green housing from a whole-life-cycle view. This finding also supports the existing literature which reveals that the construction and operation phases of green housing development have been overlooked (Kesidou and Sorrell, 2018). The reasons why developers place more focus on the planning and design phase but overlook the construction process and later operation stages will be discussed in the analysis of the interviews.

7.4 Key drivers of the Chinese green housing transition

This section addresses the question of how developers think about the key drivers of green housing development in China, both in the current situation and in the next 10 years. The results are shown in Table 7.1 and 7.2 and reveal a range of market, technological, policy and financial factors driving developers towards green housing development in China.

Drivers	Type ^a	1 ^b	2	3	4	5	Mean	Ranking
Increases company reputation and competition ability	M	1.1	14.1	16.3	29.3	39.1	3.91	1
Introduced greener technologies	T	7.6	15.2	18.5	31.5	27.2	3.55	2
Government mandatory regulations and policies	P	12.0	16.3	10.9	31.5	29.3	3.50	3
Increased customers' demand	M	9.8	16.3	17.4	27.2	29.3	3.50	3
Government incentive regulations and policies	P	13.0	14.1	23.9	22.8	26.1	3.35	5
More easier to get land from bidding	M	10.9	17.4	20.7	32.6	18.5	3.30	6
Greater return on capital	F	15.2	16.3	21.7	21.7	25.0	3.25	7
Attract more investment	F	15.2	17.4	18.4	29.3	19.6	3.21	8

Table 7.1 Current key drivers for green housing development in China (illustrated by the author)

^a M=market factors, T=Technological factors, P=Policy factors, F=financial factors.

^b Likert Scale Values (%): 1= Not a driver, 2= slight driver, 3= moderate driver, 4=significant driver, 5= very significant driver

Drivers	Type ^a	1 ^b	2	3	4	5	Mean	Ranking
Increases company reputation and competition ability	M	1.1	4.3	19.6	34.8	40.2	4.09	1
Government incentive regulations and policies	P	0	7.6	19.6	33.7	39.1	4.04	2
Government mandatory regulations and policies	P	1.1	7.6	17.4	38.0	35.9	4.00	3
Introduced greener technologies	T	1.1	7.6	21.7	33.7	35.9	3.96	4
Increased customers' demand	M	3.3	6.5	19.6	33.7	37.0	3.95	5
Greater return on capital	F	16.3	14.1	34.8	30.4	16.3	3.71	6
Easier to get land from bidding	M	17.4	20.7	28.3	29.3	17.4	3.61	7
Attract more investment	F	12.0	25.0	29.3	26.1	12.0	3.54	8

Table 7.2 Key drivers for green housing development in China in the next 10 years (illustrated by the author)

^a M=market factors, T=Technological factors, P=Policy factors, F=financial factors.

^b Likert Scale Values (%): 1= Not a driver, 2= slight driver, 3= moderate driver, 4=significant driver, 5= very significant driver

As can be seen from Table 7.1, the top four current drivers of green housing development were: 'increases company reputation and competition ability'; 'Introduced greener technologies'; 'Increased customers' demand' and 'Government mandatory regulations and policies'. Table 7.2 shows the ranking of drivers in the next 10 years from the developers' point of view. The top three drivers of green housing development in the next 10 years are

seen to be: 'Increases company reputation and competition ability'; 'Government incentive regulations and policies' and 'Government mandatory regulations and policies'. 'Company reputation and competition ability' was the most important driver for developers to build green houses and this answer stayed the same for the next 10 years. The data support the existing literature which shows that the desire for good image and reputation can affect a company's commitment to green building (Andelin et al., 2015; Zhang et al., 2018). In this case, Chinese developers believe that establishing a 'green developer' image is necessary for companies to improve their market competitiveness and survive in the industry.

'Government mandatory regulations and policies' were seen as another key driver for developers to build green housing. This finding reflects the deep value in China of 'planning' by the government as an important mechanism for shaping the market according to the needs of the state and the general public (Wu et al., 2015), especially for the Chinese housing market since the move from planned economy to market economy in the last four decades (Section 4.2). However, the responses show that in the next 10 years, 'government incentive regulations and policies' become increasingly important for developers, shifting from sixth ranking to second ranking (Table 7.2). Developers seem to believe that they would be driven more by government incentives to build green housing in the future.

In contrast, the three least important drivers were 'greater return on capital'; 'easier to get land from bidding'; and 'attract more investment' and the situation was quite similar in the next 10 years. This reveals that financial drivers were less important to developers. They did not believe that green housing projects would bring more return on capital or attract more investment. This is likely because of the higher upfront costs for developers to develop green housing (Mousa, 2015), as well as the investment and financing platform imperfections as no investment and financing platform directly targets green housing projects in the Chinese housing market (Li and Shui, 2015). In addition, developers did not think that green housing development could help them to acquire land for development. One explanation could be that the influential factors for acquiring land are complex and building 'green' is not a key factor when developers are bidding for land.

'Introduced greener technologies' were shifted from second to fifth ranked drivers and 'increased customers' demand' shifted from third to sixth in the next 10 years. For

developers, these two factors reduced in importance as key drivers in the future market. This might be because they believe that during the green housing transition in China, green technologies would be introduced into the market and greater public acceptance of green housing products would be achieved in the following decade.

7.5 Key barriers of the Chinese green housing transition

This section addresses the question of how developers think about the key barriers to green housing development in China, both in the current situation and in the next 10 years. The results are shown in Tables 7.3 and 7.4 and, like above, reveal a range of market, technological, policy and financial factors that developers perceived as barriers towards green housing development in China.

Barriers	Type ^a	1 ^b	2	3	4	5	Mean	Ranking
Higher technology costs	F	3.3	13.0	19.6	33.7	30.4	3.75	1
Higher material costs	F	4.3	15.2	17.4	32.6	30.4	3.70	2
Higher costs for training employees	F	2.2	16.3	21.7	37.0	22.8	3.62	3
No uniform solution of green housing standard	P	6.5	17.4	14.1	40.2	21.7	3.53	4
Lack of skilled employees	T	3.3	17.4	21.7	38.0	19.6	3.53	4
Lack of availability of green technologies	T	2.2	16.3	25.0	41.3	15.2	3.51	6
Insufficient technical knowledge and tools	T	3.3	17.4	28.3	35.9	15.2	3.42	7
Unclear building regulations	P	6.5	25.0	19.6	32.6	16.3	3.27	8
Lack of household awareness	M	9.8	18.5	27.2	33.7	10.9	3.17	9

Table 7.3 Current key barriers to green housing development in China (illustrated by the author)

^a M=market factors, T=Technological factors, P=Policy factors, F=financial factors.

^b Likert Scale Values (%): 1= Not a barrier, 2= slight barrier, 3= moderate barrier, 4=significant barrier, 5= very significant barrier

Barriers	Type ^a	1 ^b	2	3	4	5	Mean	Ranking
No uniform solution of green housing standard	P	8.7	12.0	19.6	43.5	16.3	3.47	1
Unclear building regulations	P	9.8	16.3	16.3	42.4	15.2	3.37	2
Higher technology costs	F	13.0	12.0	19.6	35.9	19.6	3.37	2
Insufficient technical knowledge and tools	T	6.5	18.5	22.8	38.0	14.1	3.35	4
Higher costs for training employees	F	9.8	16.3	21.7	38.0	14.1	3.30	5
Higher material costs	F	15.2	13.0	19.6	32.6	19.6	3.28	6
Lack of skilled employees	T	10.9	15.2	22.8	38.0	13.0	3.27	7
Lack of availability of green technologies	T	8.7	20.7	20.7	37.0	13.0	3.25	8
Lack of household awareness	M	15.2	13.0	16.3	45.7	9.8	3.22	9

Table 7.4 Key barriers to green housing development in China in the next 10 years (illustrated by the author)

^a M=market factors, T=Technological factors, P=Policy factors, F=financial factors.

^b Likert Scale Values (%): 1= Not a barrier, 2= slight barrier, 3= moderate barrier, 4=significant barrier, 5= very significant barrier

Table 7.3 shows that currently, the top three most serious barriers to green housing development were seen to be 'higher technology costs', 'higher material costs' and 'higher costs to training employees'. These three barriers were predominantly financial factors. However, this result formed a strong contrast with key drivers for green housing since financial factors were least significant drivers shown in Table 7.1. The research indicates that developers are currently experiencing financial pressures when developing green housing in China, and these financial pressures could be exacerbated due to the lack of capital return. However, in the future, the financial factors are shown to become less important due to the expected development of green technologies and lower costs of green materials. For example, as can be seen from Table 7.4, 'higher technology costs' declined in ranking from first to third; 'higher material costs' declined from second to seventh; and 'higher costs for training employees' shifted from third to sixth, which implies that developers expect the cost of production to decrease over time which may ease the burden of the current barriers they face.

Table 7.4 represents that, from the developers' points of view, the three most serious barriers to green housing development in the next 10 years are: 'no uniform solution of green housing standard'; 'higher technology costs'; and 'unclear building regulations'. Two policy factors shifted to the top three barriers in the future: 'no uniform solution of green housing standard' shifted from fourth to second; and 'unclear building regulations' from eighth to second. This seems to imply that developers may have less confidence in policy makers since they think that the policy efficiencies are unknown, and the current green housing standard and regulations are not clear or uniform enough for market actors to implement.

The least serious barrier was 'lack of household awareness'. This opinion stayed the same for both the current and the future housing market. Compared with the key drivers shown in Tables 7.3 and 7.4, 'increased consumers' demand' were in the middle-to-upper ranking at third and fifth respectively. This seems to imply that developers think consumer demand for green housing is an 'icing on the cake', but if there is a lack of consumer demand

currently and in the next 10 years, it would not constrain them from building green housing. However, the fact that this market factor is not seen as a barrier for the developers reflects that fact that green housing development is still in the exploration stage in China, and not perfectly implemented through the housing market. Instead, the changes in developers' attitudes are more constrained by financial factors in the short term and policy factors in the long run.

7.6 Key incentives for the Chinese green housing transition

This section addresses the question of how developers think about the key incentives of green housing development in China, both in the current situation and in the next 10 years. The results are shown in Table 7.5 and 7.6 and reveal a range of market, technological, policy and financial factors. The investigation of developers' ideas about key incentives helps to define the potential policy recommendations for the policymakers and address Research Question 7: 'How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?'

Incentives	Type ^a	1 ^b	2	3	4	5	Mean	Ranking
Reduce the cost of green technologies	F	4.3	18.5	10.9	38.0	28.3	3.67	1
Increased company marketability and industry reputation	M	2.2	19.6	16.3	41.3	20.7	3.59	2
Development of a uniform Code or standard for green housing	P	6.5	19.6	18.5	23.9	31.5	3.54	3
Simplified carbon regulations in building sector	P	6.5	18.5	18.5	33.7	22.8	3.48	4
Reduce the cost of green materials	F	9.8	21.7	10.9	31.5	26.1	3.42	5
Increase public advertise of green housing	M	7.6	18.5	26.1	25.0	22.8	3.37	6
increased green housing technology or knowledge share	T	8.7	23.9	15.2	29.3	22.8	3.34	7
More research to produce green technologies	T	7.6	23.9	15.2	38.0	15.2	3.29	8

Table 7.5 Current key incentives for green housing development in China (illustrated by the author)

^a M=market factors, T=Technological factors, P=Policy factors, F=financial factors.

^b Likert Scale Values (%): 1= Not an incentive, 2= slight incentive, 3= moderate incentive, 4=significant incentive, 5= very significant incentive

Incentives	Type ^a	1 ^b	2	3	4	5	Mean	Ranking
Development of a uniform Code or standard for green housing	P	0	5.4	13.0	40.2	41.3	4.17	1

Reduce the cost of green technologies	F	1.1	7.6	12.0	37.0	42.4	4.12	2
Reduce the cost of green materials	F	3.3	8.7	15.2	30.4	42.4	4.00	3
Simplified carbon regulations in building sector	P	2.2	6.5	17.4	39.1	34.8	3.98	4
Increased green housing technology or knowledge share	T	2.2	5.4	17.4	42.4	32.6	3.98	4
Increase public advertise of green housing	M	1.1	5.4	20.7	42.4	30.4	3.96	6
Increased company marketability and industry reputation	M	2.2	2.2	21.7	46.7	27.2	3.95	7
More research to produce green technologies	T	2.2	3.3	20.7	45.7	28.3	3.95	7

Table 7.6 Key incentives for green housing development in China in the next 10 years (illustrated by the author)

^a M=market factors, T=Technological factors, P=Policy factors, F=financial factors.

^b Likert Scale Values (%): 1= Not an incentive, 2= slight incentive, 3= moderate incentive, 4=significant incentive, 5= very significant incentive

The data in Table 7.5 shows that currently, the top three most important incentives for green housing development were: ‘reduce the cost of green technologies’; ‘increased company marketability and industry reputation’ and ‘development of a uniform Code or standard for green housing’. In the next 10 years, the top three most important incentives for green housing development become ‘development of a uniform code or standard for green housing’; ‘reduce the cost of green technologies’ and ‘reduce the cost of green materials’ (Table 7.6).

Although the respondents saw the current high costs of developing green housing as the most influential barrier (Section 7.5), as can be seen from Table 7.5, ‘reduce the cost of materials’ does not appear to be very important. This implies that most of the current green housing projects are demonstration projects, in which the developers are considering market reputation rather than the financial benefits green housing could bring to them. However, if they want to build green housing on a large-scale in the future, developers still need to take the costs into consideration.

In contrast, ‘increased company marketability and industry reputation’ shifted from second to seventh in the next decade, even though the key drivers show that ‘increases company reputation and competition ability’ was the most important driver for developers to build green housing projects. The incentives from this market factor appear to become less important which implies that developers would shift their attitude since that because they

assume/predict that green housing will become a general market trend, there would not be as much differentiation between green and non-green companies in terms of market competition.

In fact, as shown in Table 7.6, all the mean values of all incentive factors fall between 3.95 and 4.17, which indicate that developers think there are no big differences between the various incentive factors. All the factors are equally important for them to develop green housing in the future. Nevertheless, the policy incentives and financial incentives were slightly less important compared with incentives from market and technological perspectives.

7.7 Summary

This chapter has addressed Research Question 4: ‘What are Chinese developers’ attitudes towards the green housing transition?’ The empirical evidence reveals that respondents have recognised that green housing is likely to become one of the mainstream trends in future in the Chinese housing market. Indeed, a majority of them have changed, or are changing, their attitudes towards the green housing transition in China.

However, their attitudes are influenced by different factors from a variety of perspectives. Moreover, the key drivers/barriers/incentives considered by the developers also differ between the current situation and in the future. Some attitudinal changes have been revealed from the data analysis. Currently, developers are more driven to develop green housing by ‘increased company reputation’. However, they are struggling with the high costs of green housing development in the short run. If the current high costs, especially technology costs, could be reduced, they might be more willing to change towards green housing development. Company reputation is still seen to be the most important driver for developers to build green housing in the future. Policy factors are likely to become more and more important in influencing their attitudes since policy factors in all the drivers/barriers/incentives results moved to higher rankings. Although the respondents are pushed by green housing policies and regulations, they feel uncertainty due to a lack of confidence in current green housing policies and regulations implemented by the government. Thus, how, and to what extent the green housing policies and regulations

might be changed, can have a great degree of influence on developers' attitudes to the green housing transition.

In summary, this chapter has analysed the data collected from the questionnaire survey in order to provide a broader view of Chinese developers' attitudes to the green housing transition in China. Some of the quantitative data from the questionnaire could not be explained only with numbers and will be further discussed in more detail in the following qualitative analysis chapters. The next chapter addresses Research Question 5 to explore the developers' behaviours towards the green housing transition in China.

Chapter 8. Developers' behaviours towards the green housing transition in China

8.1 Introduction

As discussed in Chapter 4, although the Chinese government's efforts are to push forward the green housing transition, whether this policy transition could be smoothly incorporated into the housing market largely depends on developers' responses. Based on the survey results discussed in the last chapter, the research revealed that, generally, developers have a positive attitude to green housing development and believe that green housing will become a mainstream trend in the future market. However, attitudinal studies do not tell us whether developers actually behave in the way they said they do. Such studies need to be complemented by studies of the actual outcomes of purported behaviour (Payne, 2009). It is interesting that in interviews, developers admitted that the traditional developers' building behaviours were not in line with green housing development. Thus, exploring developers' behaviours in green housing transitions is essential since a behavioural study provides a framework for investigating market adoption processes in which complexity, contingency and real-world constraints can be understood (Cars et al., 2002).

In previous research, developers' behaviours have been often overlooked in environmental policy (Rajkovich and Diamond, 2010) and under-explored in green housing research (Schweber and Leiringer, 2012). In the light of the Chinese government's policies for the green housing transition, the research explored which behaviours have changed and which have remained, and in each case, why had that happened.

Therefore, after analysing the developers' attitudes towards the green housing transition in a broader way based on the questionnaire results, this chapter mainly focuses on exploring in some detail and depth, developers' behaviours towards the green housing transition in China. In doing so, this chapter addresses Research Question 5: 'What are Chinese developers' behaviours towards the green housing transition?' From the interviews, seven 'developer behaviours' were identified: 'changing to green development concepts'; 'producing green strategies for their enterprise'; 'balancing costs and benefits'; balancing government requirements and consumer demands'; 'building brands'; 'coordinating market

resources'; and 'cheating in practices'. This chapter provides a detailed analysis of each type of behaviour.

Moreover, although the interviews did not target specific type or size of developers, and the behaviours were identified in general, differences in behaviours from medium and large; state-own and private developers were identified in the research. The major differences will be acknowledged in the following sections.

8.2 Changing to green development concepts

First of all, behaviour is influenced by an individuals' worldview (Hall and Taylor, 1996). Thus, one of the essential factors which affects whether the developers are actively changing their practices is the development concept adopted by the whole enterprise, especially the enterprise leaders' concept of green housing development. In other words, do the leaders think it is worth doing for itself or because it is a mainstream trend in the future market? The interviews revealed that the leaders' concepts directly influenced the development direction of the enterprise its and development activities. As one of the developers stated:

The key is the people's understanding: [do you take] an environmental point of view, or a price point of view? If the leader thinks more about the price, he may rule out the better technologies [Developer A].

However, the concepts and practices of green housing are currently unevenly taken up by different types of developers. A few pioneering developers had long-term visions and had started to think about developing green housing even before the Chinese government issued green housing policies or regulations:

Our boss is far-sighted because our company started to consider green housing since we were established in 2000. At that time, there was no 'green housing' in China. But our boss believed that it is a good thing for the whole society, [and that] one-day sooner or later, our architecture and our life should be 'green' [Developer E].

Developer E indicates that green housing development was very difficult for developers to spontaneously consider 10 years ago. This is because green housing policy had not been introduced and thus, the market and society had not established 'green' circumstances at

that time. However, the situation is changing, driven by multi-perspective factors. Many of the top developers said in interviews that they were actively transforming their thoughts:

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 [Developer 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 [Developer G].

From the point of view of a green developer, transition is not a technical issue but more like a world-view issue. However, those developers who have such a sustainable world-view are relatively rare in the Chinese housing market. Most developers need to be pushed to change their ideas by external factors such as policies or competitors' actions. As a respondent from one state-owned enterprise said:

...a 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 [to develop green housings]. In my position, I do not feel that [green transition is] going smoothly, unless the government asks us to do so [Developer D].

This point of view was also supported by respondents from some middle size companies, for example:

I think the changes [to green concepts] do not rely on internal factors, but external factors... Apart from top developers, most of us are relatively passive [Developer Q].

However, respondents from large and advanced development enterprises did not agree with this opinion: they believed that the developers themselves needed to increase their environmental responsibility for the society. When asked if government policies affected business concepts and development behaviours, several replied that their concepts for green housing development were more ambitious than the policy implications:

I think this [lack of clear policy] is an excuse. This is not the root of the problem at all. The root question is whether you have a concept of sustainable development or not. If not, then you design a project only for making money... There is lack of

conditions to be able to talk with those kind of developers about green housing [Developer A].

Actually, I think it [green housing transition] should not be pushed by policies, because when the policy affects your behaviour, it means that your company is not responsible, it is the government who take all the responsibilities. We hope to promote [green housing transitions] in advance of the government, we like this logic [Developer F].

From these particular interviewees, it could seem that many developers are transforming their ideas in a greener direction that might influence their building practices. However, this idea was only held by respondents from large and advanced development enterprises. In fact, the number of developers with such green ideas is still very low at the current stage.

8.3 Producing green strategies for their enterprise

Previous literature shows that some large and advanced Chinese development companies have published corporate social responsibility (CSR) annual reports on their websites and included 'green' as one of their business strategies (see Section 4.3.3). During the interviews, many respondents from large companies mentioned that they had produced, or were in the process of producing, their own business strategies to guide the enterprise in a green direction:

In the top 100 developers, more than half of us have issued CSR reports, especially those top developers who have already identified the core concept and use it as a core value in their strategies [Developer R].

However, as Developer B pointed out, developers' had different starting points for producing CSR reports:

Because our company was listed in Hong Kong, in accordance with the requirements of the Hong Kong Exchanges and Clearing, we need to provide CSR reports. But the system and laws in this area is not so perfect in mainland China, [and] many housing companies in mainland China do this voluntarily... [Developer B].

Developer A gave another point of view for why they published their CSR reports:

We released this report to reflect our corporate social responsibility and make information more transparent... [Developer A].

In mainland China, the release of CSR reports is not currently a mandatory requirement. There is no uniform standard or regulations to guide developers to produce CSR reports, the information released by different developers lacks comparability, and the authenticity of the information cannot be guaranteed. More specifically, there are many differences in the information voluntarily promulgated by developers. In the interviews, most of the respondents discussed the contributions made by CSR reports to shareholders' equity, employee rights and interests, consumer rights and environmentally friendly ideas: 'green development' was only one part of a CSR report.

Only a few of the green developers stated that how to achieve green transition was a priority strategy. For example, developer A mentioned that:

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 [Developer A].

Some interviewees described what they have done in order to achieve their green strategies:

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 [Developer I].

We have set up a special green strategy research group to promote related work, and issued our "Green Energy-Efficient Building Management System". And we also conduct annual assessments of the energy-saving and emission reduction results of various departments and subordinate companies [Developer M].

As well as producing business strategies to guide the development direction for the whole enterprise, some small companies produced their own green housing development standards to guide housing design and construction:

Our own standard is actually higher than the national standard. We did research on LEED in the US and BREEAM in the UK at that time, and based on those very

advanced international green housing standards, our starting point is very high [Developer F].

Indeed, some of large developers had gained benefits from producing green business strategies or adopting green standards, because they had the ability to change market rules and could ask the government to produce special incentive policies for them:

... Some large enterprises produce standards themselves; they want to run in front, everyone has to follow... XXX [major green housing developer] engages in, in accordance with the government, and finally it can get those policies. For example, it can apply for 3% [construction] area incentives. That is what they want, tailored specifically to them [Developer B].

However, again, a green strategy is only one part of most developers' business strategies, and only a few top green developers said 'green' was their major priority in business development and that they had gained real benefits from it. Most of the developers put 'green' factors into their development strategies in order to follow the trend of market transition. In most of the CSR reports, the advocacy role was greater than the actual operational role; the companies published their reports mainly to show their environmental credentials. There is not much information in the reports of real significance to the public or even to the developers themselves. The 'green' content tends to be reduced to a slogan in the report.

In addition, in terms of the CSR reports producing enthusiasm, the situation between large developers and middle-size developers were very different: almost no middle-size developers had produced or published their CSR reports, and a medium size developer explained that:

For companies like us ...the focus of work is more on capital return, we do not pay too much attention in this area... [Developer D].

Nevertheless, even in the major companies, there were conflicts of interest within the businesses since large developers had a variety of departments and branches with different aims and interests.

Any company's green building departments do not survive so well for the simple reason that what they do is a good thing for the society, but they do create some hassles for the company. For example, when it comes to purchasing, green

housing needs to buy green products ...[but] the procurement department people would say 'why do you need to buy something so expensive ...' [Developer B].

In summary, it is emphasised that the businesses culture commitments to green housing by the developers is really essential as part of making the transition to a green housing future. Previous Western studies show that developers' green strategies and the production of CSR could help developers increase their green awareness and regulate their practices when they design or construct housing projects (Wilkinson et al., 2008). However, this area is unfortunately far less advanced in China, especially in mainland China.

8.4 Balancing costs and benefits

Green housing transitions are dynamic and influenced by different factors (Section 5.3). During the process of green housing transitions, many developers explore the most appropriate and beneficial transformation path and want to find perfect balancing points for transitions. The most significant behaviour is essentially economic behaviour (Leung, 1987). Data from interviews in this research supports Leung's opinion since almost all the interviewees talked about the cost issues when considering green housing development. Costs were mentioned by the interviewees in relation to the early design stage (materials procurement, technology equipment, design and consultation, green label applications); the mid-term construction stage (hire construction team, construction risk control); and the later operational stage (equipment operations and maintenance). Developers were very concerned about green housing transitions from an economic cost point of view:

Anyway, green housing means spending money, applications mean spending money, technology means spending money, materials mean spending money. To expect developers not consider the costs...well... it is unrealistic [Developer G].

My work is dealing with costs, everyday - green things are expensive [Developer C].

At the same time, different types of developers also had different capacities for 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 [Developer I].

In contrast, smaller businesses experienced more 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 middle-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 [Developer E].

The interviews revealed that inexperienced developers found it extremely difficult to work out the cost changes that would take place during green housing development:

Big problem is that we simply do not know the requirements of the green housing, or what changes would happen to our costs [Developer E].

In this context, the 'requirements' presented in Developer E's comment do not just refer to the government's requirements for green housing, but also refer to market requirements that need to be considered by the developers, such as consumers' demand or peer competition. Indeed, green housing is a complex and emerging concept, its supply chain in the market is imperfect and uneven (Section 4.4). In addition, one change in costs was likely to cause many other cost changes and these challenges were more serious for small or inexperienced developers:

When the costs are not clear, the money is not controllable, and it will bring great difficulties to management decisions, so they [small or inexperienced developers] are afraid to make the decisions [Developer A].

Even large developers also mentioned that costs were always higher than they expected, and effectively controlling costs was very difficult.

For example, when some companies decide to apply [for the green labels], they want to buy green things from the beginning, and they think it may take about, let's say, 100 Yuan per square metre, but later they normally find it becomes more and more expensive, from 100 to 110, 120, 130... Anyway, 'green' will have to spend more money. As we all know, no matter how much it costs, it costs [Developer B].

Similarly, developers said that they did not get benefits from being 'green', especially not the monetary profits they expected from green housing construction. They commented that it could not be clearly and effectively seen which part of the benefits were gained by adding 'green' factors in housing.

It is difficult at this stage to say clearly how much profit green housing can bring to us because of the extra cost added, but buyers do not buy it [pay the extra price needed to cover the costs of green construction], and the government does not subsidise it, so this part of the cost needs to be borne by ourselves, let alone [making] profits. Maybe it will become clearer in the longer term [Developer G].

However, other developers believed that the costs of green housing development would gradually decrease because of improvements in the whole market, and the costs for materials and technologies will be much lower than today:

Like the production line of xxx [a green housing project they had previously developed], the extra cost per square metre will be 400 Yuan, because as we become more mature, you will find it costs less and less [Developer F].

Many respondents said that, in order to achieve a cost-benefit balance, they would balance the proportion of green housing and traditional housing in their whole range of development projects. Some interviewees stated that they would gradually increase the proportion of green housing in all their housing projects as part of the transition to green construction:

We definitely want to achieve green buildings in the end, but it also takes time. At present, we still retain a certain degree of traditional construction to cover the extra cost of green buildings [Developer P].

This is also supported by the findings of the survey, which showed that about 74% respondents chose to slightly increase their green housing projects (28%) or significantly (46%) in the next 10 years (Section 7.3).

Behind this number, some developers thought that their decisions were in fact directly related to the market trend: as stated in Section 8.4, green housing developments are more likely to be seen by developers as creating higher costs with no obvious benefits in the short term. It is certainly a risk for developers, as the following quote shows:

So in fact a lot of things are influenced by the market. Now some companies are also concerned about, but they must balance that point [quality and quantity of green housing projects], that is, all my house quality, or I may be pursuit of quality (refers to green housing projects) for a part, and pursuit of quantity (refers to traditional housing projects) for a part [Developer H].

Other developers thought that their decisions on how much green housing to develop were directly related to government policy orientation:

I think the main thing is the policy orientation. The current policy... gradually changed from incentive to compulsion. For example, for a One-Star label, all the housing must achieve one star, and now this is mandatory for all residential buildings. If you do not do this, it is illegal, in violation of policy [Developer B].

As can be seen from above two example responses, developers' building practices, whether for traditional or green housing, were influenced by different drivers. However, whether their decisions are based on the market or on policy, the overall behaviour of developers in increasing the proportion of green housing development was generally positive and active. One question arising here from the survey results is why about 9% respondents chose to decrease their green housing projects slightly (7%) or significantly (2%) in the next 10 years. This question was asked during the interviews, and developers explained that green housing might be just one of their companies' main projects; they would also plan to construct non-residential buildings such as public buildings or mix-used buildings. However, the proportion of green housing in all their *housing* projects would definitely be increased:

Nowadays, many large developers like us have more diverse projects. Housing is only one of them, and there are other public construction projects or complexes. So when it comes to future trends, there may be some developers who will transfer to developing other types of project [Developer I].

In summary, all the respondents who were developing green housing were looking for the most appropriate point to balance their capital investment and output. Some developers were more willing to invest in or accept more costs for green housing development and especially, those developers who had made money from 'green housing', who were more willing to increase investment in further green housing development or research. In addition, the main factors restricting developers from investing in green housing were the high-priced materials and technical applications. This issue may be improved when the supply chain becomes more mature in the future and could gradually transform developers' investment

behaviours. This indicates that when more profits can be made from green housing development, more developers are likely to invest in it.

8.5 Balancing government requirements and consumer demand

As discussed in Chapter 4, in the housing market, both government requirements and consumer demand for green housing can have a great degree of influence on developers' behaviour. During the interviews, respondents indicated that there was a conflict between government and consumers over how to understand 'green housing':

In the government's eyes, green housing is a tool for achieving carbon reduction targets. But consumers think that green housing is a product to meet their needs for day-to-day uses. In consumers' eyes, the 'green house' equates to the 'comfortable and healthy house' [Developer N].

More details of this point will be analysed in Chapter 9 when discussing developers' views of institutional constraints. Here, the interviews revealed that state-owned developers were more inclined to accomplish the government goals; they simply defined 'green housing' as meeting the requirements in the evaluation 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... As for green innovation, we may find ways to circumvent it. Anyway, the weighting of [of the innovation indicator in ESGB] is not very high. If you don't do it, you can still apply for it [green labels] [Developer H].

On the other hand, private developers were more likely to do more than just respond to the evaluation standards. They not only meet government requirements, but also considered consumer demands for green housing and tended to adjust their development decisions by analysing consumers' buying behaviours:

We are not like the state-owned enterprises that just complete the required part of the government documents. 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 [Developer A].

[Meeting government requirements] is more likely to obtain market access qualification, but we also need to make money [Developer Q].

This created a market phenomenon in which some developers had replaced part of the concept of 'green housing' with the idea of 'healthy housing'. They advertised their projects as 'green housing', while in fact, the concept of 'healthy housing' had been incorporated into it, as explained by Developer B.

Actually, they [a major green developer] 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 not. But they [the company] make money because of 'green' housing [Developer B].

Although green housing and healthy housing were defined differently (see Chapter 2), there is no right or wrong way if a developer changes development methods from healthy housing to green housing in order to meet what consumers demand. From a developer's perspective, this is an effective way to balance government requirements and consumer demand.

8.6 Building brands

Previous research has shown that developers would be more willing to actively participate in promoting green practices if they found that those practices could help them gain competitiveness in the market (Nurul Diyana and Abidin, 2013; Andelin et al., 2015; Zhang et al., 2011b; Azis et al., 2013; Shi et al., 2016). The questionnaire results for this research showed that developers chose 'increase company reputation and competition ability' as the most important driver for building green housing and this result was affirmative regardless of company size. It is thus important for the research to consider whether, or to what extent, green housing development could help developers to enhance their company brands and thus improve their market competitiveness.

The interviews indicated that situation of brand-building between larger developers and smaller developers was different. Large developers lead the development of the industry and were catalysts for market transition. There were many successful examples of large development companies' brand-building :

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

In contrast, most smaller developers were likely to be followers of brand building in the market. However, there were also a few smaller development companies which used green housing as a selling point to increase 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 [Developer J].

In the last project, the reason why we were able to get the land was because we promised a high standard of green building - we want to achieve 'small but good' [Developer N].

Another point is that although state-owned developers and private developers wanted to build a brand by developing green housing, their starting points were slightly different. Relatively speaking, private companies were more concerned with building brands because they are more profit-pressured:

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 [Developer I].

State-owned enterprises were generally less motivated, but they would listen to higher level leaders' arrangements and strive for progress, as two respondents from state-owned developer enterprises mentioned:

To be honest, our company's intention is not high. Because we are xxx [Developer D's company], to be understood as a big state-owned enterprise, but the government may want us to have a lead [Developer D].

Because we are state-owned enterprises, our business has always emphasised being what we call 'a responsible developer'. In 2013, we introduced a green strategy and our [company] leaders are now more concerned with green housing. We achieved Two-Star Green rating for social security housing, and the project was the first one to get green certification for operation [Developer H].

As can be seen from the above responses, the enthusiasm of state-owned developers for building green housing mainly came from two drivers: the first was upper-level requirements by government; and the second was from the developers themselves. First, government leaders at upper-levels wanted state-owned developers to play a leading role in influencing market green transitions. The green housing projects built by state-owned developers were more likely to be experimental models, and normally these experimental projects were subsidised or invested in by the government. Therefore, there was not so much economic pressure on those green housing constructions. The second driver came from the state-owned developers themselves, because in Chinese corporate culture, state-owned enterprises normally have ambitions to gain recognition from the government or top leaders of how they lead the market towards green housing development.

However, no matter whether large or small, state-owned or private, developers mentioned two very important approaches for enhancing brand competitiveness: applying for green housing certificates and increasing publicity. The first is applying for green housing certificates (for national standard and international standards). To gain competitive advantages, firms tend to strive for legitimacy while maintaining efficiency (Yang and Su, 2013). In terms of green housing, green building labels provided by third parties like the government or independent institutions were seen as the best evidence for developers to demonstrate the quality of projects, making it easier for them to get consumer recognition and trust (Coad et al., 2009; Heinzle et al., 2013; Kahn and Kok, 2014):

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, Luban Award, Guangsha Award [two well-known environmental building awards in China], etc. [Developer E].

Being awarded [certificates] is definitely important. It means that our products are officially certified, and buyers will trust our products more [Developer K].

The second approach was increasing publicity: for example, prominently highlighting 'greenness' and the direct benefits it can bring to consumers in housing advertisements; or actively attending green housing-related conferences or events to improve the companies' media exposures in the green housing field:

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 [Developer C].

To be honest, I think attending industry conferences is very important [for companies' media exposure]. The more you participate, the more you will be known. It is not just by the public, but by [other stakeholders] in the industry [Developer O].

In summary, the empirical evidence in this section corroborates the results of the survey in which 'increases company reputation and competition ability' was one of the most important drivers for developers making green housing transitions. Brand-building both through green certificate applications and publicity are responses in order to 'increase company reputation and competition ability.'

8.7 Coordinating market resources

Green housing costs are mostly generated through the purchase of green products, whether green housing consulting services or green materials and equipment. Thus, the ability to coordinate market resources is very important for developers in order to find an appropriate cost-benefit balancing point. Green housing development involves various stakeholders, and obtaining effective resources, reducing costs while ensuring housing quality was identified in the interviews as a hard task for developers:

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

As complex projects, the whole-life-cycle of green housing needs to involve the use of resources in all aspects of the building and marketing processes. In addition to dealing with government departments and consumers, developers have very close ties with stakeholders in the green housing supply chain who provide green housing resources. Four key stakeholders were mentioned by the interviewees: design and consulting companies for green housing design, and consulting services for technology and for certificate applications; suppliers of green technologies, materials and equipment; construction teams for green housing construction; and property management companies for day-to-day operations of

green housing. The interviews indicated that many developers required and relied on other stakeholders having the abilities to conduct green design and construction:

Some developers don't have the ability to design green housing themselves, but when they are planning a project, they hire a consulting company to help them complete a series of tasks, such as preparation of the application materials, and even to provide guidance for the choice of green building materials and equipment, etc. [Developer G].

However, interviewees noted the challenges of getting access to high-quality resources and partners in the market. As a result, some top developers could rely on their own standards for screening green sources, and established their own 'green supply chain' to meet green housing development needs. One respondent from a major green developer explained their methods for dealing with the issue:

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 number of long-term partners... [and] they help me control the risks [Developer A].

Sharing risks with suppliers and construction teams was an approach that developers considered taking to reduce development uncertainty. From the perspective of the whole industry supply chain, some leading enterprises were forming alliances in the market to reduce development uncertainty. One interviewee from a leading green developer pointed out that:

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 [Developer I].

When asked how they established green industry supply chain alliances to achieve housing institution transitions, Developer I explained that:

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 [Developer I].

These industry alliances formed and led by the major green developers were an expression of their behaviour in coordinating market resources. It indicates that these major green developers are driving the green housing transition in the Chinese housing market forward.

8.8 'Cheating' in green development practice

As the above sections show, developers are responsively changing their behaviour towards green housing development. However, the research revealed that their behaviours are not always 'positive' due to the business nature of housing development companies. As reviewed in Section 3.4.4, the latest Chinese Green Building Evaluation Standard has a loophole due to its two-stage evaluations (i.e. developers could apply for green-design certificates during the design stage and green-operation certification one year after construction is complete). The interviews revealed that developers perceived this issue could or did lead to a 'performance gap' between earlier commitments and later operations. In other words, once the developers received the design certificates, it was possible that some did not follow the design and planning documents, and cut corners in later stages. Developer B provided some insight on this issue, highlighting that only 'very good' companies do green housing operations:

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 [Developer B].

Developer B provided further insight on the reason behind this practice, hinting financial reasons for 'cutting corners':

It is not easy for 95% of developers in China to get the design label, and 70-80% of them do not even have that label. As a developer, we feel that once the houses have been sold the later operation is not our business. ... This is a real sense of social responsibility thing, but most developers come from economic point of view... [Developer B].

In addition, the presale arrangement in China's housing market allows developers to sell houses when the housing projects are still under construction. Therefore, developers can advertise their projects as green housing with design certificates before consumers actually

live in the houses. Hence, the presale arrangement further provides opportunities for developers to 'cheat' during the development and sale processes:

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 house buyers uncomfortable [Unhappy with having be 'cheated'] [Developer I].

In fact, it is difficult for buyers to verify the developer's commitment to green housing, because they can only find out whether it is green or not when they actually live in and experience it. This gives some developers the opportunity for false advertising... [Developer L].

Thirdly, some developers preferred to apply for their green building labels at the national level instead of the local level. As reviewed in Chapter 7, after the central government issues national green building evaluation standards, local governments often produce local level evaluation standards depending on local conditions. Generally, the local level standards have higher targets than the central standards. Thus, Developer P disclosed that:

They can apply the label in their cities or send the documents to Beijing [national evaluation agency]. If the effects are the same, why not choose the easy way to achieve certification [Developer P]?

8.9 Summary

When talking about the future trend of green housing development, one of the leading green developers said:

Our goal is to find ways to cater to the trust of consumers to stimulate the industry to [move in] the green building direction. The government is pushing, we are pulling, so pushing and pulling together may make things better [Developer A].

Under this significant transition process, these major green developers play a vital role in the housing market. From the interviews, it can be seen that the most important thing for a successful transition is that developers change their ideas and concepts and consider their design and operation practices from a more environmental standpoint. The research has revealed that developers are making changes to their building behaviour to meet green housing targets, by introducing their own green housing strategies which fit the companies'

paths of development; finding balancing points on costs and benefits, government requirements and customers' demands; building brand recognition; coordinating market resources; but also (inevitably), 'cheating' in green house building and marketing practices.

In summary, this chapter has explored developers' behaviours in relation to green housing transitions and addressed Research Question 5: 'What are Chinese house developers' behaviours towards the green housing transition?' The chapter has emphasised the importance of understanding behavioural change as a key feature in assessing and evaluating green housing transition issues. It has sought to develop a deeper understanding of developers' behaviour under the Chinese context. However, through the course of the research, respondents also indicated that instability in the current housing market had constrained them from changing their attitudes and behaviour towards making a more effective transition towards a green housing future. Most of these constraints identified were institutional in nature, which not only highlights the institutional weaknesses within the Chinese housing market itself, but also the problems in the interactions between government policy and market responses. The next two chapters therefore address the empirical findings around these constraints on the green housing transition from the developers' perspectives at two different levels.

Chapter 9. Constraints on the Chinese green housing transition at the level of ‘institutions which govern transactions’

9.1 Introduction

The discussion of developers’ attitudes and behaviours in the green housing transition in China shows that in response to the policy transition favouring green development, developers have adopted new strategies and acquired new skills for the green mode of housing production. However, green housing transitions are very complex processes which can be influenced by a variety of factors (Geels, 2004, 2010). For developers, it can also be difficult to find the right direction and to deliver green housing in existing housing market conditions. When asked about the housing market, developers noted that they faced many ‘transition constraints’ when trying to build green housing.

During the interviews, most developers indicated that instability in the housing market constrained them and complicated their approaches to adjusting their attitudes and behaviours in order to deliver green houses. Most of the factors that characterised this instability were institutional constraints specific to the green housing transition, which not only highlight institutional weaknesses in the Chinese housing market itself, but also in the interactions between government policy and market responses.

Drawing on the conceptual framework (see Chapter 5), this chapter outlines developers’ perspectives on these constraints of the green housing transition at the level of ‘institutions which govern transactions’. This level of institution is where developers, the housing market, Chinese government bureaus, and networks between key actors involved in the transition (Andrews-Speed, 2016; Williamson, 2000). Five constraints were identified at this level, namely: ‘Supply-demand imbalance in the Chinese housing market’; ‘Lack of consumer demand for green housing’; ‘Fragmented structure of the supply chain industry for green housing transitions’; ‘Inefficacy of policy instruments’; and ‘Inefficacy of Evaluation Standards for Green Building (ESGB)’. The first two institutional constraints were market-based and resulted from the current Chinese housing market system and the last three institutional constraints were State-based and resulted from Chinese green housing policy instruments. This chapter mainly focuses on exploring these institutional constraints and

addresses Research Question 6: ‘What are the key constraints faced by Chinese developers when delivering green housing?’

9.2 Supply-demand imbalance in the Chinese housing market

As reviewed in Chapter 4, housing sector has become one of the pillars of industry for promoting economic growth in China. Over the last 30 years, both fast economic growth and rapid increase of personal disposable income have stimulated the peoples’ demand for housing, which cause a dramatic increase in housing purchases and also, housing prices (Section 4.2.1). This has shaped the institutional conditions in which Chinese developers make business and development decisions and has changed developers’ perceptions of why people purchase new homes. Developer I illustrates:

In fact, people buy houses not only to meet their living needs... The investment channels of Chinese people are still too simple [and] real estate has become a ‘hard currency’. Many people use their money to invest in housing, so the Chinese real estate market has been in short supply for many years [Developer I].

Further, the interviews revealed how the shortage of housing supply had affected how developers considered design quality and green housing due to the heightened competition consumers had faced in the booming housing market:

The current situation is, once the houses are released to market, the consumers are competing to buy [and] they are not very concerned about the quality of the houses... [Developer A].

The development of real estate in the early years is like a burst of growth, at that time, whether your projects were good or not, in fact, the impact is not too big for the business operations [because of the burst of growth]. Because whenever houses are completed, you do not worry about selling them out, the price would not be low, in this case, the developers who are willing to build the green housing are few [Developer G].

Thus, on the demand side under those current institutional conditions of high demand in the Chinese housing market, developers pointed out that the majority of consumers did not consider ‘green’ factors when buying houses or apartments (see Section 9.2). Developer D explained two reasons behind this phenomenon:

First, with large-scale urbanisation and rural-to-urban migration, housing demand in urban areas is expected to continue to grow. Second reason of why people are investing heavily in the real estate market in China is because of the lack of investment channels. Bank deposit rates are low, [they] cannot keep up with inflation, thus reducing incentives for bank savings. ... people have no choice but to rely on the housing market [Developer D].

Whilst the supply of new housing has increased in recent years, new supply is still far away from meeting demand for housing. It is the case that developers continue to focus on, not the quality, but the quantity of their products. The interviews revealed that developers were concerned with getting capital returns as quickly as possible in order to build more houses. In contrast, green housing is normally seen as costing more, in both time and resources (Hwang and Ng, 2013), and under these circumstances, there appears to be little interest in building green housing. Developer G illustrates this point, highlighting how the complexity of these broader market processes is shaping the green housing transition in China:

I think it [the green housing trend] is highly associated with the whole market: if housing prices are always soaring, and houses are in a short supply, then how many developers will pursue housing quality? I will certainly speed up the turnaround, right, because my houses sell fast, and I need to transfer the money as soon as possible. If the market becomes more rational, or [there is] oversupply, then customers will be more carefully selective. So in fact, a lot of things are associated with the market [Developer G].

These trends in the housing market and the relationship between supply and demand have, to large extent, affected developers' construction behaviours and attitudes. If the housing market continues in a state of supply-demand imbalance and housing shortage, it could be imagined that developers' enthusiasm for improving the quality and 'greenness' of their housing will be limited.

However, during the interviews, when asked whether green housing will become a future market trend in China, many of the top developers gave optimistic views about a 'turning point' in the Chinese housing market:

I think the market is transferring itself. Also, the government has realised the importance of emission reduction issues and how these issues are related to the construction industry. All the efforts made [by government and market] so far have been gradually working. The perception of the whole society is also

changing, so I think here is the point, a turning point [for green housing] [Developer I].

As can be seen from the above response, some of the top developers believed that the current housing market is at a turning point from traditional construction to green housing construction. Nevertheless, although it is questionable whether the market has reached a turning point, one thing can be certain which is that mainstream developers are optimistic about green housing as a housing market trend:

Green housing is definitely the future trend. You can see the current planning requirements. Not one of them does not ask for green housing [development], at least One-Star level [Developer I].

Green construction is an inevitable outcome of the sustainable development of the future society. It is good for the environment and for the residents. Once we start to pay attention to this and start to work hard, it is impossible to return to the previous housing form [Developer C].

These interview findings support the questionnaire findings (see Section 7.2): the speed of green housing transitions depends on the transition of the whole market and the relationship between housing supply and demand in the future.

In summary, the data in this section has shown the current housing supply-demand relationship in China and demonstrated how it influences developers' opinions to construction. Developers' enthusiasm for green housing projects is not high in the current housing market environment in China. However, the respondents gave an optimistic voice for the future trend of the housing market transition, citing policy development and changing societal preferences as the key drivers.

9.3 Lack of consumer demand for green housing

As shown in the previous section, the demand-supply relationship in the housing market influenced developers' behaviours and attitudes, which led to considering the importance of consumer 'demand' which cannot be ignored in the green housing transition. Previous scholars show that the impacts on developers' actions of consumer demand and buying behaviour is obvious (White and Gatersleben, 2011; Zhang et al., 2018b; Payne and Barker,

2018). In the interviews, many developers mentioned consumer demand, which is highlighted as another institutional constraint in this section.

First of all, respondents considered that consumers' ideas about what 'green housing' is were different when compared to the government definition. The government was more likely to see 'green housing' as a tool to achieve carbon reduction targets. In contrast, consumers had their own understanding of 'green housing':

As customers, house buyers only care about what the product [houses] itself could bring to them... They do not care about how many carbon emissions you can reduce through what kind of technology - they just care about whether the house is comfortable and healthy... [Developer A].

Developers perceived that, from a consumer's point of view, 'green housing' was more likely to be seen as a product to meet consumers day-to-day needs. In addition, the serious air pollution in China has gradually affected consumers' buying behaviour and made them more interested in the idea of green houses (Jiao and Liu, 2010), with consumers more aware of the effects on their health of hazardous substances in the air and living environment. Thus, developers felt that for consumers, a 'green house' was perceived more in terms of a 'comfortable and healthy house':

We did a Gallup Survey which was about customer satisfaction for green housing. They found that more and more house buyers consider how to reduce the effects of air pollution when they are buying a house [Developer A].

Some respondents also believed that consumer demand for green housing was gradually increasing as a result of this growing interest in health and home:

I feel that the public demand for [living] quality is slowly increasing. Now many people buy our products because it is a green house... Some people also ask questions about whether the housing products used environmentally friendly materials or heat insulation when they buy a house... In fact, the public needs a period to accept new things [Developer I].

However, the developers interviewed felt that only small number of consumers had been aware of 'green' factors when buying a house, and these consumers were more likely to be affluent or of higher class, willing and able to pay a price premium for green houses:

Our customers, many of them own more than one apartment, but they only live in our houses [which are green houses] and rent out other apartments, they will not unfairly treat themselves, obviously they will live in healthier and more comfortable houses... Some customers live in their villas in Spring, but move back to our apartment buildings in Summer and Winter [Developer A].

Developers considered that high-income groups were more able to focus on physical comfort and health when buying houses. But at the same time, developers thought most consumers lacked a proper understanding of 'green housing' and this lack of widespread public knowledge (Zhou, 2015) had constrained consumers' willingness to pay a price premium for green housing when compared to standard housing:

Currently, the biggest problem is that in China... green products... have not been known by the public, due to the stage of development of Chinese society.... I give an example, if [a house buyer] is only prepared to pay half million down payment, and the green product needs 3 million, while the non-green product only needs 2.5 million, he will choose the latter one [Developer C].

... When you build a green housing project but the public do not pay, leaders will say that market is the only standard for testing products. For example, we design and construct a green housing community, but we find another non-green community opposite [on the same] road is more popular because it is in the school district. We say that we are green products, people say, 'Forget it, you are 1000 Yuan more per square metre ...' So maybe you have all the [green] advantages compared with other communities, but the customers only consider 'green' as the tenth advantage in their minds... [Developer B].

As the above quotes demonstrate, developers perceived that 'green' factors appeared to be lower on customers' list of demands than location, school catchment, price or size when they were buying a house. Respondents confirmed that 'green' does not appear to be a priority for consumers, and they do not seem to be willing pay extra for it. However, it was noted in the literature review that 'green' may become more valued by customers over time (RICS, 2011). Some developers indicated that there had been more customers interested in green housing in recent years, but this still did not translate into higher prices, implying that the price premium is likely to remain a cost constraint on the development of green housing in the near future.

9.4 Fragmented structure of the supply chain for the green housing transition

As a complex project, the whole-life-cycle of green housing needs to involve the use of resources from the supply chain in all green housing development stages (Shen et al., 2017a, 2017b). These resources can be categorised into three main groups: design and consulting companies for green housing design, consulting on green technology and for obtaining green certification; suppliers of green technologies, materials, equipment and construction services; and property management companies for operating and maintaining day-to-day use of green housing (Section 4.3.2). In addition to interactions with government departments and consumers, housing developers have very close ties with these supply chain stakeholders in the housing industry. However, at the time of research, China's green housing supply chain industry was not yet fully coordinated. The interviews revealed that it was not an easy task for developers to effectively access high-quality resources and partners in the market when they were developing green housing.

China is not like those Western countries with mature industry chains and very good support for their resources. [In those countries] if you have the money, you do not need to be worried about how to get appropriate resources in the market. We are not like that... [Developer I].

In addition, the differences in company size or green housing construction experience meant that different developers had different abilities to access and integrate resources: they also faced different problems in the industry supply chain. The following sub sections discuss the three stakeholders in the green housing industry chain that were most prominently mentioned in the interviews and how they may become constraints on the development of green housing in the future.

9.4.1 Design and consulting companies

According to statistics, in 2012 the output value of green building design and consultancy businesses in China reached about 1 billion Yuan (CIHAF, 2012). As government policy is taking an energy saving and emission reduction direction, 'green' or 'low-carbon' has been gradually promoted in the Chinese housing market. The developers interviewed believed that 'green housing' would become one of the basic design criteria in the future (Section 7.3). Therefore, green housing design skills will also become important for housing designers and engineers and their capacities for energy-saving or green design have gradually become

key elements for developers to consider; and have become a measure the overall strength of a design and consultancy company in China.

However, the interviews revealed that current status of green design and consultancy businesses in the market was not positive from the developers' perspective, as one developer bemoaned:

The current situation like 'three-Nos': [companies] have no qualification requirements, no staffing requirements, and no technical skills requirements. Some dummy corporations with only two or three people, also dare to participate in market competition and solicit projects. It is conceivable that even if they can complete the green building design consulting program, the quality of the program will not be high [Developer B].

In fact, although the number of green housing projects is growing (NBS, 2017), the quality of green housing consultancy programs has not risen in the same proportion. A large number of false and poorly designed consulting programs are still prevalent. According to the economic principle, the market will operate as a self-regulating mechanism, only the fittest will survive and will gradually improve the market environment (Allmendinger and Ball, 2006). However, in the case of green housing in China, this kind of principle appears to need prerequisites, in the form of 'carrots and sticks', as one developer commented:

At this stage, there is no set reward and punishment system in the market to supervise or restrict the behaviour of [consulting companies] [Developer D].

This problem may further deteriorate the market environment in which developers operate since, according to Developer A, 'bad drives out good'. It means that if there is no access threshold for design and consulting companies, then lower-quality companies could easily enter the market by reducing their prices and as a result, higher-quality companies could be priced out of the market.

9.4.2 Suppliers for green housing construction

The above situation regarding design and consulting companies was found in the research to apply also to suppliers in the Chinese green housing supply chain. Developers indicated that whilst many suppliers had rushed into the market, there were few high-quality ones to be found, making the development process more and more difficult:

In addition...the whole procurement system also faces a lot of difficulties, because the suppliers in the Chinese market are flocking to join, and quality cannot be guaranteed. How to buy the good stuff is not an easy thing, and especially for green building, it is much harder to find the good thing. So in terms of resources, because we have flaws in our system...in the current development stage... the work becomes even more difficult... [Developer A].

The same problem also appeared in terms of construction teams. The current construction process in China is that the developers design and plan a site, and then outsource the construction works to construction teams as third party. However, these construction teams were also found to be of uneven quality, which was a big issue from the developers' point of view.

... If constructors or builders can follow the plan documents to build, that is fine, but there are so many quality risks which may not be manageable during the construction stage. This is due to China's construction system... it is not like the kind of industrialised workers in the West, [Chinese workers] levels are uneven, some of them are untrained, or they lack quality control, or a sense of responsibility... So this whole series of problems can lead to a lot of construction problems even in a traditional project, but the problems will be even more serious in green housing [Developer I].

Moreover, since there was a scarcity of high-quality green materials and advanced green equipment in the market, developers faced high costs for purchasing green materials and technologies. The current high costs of green material and equipment lead developers to scale back from developing green housing, which was also a finding revealed in the survey (i.e. the two most important barriers to green housing transition in the current stage are 'higher technology costs' and 'higher material costs'). Developer E used LED lighting as an example to explain this:

Everything has two sides: LED lighting is almost a perfect solution for green housing to promote efficient lighting and meet energy-saving requirements, but it also has unavoidable shortcomings. In the field of architectural lighting, undoubtedly, the initial production cost of LED lighting is higher than traditional products and therefore increases the final cost. It is like a paradox: want to use, need to use; but cannot afford, or [want to] worry about, an increase in cost [Developer E].

However, the choice of materials was related to many factors such as policies, consumer attitudes and lifestyles. Under the policy for emission reduction and environmental

protection, incandescent lamps are forcibly eliminated, while LED lighting is advocated. Although the green housing transition is still in its infancy, more suppliers have been involved in this transition which has prompted a rapid decline in LED lighting prices. During green housing transitions, in addition to lighting, other factors such as solar thermal or high-performance glass have similar cost and availability processes (Lin and Liu, 2015). Currently, the combined effects of these equipment and material costs influence the overall costs of green housing construction and operation. However, as the questionnaire results showed, in the next 10 years, respondents expected that, as a result of policies and societal transitions, the barriers caused by these costs would be reduced ('higher technology costs' declined in ranking from No.1 to No.2, and 'higher material costs' moved from No.2 to No.6).

9.4.3 Property management companies

China's housing system is a process in which the developers design and construct buildings, while the property management companies operate the day-to-day uses of buildings (Section 4.4). The interviews revealed that developers felt that there was a 'responsibility gap' between themselves and property management companies, with the later organisations perceived as being responsible for the later operational stage of the housing development process, as Developer D illustrates:

Developers do not consider the later operation stage that much, because they think it is not their responsibility, it is property management companies' responsibility [Developer D].

This 'responsibility gap' leads to an institutional constraint because developers regard 'selling the houses' as their key area of responsibility, with all their previous development activity to this point being aimed at selling the houses as fast as possible in order to earn higher profits:

Developers think they are finished once the house is sold. [Once] they've sold the houses and got the reputation, who will care about the later stage? It is common that the final green housing performance is not as the developers promised in operation phase, and this is the reason [Developer F].

However, as a whole-life-cycle product, the later operation stage is a very important aspect of green housing, but the research revealed that developers viewed traditional property

management companies as not routinely being able to meet the management requirements of green housing. For example, some technology maintenance and monitoring works for green housing need to be done by professional teams, however, in the interviews, developers complained that the quality of current property management teams is very low:

Property management maybe is the most missing part. Current property management is still in the same way... collecting management fees, trimming the lawn, and helping to collect the parcels... [Developer C].

Compared with green suppliers and consulting companies in the green housing industry chain, the transition of property management companies towards green housing management, as perceived by developers, is relatively inactive and has not brought about any benefits:

The green housing transition has impacted their [property management companies] traditional operating systems but has not brought obvious benefits to them [Developer I].

As a result, developers perceive property management companies' motivations to move towards green practices as low.

In addition, the 'responsibility gap' has the potential to lead to another issue. During the interviews, developers reported that when they added energy-saving and emission-reduction technologies or equipment to their green housing projects, some property management companies stopped the equipment for reasons such as increased cost of equipment operation, improper maintenance, lack of skilled workers to operate and fix the equipment, or users refusing to pay:

Some projects cannot get the [green] operation label because the equipment is not running. [The property management companies] are too likely to stop the equipment because the cost of operation is too high. For example, the cost of running a reclaimed water system is very high [Developer G].

You employ them repair the fresh air system or the solar system, but they would not be able to fix it. The talents in this area are too lacking, but the people who know the technology are unwilling to engage in [the property management industry] [Developer J].

It is imperative that if the green housing transition is to be successful and achievable, more work needs to be done establish who should be responsible for the later operations of green housing developments. This issue has been solved to some extent by some of top green housing developers since they have established their own property management companies to take on the responsibility for the later operation of green buildings. However, the majority of developers did not have these resources.

9.5 Inefficiency of green housing policy instruments

At the level of ‘institutions which govern transactions’, aside from institutional constraints caused by the housing market system and described in the preceding discussion, developers also indicated a further institutional constraint caused by the implementation of current green housing policies and regulations to the market. When asked the question, ‘How do you evaluate the current green housing standards and regulations?’ some respondents highlighted the changing speed of green housing policies and regulations as a key issue, together with the removal of previous subsidies:

There are some [subsidies], but they will be less and less, because the government is enforcement pushing ... I think it may have been attractive 5-8 years ago, but now it may be a bit too outdated... [Developer G].

Our [green housing] project was built from 2013 to 2016, and many regulations from different fields were changed or altered during that time. For example, the energy reduction requirement used to be 70%, but now it has been increased to 75% [Developer G].

Since green housing development is still in its infancy in China, many green housing-related policies are still being actively adjusted, which is a very common phenomenon in China’s policy context:

This is too normal...because the policymakers are still exploring... [Developer K].

However, this puts an institutional constraint on developers from the uncertainty caused by the high-speed change of green housing policies, as Developer C noted:

As developers, we need to respond to the latest policies as soon as possible, but it also means that we are full of uncertainty about the current policies, such as

some incentives. We are not sure that if we target these incentives, will the response still be effective when the projects are done [Developer C]?

This finding supports the quantitative results discussed in Chapter 7, in which developers believed that in the next 10 years, one of the three most significant barriers to delivering green housing was 'Unclear building regulations'.

In addition, there were many other policy changes which made developers frustrated. During the interviews, one important policy change noted that was affecting developers was that the One-Star green building label has become compulsory. The related incentive policies were replaced by mandatory policies, and the old subsidy policies for One Star green housing were removed. In other words, all new housing projects must now be built to a One Star level without subsidies. This issue was the cause of complaint for many respondents due mainly to the impact on 'invisible' costs and business planning:

In the beginning, the government published some incentive policies to push green housing development, then they think everyone has been aware of it, then they removed those policies. They then published some mandatory policies: in Beijing, for example, all the residential buildings must be One Star level. It is very hard, and the incentive policies have gone. It is an invisible increase in developer's costs, but you have to implement it. If you do not, you would have issues with the approval process. In the end, we must and we have to do it [Developer H].

I think it is mainly depending on policy orientation, the current one is to change from incentives to mandatories. For example, all the new residential buildings need to be One Star. If you do not do, you are breaking the regulations and violating policies... it is too difficult to let the government spend their money [provide monetary incentives] [Developer A].

These changes from incentive policies to mandatory regulations have generated some controversies and complaints from developers and have reduced their enthusiasm for building green houses. This caused frustration and uncertainty on the developers' part since they were not sure of the future benefits they could otherwise have secured from government policies:

... We hope that this kind of [incentive] policy has continuity. For example, if you do not subsidise One Star buildings will you continue to subsidise Two Star and Three Star buildings? This is the thing that when you consider something, whether or not you consider it in a longer term? Maybe [the Chinese government] only considers the current or short term [Developer H].

This research thus reveals that if the developers feel uncertain about the continuity of the policies and regulations, they would be hesitant to build green housing projects. They are likely to reduce the proportion of green housing in all their development projects, which may explain the results of future green housing trends in from the questionnaire (see Section 7.1) that showed some developers thought they would reduce their green housing projects in the next decade.

The policy review in Chapter 3 showed a range of supply-side policies for promoting green housing issued by different cities in China. However, the implementation of these policies, particularly subsidy policies, was revealed by developers to be inefficient and inconsistent in the interviews, with cost implications resulting:

But the [local government] encouragements are not enough, especially when it comes to money. They said they will provide subsidies, but in fact, not much [Developer B].

Some cities have published subsidy policies, but it is few. There are 2-300 cities, only less than 20 cities do it... Also, the government said green housing will be subsidised, but the developers who can actually get the money are... not many... It is just black and white on the paper... the real situation is that there is no money, it is just an oral incentive [Developer J].

For example, if developers need to cost an extra 100 Yuan per square metre to build green housing, and there is no subsidy from government, developers ask customers to pay extra 30 yuan, but they [customers] do not even pay [that much] for it. Actually lots of housing companies do not have good operating margins, 100 Yuan per square meters is not a small thing for them [Developer A].

The research also revealed that many developers did not receive the subsidies promised by these policies. As a result, this continued to dampen developers' enthusiasm for green housing development, and can be seen as another institutional constraint hindering the green housing transition in the Chinese housing market. This indicates that government should more carefully consider the market response possibilities when policymakers published or remove a policy, and consider how better to use the incentive-mandatory policy combinations to promote rather than constrain the green housing transition.

Further, from the developers' point of view, there were some 'invisible punishments' in the current green housing policy instruments in China. In other words, some regulations were

'punishing' the developers who build green housing. For example, the following quote by Developer A outlines how internal developable space was being reduced by policies on wall thickness:

Some local policies [include] calculating the thickness of external wall insulation into the volume rate. That is, the government approved volume rate for a piece of land, for example, could be 2.0 volume rate: [that is] on 10,000 square metres of land, you can build 20,000 square metres of housing, but this 20,000 square metres includes the external wall insulation, no matter how thick it is. This means house buyers will lose many square metres [of internal space] which what they are really care about. This kind of policy is not encouraging developers to make energy-savings [Developer A].

The above example explains why developers felt they were being punished by existing policies and regulations. It is an interesting point which has not been mentioned in previous literature; scholars are more likely to discuss the implementation of policies and their efficiency (e.g. Zhang and Zhou, 2016). These practical complaints can only be heard in green construction practices since developers are policy-takers in the market. Again, as previously argued, policy-making and implementation should take the market reactions of developers into account, and consider the possible practical and market impacts of all policies and regulations, during the design and implementation of such policies.

9.6 Inefficiency of Evaluation Standard for Green Building (ESGB)

As the major green housing evaluation standard in China, the implementation of the ESGB has a large degree of influence on developers' behaviours (Zhang et al., 2017; Ye et al., 2013). As analysed in Chapter 3, the function of the standard is to evaluate the green building practice in China and the majority of green housing activities are driven by this evaluation standard. However, this research reveals that the standard itself has some loopholes, which limit its effectiveness both in principle and in practice. The developers interviewed for this research raised a number of important points that show how the evaluation standard acts to constrain green housing development. These are discussed in turn below.

First, as reviewed in Chapter 3, the rating system divides the assessment process into two stages: (1) planning and design stage; (2) acceptance and operation stage. Different criteria

are applied in different assessment stages. In the planning and design stage, design documents are assessed and the green design label is only valid for one year. The formal green label is issued based on information gathered in the first year of operation (Ma et al., 2016). However, the research revealed that it is common for developers to place more focus on the first stage and ignore the second due to loopholes in the monitoring process:

...No one will consider this [that the design label will be invalid one year later], 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. The second thing is, 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, so in the end, those projects would become semi-green, fake green or even non-green projects [Developer B].

The interviewees have previously provided an explanation for why developers could 'cheat' in the green housing development process (Section 8.9). On the one hand, this two-phase evaluation system allows developers to falsely advertise their housing projects as green housing because they have the design labels and house buyers do not understand whether the projects are only designed green or actually operate green. On the other hand, government supervision is insufficient in the construction and operation periods. This 'insufficiency' is caused by the standard itself which was highlighted by the respondents as being confusing and complicated:

Have you seen the standard? It has many rating items - seven or eight. Different items have different weights, which means if the government think [a particular item] is important, they will put more weight on that one - construction and operation stages are the least important ones [Developer H].

Table 3.2 in Section 3.4.4 shows the weights of different items in green housing evaluation. It can be seen that the indicators of 'construction management' and 'operation management' have the lowest weightings. This effectively allows developers to overlook the construction and operation stages of green housing development. In addition, the survey results showed that construction management and operation management were the two characteristics least considered by developers (Section 7.3) and the interviews are able to offer some reasoning behind this.

The second important problem with the ESGB raised in the interviews, which was reviewed in Chapter 4, is the poor quality of green housing being constructed. The number of green housing projects in China has increased significantly over the past 10 years. However, behind these numbers, this research reveals that the quality of many green housing projects may not match the standards expected. This was partly due to the green housing certificate application process, as one developer explained:

[The] green label application... standard is a design standard, but not a construction standard, which means it can be fake. Also, it is not a mandatory standard [Developer B].

The reasons for this are mainly due to the fact that at the application submission stage, all the documents are submitted to the evaluation agencies in the form of written materials. The reviews by the evaluation agencies are also undertaken only through a review of the data provided in these documents, which allows the possibility of misrepresentation in the written materials, as Developer B continued:

The data could be fake in the papers: even if not all the data are false, a certain possibility exists. That is the latent rule of the application, and it is common in China [Developer B].

One of the reasons for this loophole is the inefficient supervision by government departments, and even worse, sometimes the government even allows this loophole to exist. During the placement I undertook for this research, this issue was discussed with an officer in the Technology and Industrialisation Development Centre, since the Centre is the national level evaluation agency for green housing projects. The officer responded that:

We need to have the least confidence in each other (evaluation agency and developers) [Government officer].

It may indicate that the evaluation agencies actually noticed that there may be some 'fake data' in the application document, but they connive with this situation and the latent rules might happen in the process.

The third point raised by the interviewed developers was the high cost of green housing development. This meant they tended to work towards meeting the easiest, often cheapest, requirements in the evaluation standard to achieve the labels, rather than introducing more

expensive or innovative technologies. In this sense, the label application appeared to have become more formalistic, rather than a means of stimulating innovation, as Developer H explained:

Green housing is not like the public thinks - it is not complex. The technologies we used on our buildings do not need us to innovate anything. In terms of the standard, because it is selective, the scoring for all the items is accumulated together, right? Therefore, we can avoid using some expensive technologies or equipment, we can just choose to use something fit in our architectural form [Developer H].

If every developer were to choose the easiest way to achieve the label, the application process is likely to become more formalistic, and to a certain extent, act to constrain the transition towards green housing development. The research revealed that developers only sought to use the easiest way to gain green certification, and thus their enthusiasm towards green housing development has not been sufficiently motivated by the ESGB. In addition, as green housing transitions are a social-technical innovation process (Geels, 2004), if developers only seek to meet the lowest technical requirements, the drive for innovation will be greatly reduced. As the quantity of officially approved green housing increases overtime, there is a very real risk that the quality may actually decrease, and the green building label application becomes further formularised.

Another green building label loophole mentioned by developers was the differences between the national level evaluation standard and local level evaluation standards for green housing. As reviewed in Section 3.4.4, a national standard is published by MOHURD, and then local governments produce their own standards. However, the research revealed that in general, the requirements at the local levels are actually higher than at the national due to competition between the regions:

National standards are actually the minimum level, and the standards set by local governments are generally higher than the standards required by the state...The local [governments] are also competing: you set the target at 80%, then I will set 90%, and somewhere else will set 95% [Developer E].

Therefore, some developers exploited this situation to their advantage by seeking reviews of their green development projects at the national level in order to circumvent the more stringent local standards, as the following comment explains:

...The current evaluation system is not perfect - some projects can be reviewed at the local level, some can be sent to Beijing [national level]. But these two standards have differences between the same scoring items, so if you are able to be reviewed at the higher level, it will be easier. [Developers] just want to get that label in any way they can... [Developer E].

9.7 Developers' policy suggestions

As the above sections have shown, the interviews revealed that developers faced a variety of institutional constraints on the green housing transition at the level of 'institutions which govern transactions'. As such, part of the interviews focused on exploring their ideas to improve the current situation. Developers provided a range of suggestions that will now be discussed.

9.7.1 Provide more incentives for consumers

Interview respondents often referred to problems around consumer demand for green housing. When asked for suggestions on how green housing market transitions could be more effective, many developers put forward the idea of stimulating consumers' buying behaviours.

Who buys green houses, the government give them some concessions, so that more people are willing to buy green houses. And developers could easier sell their green houses, while the development of ordinary housing is not easy to be sold... [Developer J].

The above quote discusses the idea that, when people are thinking of buying a house, the government should give them some concessions to encourage them to buy green housing. More specifically, it was surprising to hear that developers who usually paid great attention to the benefits and subsidies that they could gain for delivering green housing development, suggested that these be transferred into consumer subsidies:

Financial subsidies, in fact, from a developer's point of view, I would rather not get the money, I would like you to give this subsidy to consumers, make consumers more willing to buy my green products, and not buy non-green products [Developer A].

When asked what approaches could stimulate consumers' buying behaviours, developers generally gave two financially-motivating suggestions, as the following quotes illustrate:

We can encourage consumers: for example, most of the people need mortgage loans when they buy houses. If you buy a green house, you could get better interest rate depending on [the house's] star rating [Developer F].

We could set different transaction costs, such as deed tax. When you buy green housing, your transaction costs could be cut in half [Developer I].

As these comments show, developers suggested that the government should transform the current mode of subsidy policies away from subsidising green housing developers towards subsidising or providing tax relief for green housing consumers. These are useful policy suggestions because they could help to solve the issues at the root of the problem, which the current policies and regulations do not address in the market. The root here refers to public awareness and acceptance of green housing. In other words, the government should pay more attention to the demand side when considering future green housing policies in the subsequent stages of the green housing transition. In this regard, the improvement of public acceptance could naturally help to improve developers' motivations for green housing development, and thus coordinate the relationship between government environmental targets and market activities. However, as it stands, this remains a key aspect neglected in current green housing policies and regulations.

9.7.2 Provide more incentives for property management companies

Property management companies play an essential role at the green housing operation stage (Li et al., 2018b), and developers believe that improving the quality of property management is very important to facilitate greater levels of green housing development. Currently, property management companies lack specific knowledge and skills for the operation and maintenance of green housing (Section 9.4.3), which greatly affects the operational stage of green housing. Therefore, it is important to pay more attention on strengthening the professional competence of property management personnel, and improve their skills of green housing (Ding et al., 2018). The developers made two key suggestions for stimulating the property management companies' transitions, relating to fees and training, as Developer B and D explain:

The operation costs for property management companies are different between green housing communities and traditional communities. The government could produce policies for them and allows the green housing communities' property

management companies to charge higher operation fees, so they are more willing to maintain [the properties] [Developer B].

It is possible to strengthen the training of property management personnel, such as regularly organising training sessions, and strengthening the personnel's understandings of green management and green equipment. In this way, if there is any problem with the household, it can be solved in the shortest time [Developer D].

9.7.3 Provide more incentives for green developers

As will be discussed in Section 10.4.4, developers think that current support offered by the banking sector for green housing transition is not strong enough, and apart from monetary subsidies from the government, there is 'almost no green finance available' [Developer Q] for developers who want to build green housing. This puts significant financial pressure on green developers and has been revealed in this research as a serious impediment to the transition. The respondents called for more diversified financial methods to support the transition:

...[The government]) can encourage[green housing] like this: if the developer builds green houses, you can get a loan at prime bank interest rates, green loans, let's say...[Developer L].

Financial factors were important drivers for developers to increase the adoption of green building practices. If they could see that they could get greater capital returns or lower interest rates for green housing development, they would be more willing to get involved in the green housing transition. The above advice could promote the financial advantages of green housing development compared with traditional housing development, thereby stimulating greater levels of supply.

Indeed, the policy suggestion most often made by developers was how to improve and produce incentive policies and regulations, because it is most relevant to their interests. Developers thought that the current approach to incentives was relatively unitary; most incentives are monetary subsidies and some developers thought that even the monetary subsidies were 'out of date'. Respondents pointed out several other forms of compensation or incentives, for example land acquisition as the following quotes show:

I think that in the future, the incentive policy can be tilted in the direction of acquiring land for housing. The government can give more consideration to the demand for [land resources] at very beginning rather than subsidy given at the later stages. If you develop green houses, [the government] will more likely you give you the land... [Developer F].

...you provide more (housing) area incentives for us; we also think it is very practical... [Developer A].

These incentive policy recommendations are both efficient and feasible, because land resources are becoming increasingly scarce in China, especially in first-tier cities. This is also one of the points that most concerned developers. If land-use policy was inclined towards green housing developers, more developers would be transformed from passive to active green developers in order to obtain this land. In addition, the area incentive (subsidies developers to construct more square meters with same land cost) is also an appropriate approach, since the increase in area means increasing the attractiveness of green housing for consumers (Ghodrati et al., 2012). If buyers are more willing to buy green houses, developers would be more willing to build green houses. Thus, this policy could help solve the conflicts of interest that currently exist between house buyers, policy-makers and developers.

In addition, in relation to the mandatory-incentive policy balance, a developer also made the following recommendation:

At this stage, it [green housing] needs more experiments: you could produce some incentive policies to encourage developers to try more. This would gradually expose the issues so that we can overcome [problems] in the future. Then you could publish some mandatory policies, and the actual effect [of this process] may be better. If you enforce pushing the development before experiments, the issues will be harder to solve in the future [Developer H].

This respondent felt that current mandatory policies were too forceful and it was not an appropriate or mature enough stage to implement such strong mandatory policies to the market since the market was not ready for green housing development. The research so far has shown that when the market is not ready, a mandatory approach raises more issues for developers, such as technology and finance issues related to the higher costs and lower marketability of green housing when compared to traditional forms of housing. More

incentive approaches could mobilise developers' enthusiasm, which is important for the green housing transition in China.

9.7.4 Enhance whole-life-cycle monitoring

As the results of the questionnaire have shown, the majority of developers' motivations towards green housing development were driven either by government push or market pull factors. As this stage of the transition, the role of government push is stronger in the Chinese housing market. In other words, if the government neglects to supervise a certain stage in the whole-life-cycle of green housing, naturally most developers would choose to ignore that stage, as the preceding sections have revealed. One developer put forward the following suggestion for how to 'further strengthen the government's supervision':

Now [developers who] get the design label can get subsidies, [and with] the operation label can get other amount of subsidies. The government could choose to reduce the design phase subsidies, or only give a part of, and if the [operational] results are as expected, then release the remaining subsidies... [Developer D].

This is, of course, an idealised suggestion since it requires a much longer regulatory cycle, and one of the main issues in the Chinese government is precisely the lack of long-term monitoring (see Section 9.2.4). This deep-rooted contradiction cannot be easily resolved in the short term.

9.7.5 Produce green housing policies and regulations according to local conditions

China is a vast territory, and when considering climate and environmental-related issues, the differences between the local conditions and features in North, South, East and West, and even between provinces, are very large. Initially, the central government formulated the 'Green Building Evaluation Standard' at the national level to guide and promote the development of green buildings nationwide (Section 3.4.4). However, it poses some problems, since some general requirements may not apply to areas with special conditions (EID, 2010). Developers spoke in the interviews about greater rights of decentralisation to meet these circumstances, and suggested that all local governments should have the right to set their own standards and evaluate buildings, as Developer P and Developer R explained:

... It is the consensus of green housing development that climate and resource conditions across the county are different, and the applicable technical differences in different regions are obvious. Choosing the appropriate technical measures according to different climatic conditions is the prerequisite for green housing development [Developer P].

Choosing a green housing development model which fits the local conditions is a cost-effective way for both government and developers, and I think local governments could conduct more research and make more effort in this area, so that they can truly achieve 'green' development... [Developer R].

In fact, this policy suggestion has been taken into account by the higher authorities, and local governments have begun to actively promote the development and implementation of local standards (see Chapter 4). However, from the developers' points of view, giving local governments more discretionary rights could help reduce barriers to green housing development since this could reduce a series of costs such as green housing label application costs and time costs. Therefore, policy makers should further consider how to produce policies and regulations to meet local conditions and produce win-win results both for developers and governments.

9.8 Summary

To conclude, this Chapter has targeted Research Question 6 to explore the key constraints faced by Chinese developers when delivering green housing. The institutional constraints outlined in this chapter are at the level of 'institutions which govern transactions': 'Supply-demand imbalance in the Chinese housing market'; 'Lack of consumers' green housing demands and buying behaviours'; 'Fragmented structure of the supply chain industry for green housing transitions'; 'Inefficacy of policy instruments'; and 'Inefficacy of Evaluation Standard for Green Building (ESGB)'. The first three institutional constraints arise from the current Chinese housing market system (market based) and the last two institutional constraints relate to Chinese green housing policy instruments (state based).

The analysis has shown that delivering green housing policies and regulations currently have limited effectiveness in the market, and developers have a range of frustrations about the damage to their interests from current market mechanisms (whether they be an unintended consequence from green housing policy or otherwise) and existing policy instruments. These

issues raise questions about what alternative policy approaches may be necessary, beyond existing mandatory and incentive policies, to make green housing more acceptable and achieve greater commitment from developers to deliver green housing. Consequently, a range of potential solutions were suggested by interviewees, including: providing more incentives for consumers, property management companies and developers; enhancing whole-life-cycle monitoring; and producing green housing policies and regulations according to local conditions. These policy suggestions are also valuable empirical evidence for addressing Research Question 7 in Chapter 11 in relation to providing potential policy recommendations for the green housing transition.

The next chapter continues to address Research Question 6, by analysing the constraints on the green housing transition at the level of the 'institutional environment' from developers' perspective.

Chapter 10. Constraints on the green housing transition at the level of ‘institutional environment’

10.1 Introduction

An understanding of the institutional environment are crucial for investigating transitions (Estache and Wren-Lewis, 2009). As discussed in Chapter 3, compared with Western countries, in China the institutional environment is shaped by the government, which has extremely strong influences on housing market activities. In addition, green housing is a relatively new concept and before the market for this becomes mature and customers’ awareness improves, environmental governance is important to support the green housing transition in the market institution. However, Chinese environmental governance has its own characteristics (see Chapter 2) and the research revealed that some are perceived by developers as institutional constraints on the green housing transition at the level of the ‘institutional environment’. The institutional environment which has a preponderance of formal institutions consciously designed by the Chinese government. For example, the Chinese governance system and the structures of the Chinese government departments, which influence carbon regulation and the green housing transition. Five constraints resulting from the system of Chinese governance are summarised in this chapter, namely: ‘Absolute power on decision-making and lack of public participation’; ‘Lack of flexibility and efficiency of the existing governance system’; ‘Lack of long-term monitoring’; ‘Conflicts within different government departments’; and ‘Strong control over land resources’.

This chapter continues to address Research Question 6: ‘What are the key constraints faced by Chinese developers when delivering green housing?’ The findings in this chapter are mainly based on the data collected from qualitative research, in which the constraints are identified from developers’ interviews, while the work placements from the MOHURD Technology and Industrialisation Development Centre are also used to verify, question or explain the developers’ opinions.

10.2 Absolute power in decision-making and lack of public participation

The research revealed that in China, developers' attitudes and behaviours were heavily influenced by government actions. This is mainly because the Chinese government has absolute power over decision-making, which is significantly different when compared with Western countries (Wu, 2015; Andrews-Speed, 2012). The research confirmed that this centralisation was deeply embedded in the housing administrative system, as the following quote by a respondent from large development company illustrates:

The government's role is... I have to say...very important, because the entire industry is oriented and promoted by government. Many rules are made by government, a policy, to the left or to the right [drive to which direction], can determine the whole industry's prosperity or decline [Developer A].

Developers acknowledged that the government's rules were important in decision-making and market transitions, however, they also thought that sometimes the Chinese government was over-controlling when it came to the housing industry, which Developer A continues to complain about:

.... But our government is different [from] Western government: Western governments only focus on core things, and let the market or industry groups, for example, all kinds of associations, research institutions solve the industry issues. But in China, these things are in the hands of the government [Developer A].

In contrast, some of the developers expressed affirmation of government power and the important role that governments have to play in 'pushing' transitions towards new systems and new market processes:

This (green housing transition) is a very big change, and if there is no government's push, or some international institutions' push, the whole process would be much slower than today [Developer F].

Because housing developers' enthusiasm for green housing development was not significant due to many practical difficulties they faced (Osmani and O'Reilly, 2009; Zhang et al. 2011a), the government had the opportunity to use its absolute powers to ensure the transition remained on the right track and was delivered in the time frame envisaged.

Whilst this point of view indicates that the starting point of green housing governance could be deemed positive, it does not mean that the system or approach does not have its problems. Therefore, in general, although developers acknowledged the importance of the Chinese government's approach to the green housing transition and associated policies, the felt that the power the government have could lead to a series of problems, for example,

developing policies that are not compatible with existing market rules (CIHAF, 2012), as Developer C pointed out:

Our government publishes some mandatory policies in order to achieve political goals: for example, all new houses should be One Star [a standard level in Evaluation Standard for Green Building], and some areas' requirements are even higher. But do they consider the development stage of the housing market? Are other factors in the market mature enough to support their political goals? The pressure they put on us are actually because they do not understand how markets work [Developer C].

The top-down governance system has also created a related institutional constraint which is the lack of public participation, especially market actors' participation, at the decision-making stage of policy formulation. The public has not generally been consulted during decision-making in China, and there are very few existing opportunities for participation (Wu, 2015). This lack of interaction between policy-makers and stakeholders was also evident when it came to the governance of the housing market, as Developer E noted:

...Government policies are actually most often disjointed from market, and the relationship between us and the government is not a healthy cooperative relation... Public participation is far from being achieved in China [Developer E].

Generally speaking, the top-down system meant that the politics are manifested more within the government or as inter-governmental politics (e.g. central versus local) (Wu, 2015) as consultation takes place within the state regulatory system rather than between the state and housing industry. Therefore, it can be said that green housing policy-making has been achieved through intensive negotiations between central and local governments, with developers feeling excluded and not consulted during that process:

The developers who can participate in the policy making are now very few. Like us, we don't have to think about it (participating in policy making). Many so-called policy seminars invite some developers to participate, but in fact, they just attend the seminars, but not really 'participate'... [Developer C].

But as one interviewee pointed out, this situation had been improved in recent years since the Chinese government began to consult with key market actors to get them more involved in policy-making procedures and, as Developer D points out below, learn from developers as the green transition evolved:

[The largest green housing developer in China] is the pioneer, right? It has its own strategies and policy research institutions, and of course the government wants to learn from them [Developer D].

However, this consultative approach only appeared to involve those major developers who had strong market powers, and who are 'pioneers' in the market promoting the green housing transition in China. Under these circumstances, those leading organisations are more hopeful that their voices can be heard, that they had opportunities to consult with the government, or make recommendations during the policy-making processes. However, across the whole range of Chinese housing developers interviewed, this viewpoint was a small minority.

For some developers, the lack of participation was considered to directly cause an asymmetry of information. For example, some of them could not get information about the latest policy changes or fully understand how to apply for green housing certificates or subsidies. Some developers were able to actively obtain the information, but by and large, most were not able to as the following quote from Developer E illustrates:

We are not like those top green developers, we are almost like a policy-taker, let alone those small companies. So many regulations need to be learnt, plus they [small companies] lack experience with applying them. , If the government do not improve the communication mechanisms, they [small companies] will miss some useful information, which means that information could be void [Developer E].

The quote shows that if, small companies cannot get up-to-date information from the government, they could potentially be working with outdated or superseded regulations. In contrast, during my placement in the MOHURD Technology and Industrialisation Development Centre, this was discussed with a government officer who was in charge of the production of the ESGB, and he stated:

...Once the latest policies or regulations are published online, all the house developers will be competing to learn [about them], and the government does not have to spend too much energy to convey the information [Government Officer].

It can be seen that there was a conflict between government and developers when it came to green housing development. There was an 'understanding gap' between these two actors within the housing market institution, where government placed undue expectation on market actors to seek out and familiarise themselves with the latest regulations with little to

no promotion. As a result, many developers did not effectively access the necessary information about the latest green housing policies and regulations. Thus, how to deal with the issues caused by this information asymmetry is considered vital for the effective operation of the housing market institution with a green housing transition.

To conclude, developers commonly and positively acknowledged the government roles in green housing transitions, however, the power of the Chinese government could also lead to a series of negative effects. In considering the housing market as an institution in the Chinese context, it is therefore important to further consider how power should be allocated between government and other stakeholders in the housing market. Whether some kind of power needs to be decentralised and maybe 'returned' to the market is a question that remains to be addressed.

10.3 Lack of flexibility and efficiency in the existing governance system

During green housing transitions, many innovations are required to support the transition. From the developers' points of view, 'innovation' refers not just to advanced green technology, but also importantly, to innovations in policy-making and governance systems. Some developers considered that the inflexibility of the current Chinese governance system was a hindrance to achieving the green housing transition. One particular developer highlighted the legacy of previous regulations as a particular constraint:

Although the government is promoting green housing development, in the specific implementation process, it needs some regulations to support, and these regulations must be advanced compare with the original system. In other words, the existing system is likely to constrain the transition. Because most of the requirements in the original building system are non-green, the flexibility and efficiency of our government agencies have relatively large impact on the transitions, right? So I believe government need to change the way of administration, otherwise, you can only walk on the old road. That is the problem [Developer A].

This inefficiency of government operations was observed during this research. During my placement, it was observed that government departments did not operate in the same way as private companies, which focuses on making profits and thus require a more efficient use of resources and time. The government departments observed did not appear to have the

same level of pressure to arrive at a conclusion or deliver a solution quickly. One government officer explained this:

We also want to make change, but the reality is that the internal government system is relatively solid. ... Corporate culture, foreign companies and private companies are more concerned about innovation. But the government's culture is more about doing things step by step [Government Officer].

Coupled with the lack of participation mentioned above, developers argued that due to the current system and the government's lack of creativity, the ability of the government to accept new systems and processes was limited. This institutional constraint could lead to a slow transition process in the policy area. It is interesting to note that this finding is not in conflict with the findings analysed in Section 9.5, which related to the 'high-speed change of green housing policies'. This is because although policymakers frequently modify green housing policies, the effectiveness of those policies is questioned, as Developer Q said when talking about a particular 'new' policy:

But in its form, the language was fresh, but without changing the core concept [Developer Q].

Overall, inefficiency and a lack of flexibility were found to be two of the critical institutional constraints that have effects for delivering efficacious green housing policies and regulations.

10.4 Lack of long-term monitoring

As discussed in Chapter 3, though the five-year government election cycle and five-year-plans may appear to compare favourably with the shorter time horizons of the government. In other words, economic growth appears to have been a higher priority than reform or green development and leaders only consider development over five to ten years (Naughton, 2010). This situation appeared to constrain the transition toward green housing development since long-term environmental factors were not perceived by developers as a priority for local government officials, as Developer J notes:

Environmental planning? Every local government talks about it in their planning strategy. But actually that is not what they are considering in the current stage - GDP is, because every city is competing for economic growth [Developer J].

Green transitions take a longer time period, and are likely to cost more in the short term (Hwang and Ng, 2013; Huang et al., 2015). As a result, leaders were perceived by developers to be unwilling to spend too much of their budget on this (CIHAF, 2012; 2015), as Developer G states:

To be honest, it is easy to manage [green housing projects] in one year, but they may not be able to stick to it in 5 years or even 10 years. Due to the current domestic institutional system, they may not be able to evaluate this [a green housing project] over a whole life cycle. Our government do not consider some of the comprehensive energy efficiency or savings... [Developer G].

The results also revealed that developers thought many government leaders only focused on whether green housing projects could achieve green standards in the early stages of development. However, as a whole-life-cycle project, the latter stage of operation for green housing is just as critical. According to developers, the government appeared not to pay much attention to this aspect of the housing development process because they only considered what they could achieve during their own tenures, which are shorter than the whole-life-cycle of a housing project. Developer B provided one such example of this frustration:

For example, a leader claimed how many green projects had been built during his tenure, but he circumvented a question about whether these green projects were [only] designed green or [also] operated green? Buildings are issued with different labels in these two stages [design/operation stages]. And perhaps during the process of a housing project between applying for a green design label and applying for a green operation label, the leader has changed, thus the effect of long-term monitoring could be reduced and neglected [Developer B].

To conclude, this research reveals that developers considered long-term monitoring by government inadequate since government officials did not have long-term interests in, or long-term visions for, green housing transitions. As a result, the effectiveness of the overall transition is arguably reduced.

10.5 Conflicts within different government departments

The Chinese government has different departments for policy-making, land development, transportation provision, economic growth and environmental protection, which are all aspects related to housing development in some form or another. As in Western

governments, such institutional division of responsibility leads to a variety of conflicts between different government departments, as a government officer in the MOHURD Technology and Industrialisation Development Centre explained:

In our country, we do not have conflicts between different legislation, but we cannot exclude the possibility of conflicts between different departments. Take land-use as an example: the urban planning department publishes a policy document for a piece of land; but at the same time, the land department have another policy document, and so does the environmental department, and these three documents require different things for a same area. This is the problem of our country's administrative system, because our administrative system has vertical levels such as nation, province, city and town, and it also has horizontal levels like construction, environmental departments [Government Officer].

As the government officer above explained, the duties and functions of different government departments are clear at the legal level; however, the legislation is only developed at the highest level and therefore, cannot be specific. In reality, the situation becomes more complex as different departments have their own political goals and in order to achieve those goals, they are likely to give priority to their own jurisdictions.

During interviews, the developers also indicated that this issue not only happened across horizontal levels, but also in vertical levels, meaning that conflict of interests also existed between central government and local authorities:

In fact, they (local governments) do not always [act in] strict compliance with the central government: GDP is still the priority instead of environmental protection... especially in the housing industry [Developer M].

Thus, conflicts of interest between government departments and duplication of information appeared to be an inevitable aspect of the institutional environment. The developers argued that the governmental institutional framework affected their responses to emerging policy:

It is too hard for us to meet all the requirements in different documents and deal with conflicts between them - the issues are caused by government departments themselves [Developer J].

This finding supports the quantitative results discussed in Chapter 7, in which developers believed that in the next 10 years, two of the three key barriers to delivering green houses were 'No uniform solution of green housing standard' and 'Unclear building regulations'.

10.6 Strong control over land resources

As reviewed in Chapter 4, land is not privately owned in China and its function and the length of use are controlled by the government (Wu et al., 2012). The Land Administration Act gives compulsory purchase power to local government, which can buy land from farmers at a low price and then sell it at a higher market price to developers. This price gap is an important source of revenue for local government (Wang et al., 2012). However, for the majority of developers interviewed, this process was problematic since land was seen as a major cost and the local government a 'monopolistic supplier':

Local government is a monopolistic supplier. It not only acts as a political institution, it also plays a role in the market [Developer A].

This situation appeared even more severe in Chinese mega-cities, since land resources have become increasingly scarce in these rapidly developing cities where development pressures are at their greatest, as Developer F noted:

Especially in Beijing, Shanghai, Guangzhou, Shenzhen, it is more and more difficult to get land. Most of the auctions and bidding are not working now, and we need to rely on some corporations [with governments to getting land] [Developer F].

Under this institutional arrangement, land is a major asset under the control of local government. Planning helps to strengthen the power of local government in maintaining its monopolistic position, because without going through an initial land sale to the local government, the developers cannot obtain the deeds of the land (Wu et al., 2012). This in turn had shaped green housing delivery since local governments made it a prerequisite in land transfer contracts:

Green housing development seems to become the prerequisite for getting land: many [local] governments put the requirement of green housing development as a necessary condition into their land transfer contracts. Therefore, green housing is a 'have to' instead of a 'suggest to' [Developer M].

Local governments were usually more willing to sell land to developers who offered higher prices, rather than to developers who produced comparatively more costly green housing and therefore, as a result, were unable to offer a competitive price for the land, as one frustrated developer noted:

I think many of the current land policies do not favour green development; 'Green' is not what they consider a priority. I feel like those 'green things' I added on our projects are additional benefits for them [the local governments] [Developer J].

As a result, this situation added greatly to development costs for those developers who focused on delivering already more expensive green housing developments. This reduced their opportunities for building green housing schemes in mega cities such as Beijing and Shanghai.

10.7 Developers' policy suggestions

In the interviews, developers pointed out a variety of institutional constraints on the green housing transition in the 'institutional environment'. When asked for suggestions for dealing with those constraints, developers only provided one suggestion to improve the current situation, perhaps signifying an underlying acceptance of the overall governance framework in China. The suggestion for improvement at the institutional environment level was also much weaker than for the 'institution that governs transactions' level, as discussed in Chapter 9 such as providing more incentives for consumers or green developers, and enhancing whole-life-cycle monitoring. This is because the institutional environment is much more difficult for developers to change, and Chinese environmental governance contains some deep-rooted values which cannot be easily altered.

10.7.1 Get developers and other stakeholders involved in policy-making processes

The developers interviewed showed that they were willing to get involved into the process of policy-making, as Developer O illustrates:

I think [the policy makers] can get more advice from developers in the process of developing green housing policies... because the ultimate goal of policymaking is to operate in the marketplace... [Developer O].

In practice, there were several examples of developers' involvement in green housing policy-making, with Developer F providing one such example:

We have been invited to [contribute to] the modification work of 'green community standard' which is a very important standard for industry transition... Our boss will go to the meeting and provide suggestions to them, and also other experts, which is good, to let all the actors get involved [Developer F].

Although this point was only mentioned by one developer, it is a very important policy recommendation, because integrating the process of policy implementation into market conditions is a serious unresolved issue in China. The decentralisation of policy should not simply refer to the national-local government relationship, but also to the relationship between the government and other stakeholders in the market. Improving communications between all actors should help to improve the feasibility of the policy operation and overall green housing transition.

10.8 Summary

In summary, this chapter has focused on exploring developers' perspectives on the key constraints in the Chinese green housing transition at the level of the institutional environment. It has addressed Research Question 5: 'What are the key constraints faced by Chinese developers when delivering green housing?' The research has shown that environmental governance is central in enabling green housing development to take place in the institution of the housing market. However, developers highlighted a series of important constraints that they thought were caused by the government administrative system that cannot be ignored. These institutional constraints include: the power given to the government and lack of stakeholder participation; the inefficiency and inflexibility of the existing system; lack of long-term monitoring; conflicts within and between government departments; and strong control over land resources.

The institutional constraints identified by developers as shown in both Chapter 9 and 10 has directly or indirectly lead them to feel uncertain about investing in green housing development. In addition, developers' innovations and enthusiasm were not shown to be effectively encouraged by the existing policies. Some of these problems were the result of the institutional environment of China's green housing development, which is relatively difficult to change. However, some of them are also caused by the lack of cohesion between the government and the market. If the government could effectively deal with these institutional constraints, it may be able to more smoothly to promote the green housing transition.

The discussion in the following chapter brings together the empirical data collected by the research, the existing literature and the conceptual framework to examine how the research aim, objectives and questions have been addressed.

Chapter 11. Discussion and reflections

11.1 Introduction

Bringing together the empirical results presented in Chapters 7 to 10, with the discussion of the literature (Chapter 2 to 4) and the conceptual framework (Chapter 5), this chapter addresses the research aim, objectives and questions. The implications of this study for existing research, and for theory, methodology and practice are also addressed in this chapter. Overall, the discussion shows what new knowledge from this research can contribute to the current green housing policy, housing developer and institutional analysis literature.

The main aim of this research was to investigate the institutional constraints on the green housing transition in China by evaluating the capacity of Chinese developers to deliver green housing in the Chinese housing market.

Four research objectives were set for the research:

- Objective 1: To investigate the potential impacts on developers of current carbon regulation and green housing development policies in China;
- Objective 2: To evaluate the contribution of new institutionalism theory to the understanding of green housing transitions and to develop a conceptual framework;
- Objective 3: To examine developers' capacities for the implementation of green housing targets in the Chinese housing market; and
- Objective 4: To identify the key institutional weaknesses in the green housing transition in China.

In order to address the research aim and objectives, and in response to the research gaps identified in the existing literature, seven research questions (RQs) structured the research:

- RQ 1: What is the current status of carbon regulation and green housing policies in China?
- RQ2: What are the potential drivers and challenges faced by developers to the implementation of carbon regulation and green housing policies in China?

- RQ 3. What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?
- RQ 4: What are Chinese developers' attitudes towards the green housing transition?
- RQ 5: What are Chinese developers' behaviours towards the green housing transition?
- RQ 6: What are the key constraints faced by Chinese developers when delivering green housing?
- RQ 7: How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?

This chapter is divided into four parts. The first part draws a picture of the Chinese developers' dilemma as they consider the green housing transition. This part evaluates developers' attitudes and behaviours and shows how Chinese developers' house building behaviours in relation to green housing development are constrained by the institutional context. The second part discusses the institutional weaknesses of the green housing transition in China which are found at multiple levels and are the result of multiple factors. Thus, this part also emphasises the interaction between different institutional constraints and how they contribute towards an overall institutional weakness in the Chinese housing system. Drawing on the first two parts, the third part of the chapter drives further to evaluate the feasibility of the green housing transition in China. The fourth part addresses Research Question 7 to provide a range of policy recommendations for China's green housing transition.

11.2 Chinese developers' dilemma in delivering green housing

This research has drawn on institutional analysis as a conceptual framework and has contributed to the green housing literature. Developers were used as a research sample to understand market response of the green housing transition in this research. Previous housing-related studies using institutional analysis have revealed that key market actors' acceptance of green technology and behavioural change are important institutional

elements in promoting green housing transitions (Nykamp, 2017). This research supports this point and indicates that Chinese environmental governance and government regulations have important impacts on changing developers' attitudes which also reflect the changes in embedded institutions (i.e. values and beliefs) (Williamson, 2000; Vatn, 2015). The results have shown that 91% of the respondents believed that green housing would become a main building trend in China's future housing market, indicating that 'the rules of game' have defined the 'right way to act' (Aasen and Vatn, 2018, p.106).

Much of the evidence in this research revealed that developers' high-level attitudes towards their company's reputation and business success influenced their green building behaviours. For example, developers thought that currently, the most important driver for them to develop green housing were: 'increases company reputation and competition ability' (Section 7.4). Therefore, they conducted a series of actions to increase their company's reputation and business success, such as: 'producing enterprises' green strategies' (Section 8.3) and 'building brand' (Section 8.6).

However, although many developers were aware of the importance of the green housing transition, implementation is another matter (Zhang and Zhou, 2016). It means that attitudes are not completely equivalent to behaviours (Liu, 2009; Liu and Ye, 2012; Zhang and Zhou, 2016). For example, although most of the developers interviewed were aware that green housing would become the major trend in the future Chinese housing market, many of them were 'waiting-and-watching'. Even large and advanced developers had not completely changed their building behaviours towards green housing development. This might be explained by the fact that actual transactions are also constrained by various institutional elements such as the Chinese housing market system and the environmental governance system (Andrews-Speed, 2016). A range of institutional constraints were found in this research that explained developers' dilemmas in delivering green housing.

Comparing the key drivers of, and challenges to, green housing development faced by developers as shown in the literature review (Section 3.4) with the empirical data collected from Chinese developers in this research (Chapter 7), the findings support the idea of Nguyen et al. (2017) that many of the barriers faced by developers in developed and developing countries are quite similar. For example, higher costs of green technologies and

equipment (Rehm and Ade, 2013; Marker et al., 2014; Dwaikat and Ali, 2016); lack of consumers awareness (Brounen et al., 2013); or inefficient policies and regulations (Darko and Chan, 2017; Zainul Abidin et al., 2013; Luthra et al., 2015). These barriers were frequently mentioned in both the questionnaire feedback and the interviews for this research.

In institutionalism theory, transitions cannot be dictated by government alone (Payne and Barker, 2018). Social acceptance and common frames of mind are also important elements (Moloney et al., 2010; Tabi, 2013). The findings in the research revealed that both regulation requirements from government and consumer market demand have a great degree of influence on developers' attitudes and behaviours (Enker and Morrison, 2017; Nguyen et al., 2017; Zhang et al., 2018). However, the empirical evidence has also showed that a conceptual conflict between government and consumers on green housing exists in the Chinese housing market institution (Section 8.5). The developers felt they were caught in the middle of a complex situation since they had to find the most appropriate approach to meet the requirements of the policy arenas, consumer demand and the wider market arenas from the same housing project.

This situation faced by developers is even more challenging when costs (both monetary and time costs) are discussed, especially in the short term (the three most important barriers found in the questionnaire survey were about 'costs'). The empirical evidence showed that even when the government implemented incentive policies and provided subsidies to those developers who developed green houses, the subsidies were below the level needed to cover the extra costs of building green houses (Section 9.4.1). As profit-making companies, the only way for developers to cover these added costs is to pass them on to consumers (Guy and Hanneberry, 2008).

However, the data also revealed that currently there is a lack of public acceptance of green housing in China. The change of consumers' awareness of green housings and their buying behaviours is ongoing but very slow. As the result, it was difficult for Chinese developers to meet government regulation whilst seeking to pass the extra costs of their green housing products on to consumers. As a result, this research discusses that Chinese developers are in

a 'dilemma' where both the short-term costs pressures and longer-term transition pressures have to be absorbed by themselves.

New institutionalism theory suggests that companies tend to strive for 'legitimacy' while maintaining 'efficiency' (Yang and Su, 2013; 2014; Yang et al., 2012). This research contributed that Chinese developers tended to meet government green housing requirements in order to seek legitimacy, while seeking to meet consumers' green housing demands and improve market reputations in order to maintain efficiency. Thus, the changes in their behaviours can be explained by them seeking legitimacy through a 'logic of social appropriateness' while searching for maximum economic gain through 'a logic of instrumentality' (Campbell, 2006, p.926). In other words, although Chinese developers' behaviours have been found as interactive processes, their attitudes influenced them to be rational and goal-oriented to make choices (Hall and Taylor, 1996).

Moreover, the adaptive efficiencies of developers within the institution largely depended on their adaptive capacities (Andrews-Speed, 2016). Although this research focuses on investigating the Chinese developers as a whole group, some differences of the adaptive capacities between different types of developers found in this research are highlighted here. The empirical evidence in this research showed that different types of developers behaved differently when faced with the green housing transition. The research showed that a small group of large-size advanced green development enterprises had higher adaptive capacities in relation to the green housing transition. For instance, they seemed more willing and able to invest in green housing development, while smaller enterprises experience more difficulties and were less willing and less able to undertake green housing investment (Section 8.4). In addition, the empirical data revealed that state-owned developers in China faced a different situation from private developers. For example, when they sought to balance government requirements and consumer demand, state-owned developers were more inclined to accomplish government goals, while private developers were more likely to consider how to balance government requirements and consumer demand, since they are under more economic pressure (Section 8.5).

Nevertheless, institutional environments provide both challenges and opportunities (Scott, 2008; Suchman, 1995). The state-market relations perspective used in this research enabled

the exploration of how Chinese developers accommodated strategic responses to handle institutional constraints and took advantage of institutional capitals. As the key actors in the housing market institution, developers in green housing transitions sought to take advantage of the prevailing institutional environment in order to favour their own interests (Andrews-Speed, 2016). Indeed, some empirical evidence in this research has shown that large and advanced green housing enterprises sought to work with the prevailing institutional environment by investing in green housing technologies (Section 8.4) or integrating market resources (Section 8.7). Thus, this research states that these large and advanced developers' green housing activities are not only shaped by the institutions, but also, they are shaping the Chinese housing market institution to favour their own interests in the long run.

Indeed, the extent to which developers can influence or change institutions depends on their capacity to influence collective action and this depends, in turn, on the distribution of power within the prevailing institutional framework (Hall, 2010). Such changes are extremely difficult to bring about in the Chinese housing market since the capacity of a small proportion of large leading developers or of a large proportion of less powerful developers to influence institutional change depends, in part, on the political culture of the society (Wu, 2015). This research found that the power asymmetries in China intensify the developers' 'dilemma'.

Overall, a new institutionalism theory provides an analytical framework of how Chinese developers within the housing market institution response to the green housing transition (Scott, 2008; DiMaggio and Powell, 1991). Institutional analysis provides a way of viewing how institutions shape the capacities of developers and their actual transactions (Hawtrey, 2012) and vice versa: how they seek to influence the institution to suit their own needs. This research thus emphasises that the Chinese institutional context of the green housing transition functions as a facilitator for, as well as posing constraints on, developers' delivery of green housing. In other words, an in-depth exploration of developers' attitudinal and behavioural changes found they could be largely associated with, or constrained by, the institutional context in China, which is evaluated in the following section.

11.3 Institutional weaknesses in promoting the green housing transition in China

Every economy has its institutional weaknesses when promoting socio-technical transitions (Estache and Wren-Lewis, 2009). The institutional weaknesses found in China by this research mean that the optimal regulatory policy may be different from that of developed economies. A range of constraints have been identified in this research, which respectively reflect many institutional weaknesses in China for promoting the green housing transition. In addition, drawing on the conceptual framework, the examination of institutional weaknesses has been undertaken at the ‘institutional environment’ level and the ‘institutions which govern transaction’ level (Williamson, 2000). More specifically, the data found in this research supports the idea that the various levels of institutions and actual transactions (i.e. developers’ attitudes and behaviours) have bi-directional influences between each other, and influence Chinese developers’ capacities for green housing development.

Level of Institutions	Key Constraints found in this research	Institutional weaknesses
‘Institutional environment’ level	Absolute power over decision-making and lack of public participation	Top-down governance system, power imbalances
	Strong control over land resources	‘Socialist Market Economy’
	Lack of flexibility in the existing governance system	Government-led
	Lack of long-term monitoring	Lack of a long-term vision to ensure success
	Conflicts within and between different government departments	Overlap of duties and policies, fragmented authoritarianism
‘Institutions which govern transaction’ level	Supply-demand imbalance in the Chinese housing market	Economic pressures against green housing development
	Lack of consumer demand for green housing	Disconnection between consumers and governments
	Fragmented structure of the supply chain for the green housing transition	Fragmented market

	Inefficiency of green housing policy instruments	Policy failure, 'green' is not priority
	Inefficiency of Evaluation Standard for Green Building (ESGB)	Neglect of post-construction evaluation

Table 11.1 A summary of institutional weaknesses reflected in constraints on China's green housing transition (illustrated by the author)

Table 11.1 shows a summary of institutional weaknesses revealed by the empirical findings and the constraints currently being experienced by Chinese developers during China's green housing transition. At the 'institutional environment' level, although some literature states that climate governance in China displays a degree of flexibility (Lo, 2014; Economy, 2014; He, 2014), this research reveals that the Chinese top-down governance system still has significant influences in making the 'rules of game' (Vatn, 2015) of the housing market institution. 'Decentralisation' in current climate governance refers only to the relationship between central government and local authorities (Liu and Salzberg, 2012; Cai and Treisman, 2006). It does not refer to the state and the market. In contrast, this research confirms that the value of centralisation is deeply embedded in the housing market administrative system. As Developer A said: *'A policy, to the left or to the right [to which development direction], can determine the whole industry's prosperity or decline'*.

This top-down governance system contains many institutional weaknesses that this research has revealed constrains the green housing transition in China. This research identified five institutional weaknesses caused by this top-down governance system that currently frustrate Chinese developers' uptake of green housing. First, key market actors, including developers, are largely excluded in decision-making which leads to power imbalances in state-market interactions at the level of the institutional environment (Section 10.2). This point supports Laffont's (2005, p.245) idea that China can be described as having 'economies with missing markets.' Secondly, power imbalances continue to lead to a lack of flexibility in the existing governance system (Section 10.3). This reflects the institutional weakness of the government-led system in which there are no external forces to push the government to make effective changes.

Thirdly, unlike the capitalist economies of Western countries, the ‘socialist market economy’ in China allows government actors, and especially local government actors, to play the role of landowner (Yao et al., 2014). This research reveals that the relationship between market actors and government actors creates more ‘ambiguity’ within the Chinese housing market institution, as Developer F disclosed: *‘It is more and more difficult to get land; most of the auctions and bidding are not working now. We need to rely on some corporations [with governments to getting land].’* In the housing market institution, these corporations could translate into incomplete contracts (Laffont, 2005) because key actors’ (i.e. developers and local governments) are often informally bounded.

Fourthly, the institutional weaknesses of ‘fragmented authoritarianism’ (Lieberthal and Oksenberg, 1990) have also been revealed in the research (Section 10.5). The empirical data confirms that green housing-related government departments are distributed within and between vertical authorities (Ministerial departments) and horizontal authorities (central and local governments) (Dai, 2015; Lo, 2015a). This leads to overlaps of duties and policies between different authorities. In the interviews, developers complained that when these overlapping regulations were introduced into the housing market, they led to misaligned incentives for market actors (Andrews-Speed, 2012; Shen, 2017).

Fifthly, even if many local governments have considered green housing development in their local planning strategies, according to the developers interviewed in this research, many government leaders only focus on whether green housing projects meet the requirements in the early design/planning stage (Section 10.4). However, as a whole-life-cycle project, the latter stage of operation for green housing is just as critical (Huo et al., 2019b). This reflects one of the institutional weaknesses in Chinese environmental governance: policymakers may wish to support green housing development for the political benefit while not willing to devote sufficient resources to its full implementation due to split incentives and lack of a long-term vision.

The research also reveals that the institutional weaknesses discussed at the ‘institutional environment’ level appeared to influence the changes at the level of ‘institutions which govern transitions’. The institutional weaknesses found at the level of ‘institutions which govern transitions’ can be grouped into market-based and policy-based. From the market-

based, as discussed in Section 11.2, although the interactions focused on in this research are mainly between government and developers, the empirical data shows that developers highlighted the lack of consumers' green housing demand in the Chinese housing market institution. State-market interactions are about the multiple and complex dynamics of the relations between public and private actors (Healey, 2007). New institutionalism theory suggests that different institutional actors have different values (Jenkins and Smith, 2001). Therefore, one of the institutional weaknesses in the Chinese housing market was that (the lack of) consumer awareness of green housing had largely been overlooked by policymakers as an issue for consideration in the green housing transition (Section 9.3).

Figure 11.1 shows the triangular relationship between governments, developers and consumers as depicted from the findings of empirical data. As can be seen from the figure, the developers in this research indicated that there was a disconnection between government and consumers within the housing market institution, especially for green housing buying activities. They further indicated that current green housing incentive policies might be making efforts in the wrong direction. To explain, the developers argued that the government currently pays more attention to seeking to shape developers' building activities by issuing regulations and policies for green housing rather than incentivising consumers towards purchasing green housing, or educating them on the benefits.

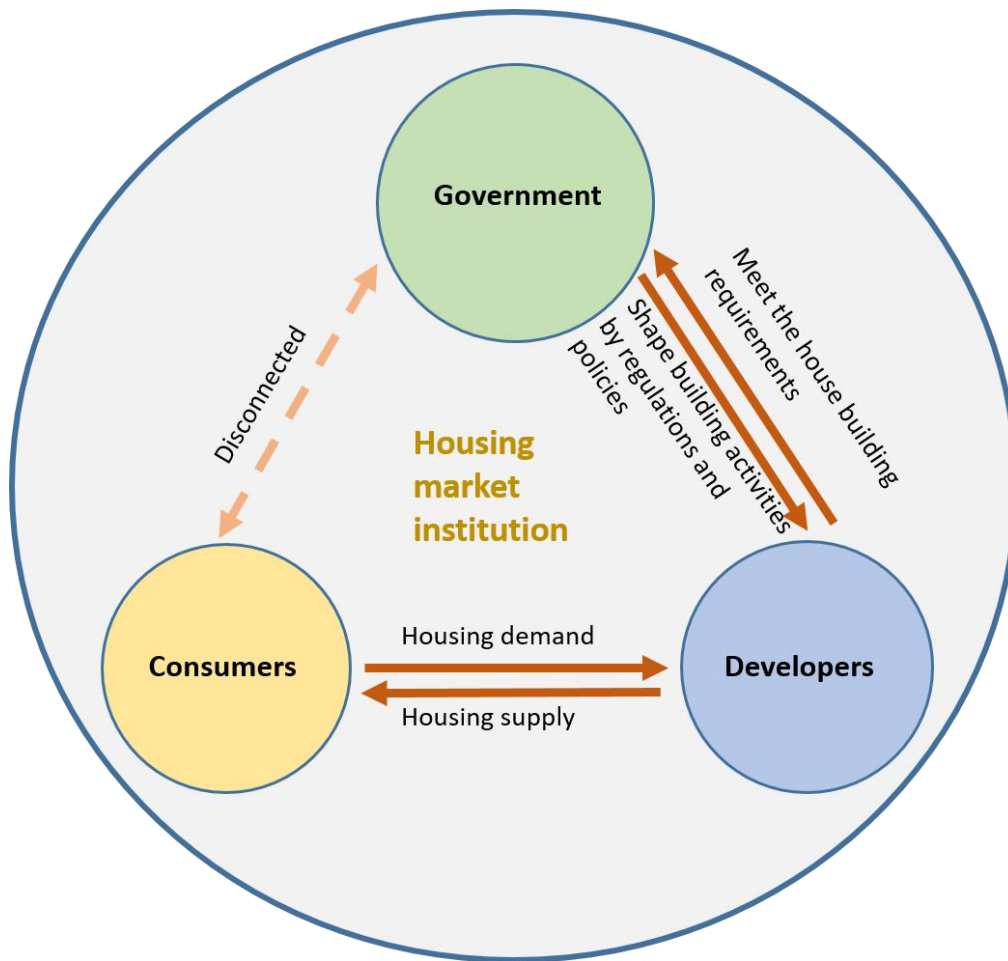


Figure. 11.1 The relationships between government, developers and consumers in the Chinese housing market institution (Illustrated by the author)

This research therefore indicates that, like the western and liberal context, the focus of green housing policies should not be on developers alone, but, importantly, should also address consumer demand (Payne and Barker, 2018). However, this research contributes that the current disconnection between government and consumers in the China's housing market therefore leads to low consumer awareness of, and low-demand for, green housing products which can be seen as an institutional weakness from the market base.

Another significant market-based institutional weakness in the Chinese green housing transition is market fragmentation, which can be most clearly seen in the immature supply chain industry of green housing development in China (Section 9.4). Figure 11.2 shows the fragmented supply chain in China's housing market: all the supply chain actors connected with developers, but they disconnected with each other. Such disconnections lead to a lack of coordination and integration in projects. Thus, the industry is more focus on optimising

the project process, rather than the performance of the housing's whole-life-cycle (Kesidou and Sorrell, 2018).

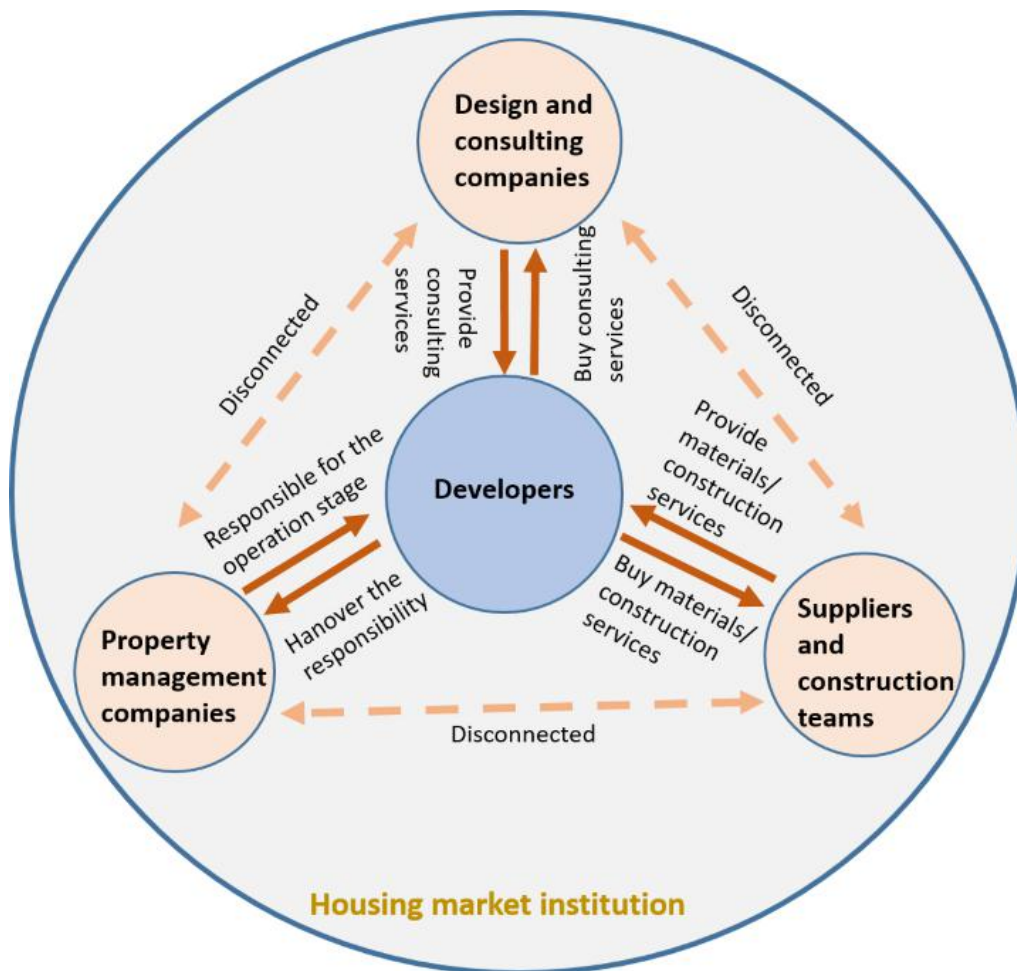


Figure 11.2 Fragmented supply chain in China's housing market (illustrated by the author)

Some existing literature identified the characteristics of the supply chain in China's housing development as fragmented and fiercely competitive (Shen et al., 2017). This research contributes that there is a separation between the design, construction and operational phases in China's green housing transition, whereby different supply chain actors participate and input sequentially. As a result, this 'lack of systemic vision' (Kesidou and Sorrell, 2018) within housing market institution hinders integrated design and collaboration of the projects.

From policy base, on the one hand, developers identified some 'policy failures' such as incoherence of policy changes and unfulfilled incentive promises (Section 9.5). This can be seen as an institutional weakness since the current green housing policy instruments cannot

be smoothly implemented into the market institution and thus, cannot maximise their efficiency and objectives (Li and Shui, 2015; Shen et al., 2017).

On the other hand, as the most important national standard for guiding green housing development, ESGB plays a guiding role in Chinese green housing development (Ding et al., 2018). The empirical data shows that developers' activities are largely influenced by the ESGB (Section 9.6). However, the government's focus on green housing development as represented in the ESGB settings reflect some institutional weakness. First, the government's focus on the design and planning stage of green housing development reflects a lack of long-term vision (Liang et al., 2016) needed in the green housing transition. Secondly, there is a lack of stimulation for innovations in the ESGB. As a result, the data in this research revealed that some of the developers interviewed often chose to meet the minimum requirements and even 'cheated' when they applied for green housing certificates (Section 8.6).

11.4 Feasibility of the green housing transition in China

This research has employed institutional analysis as a conceptual framework to examine how the changes in the housing market resulting from the green housing transition have affected, and been affected by, developers. In other words, the green housing transition can be conceptualised and examined as a series of institutional changes emerging from state-market interactions taking place during the transition; institutional weaknesses (such as those discussed in the last section) may influence the overall feasibility of the transition. This can occur at different levels of institution (Andrews-Speed, 2016). Knowing developers' attitudes and behaviours could also help in understanding these processes and evaluating the feasibility of the policies. This section considers the literature review, research theory and empirical findings and makes an original contribution by evaluating the feasibility of the green housing transition in China.

In the short run, three points have been generated from this research when considering the feasibility of the green housing transition in China. First, this research highlights the extra costs for developing green housing products which need to be highly considered by the State. The top three barriers of the green housing transition chosen by developers were all

about extra costs (Section 7.5). Especially the cost of green technologies, which has been chosen by developers as the top one incentive for the transition. As discussed in Section 11.2, developers felt struggled with the extra costs due to the lack of financial support by the government and lack of demand from consumers. However, this research also reveals that developers believe the extra costs will be reduced in the long run.

Thus, the long-term strategy is really important in order to reduce the actors' uncertainty risks (Jin and Hunter, 2013). However, the second point is that the implementation of current green housing strategies is seen as a medium-term policy goal in China: the five-year-plan regulation framework, for example, and longer-term strategies and policies for the green housing transition are generally absent or only vaguely mentioned (Zhang et al., 2018b; He, 2016). The empirical data in this research shows that the government's long-term regulation commitment to promote the green housing transition is limited. This situation could constrain transition toward green housing development since developers and other market actors suffer from the major deficiency of the plans which tend to only provide detail on short-term targets.

Furthermore, the credibility of the policy instruments, in other word, to what extent the policy instruments are considered reliable (Rogge and Reichardt, 2016), will influence the market actors' perceptions and have direct influences on their investment decisions (Rogge and Schleich, 2018). The efficiency and effectiveness of current green housing regulations and policies have been questioned by developers (Section 9.5) and these perceived 'failings' in the design of policy elements could further deter them from making changes.

Thirdly, from the perspective of housing market, this research revealed that the current lack of public acceptance of 'green housing' could reduce the feasibility of transition. The existing literature has shown that consumer awareness of green housing has a large effect on developers' behaviours in producing it (Zhang et al., 2018b), but Chinese consumers' current awareness and knowledge of green housing is insufficient (Zhao et al., 2015), and this is supported by the empirical findings in this research (Section 9.3). Nevertheless, the developers also pointed out that only small number of high income groups take 'green' or 'sustainable' into consideration when they were buying a house (Section 9.3). It indicates that the current market environment is not ready for the transition. Therefore, this research

contributes to showing that the green housing transition in China are far from straightforward and require a deeper exploration than currently seen in the literature of how to deliver an effective transition in the housing market.

However, the issues of climate change and carbon challenge has been emphasised in China's environmental governance, which create 'windows of opportunity' (Kucharski and Unesaki, 2018, p.127). In the long run, this research reveals that from the developers' perspectives, the longer-term housing market trends and carbon regulation trends will become 'greener'. Although the empirical findings show the green housing transition is not straightforward and contains a range of institutional constraints, the uncertainties in the market could also become opportunities since the current institutional conditions of Chinese green housing transition are dynamically changing and the market is not completely 'locked in'. The changes in developers' attitudes and behaviours found in the research reflect that the Chinese housing market institution are 'dynamically stable' which can be seen as an ongoing process.

From developers' perspective, the Chinese housing market is facing a 'turning point' from traditional construction to green housing construction. How feasible and how long will be taken to achieve the green housing transition largely depend on how policymakers deal with the institutional weaknesses and use them as institutional strengths and how the State and market actors co-evolve with each other.

11.5 Beyond constraints: policy recommendations for supporting the green housing transition in China

This research has explored Chinese developers' capacity for the green housing transition, and has drawn attention to the continuous interactions between market responses and policies. However, the research reveals that the market is not fully capable of driving institutional changes itself and thus there is a requirement for policymakers to deal with the constraints the research has identified. This is especially important in China due to the top-down system, and the nature of Chinese housing sector is not fully market-oriented (Zhang, 2014).

The developers' dilemmas, institutional weaknesses and feasibility of the transition discussed above reflect, to some extent, a range of policymaking blind spots which in turn are linked to the cognitive constraints imposed by existing institutions (restricting the perceived solution space), the inertia and path dependence of those institutions, and the political influence of the relevant incumbents (Geels et al., 2018).

This section seeks to address Research Question 7 which is to provide more feasible policy recommendations for the green housing transition in China. In this research, policy change is regarded as a form of institutional design (Alexander, 2005) and the process is seen as incremental (North, 1990). While policymakers still have leading roles in the process, particularly in the Chinese context, recommendations for policy change have been informed by an understanding of how the Chinese housing market institution and developers operate, experience constraints, change and can be changed. Therefore, the developers' suggestions gathered in this research have been taken into consideration when shaping for policy suggestions.

Is it important to highlight that green housing transitions are complex, multi-actor, multi-factor, multi-level tasks, involving long-term frameworks, multiple participants (Geels, 2010). This complexity means that a multiple policy approach is needed in order to address multiple objectives (Loorbach, 2010).

11.5.1 Establish long-term strategies in the housing sector

Green housing transitions can take more than one generation to eventuate (Moore et al., 2014). Thus, the dearth of longer-term strategies regarding green housing is a notable issue. Previous literature has stressed that green housing transitions should be complemented with long-term agenda setting in order to reduce uncertainties (Rotmans and Loorbach, 2010). However, as the review of current green housing strategies in China shows in section 3.4, long-term strategies are absent. The findings of this research have also shown there to be significant uncertainty for developers surrounding future requirements in the housing sector.

Therefore, it is suggested that a longer-term goal for the green housing transition in China are necessary. When considering longer term strategy development, policymakers should evaluate present green housing policies and carefully consider the current conditions of housing market activities and future trends of the market; and include updated green housing development costs data and predicted impacts on the housing industry and consumers. While the green housing transition in itself might not be such an endpoint, it intends to explain the future direction of housing performance requirements for the market.

11.5.2 Improve stakeholders' participation

This research has collected a range of developers' ideas for enhancing the green housing transition in China. However, the extent to which developers can change institutions depends on their capacity to influence collective action and this depends, in turn, on the distribution of power within the prevailing institutional framework (Hall, 2010). In fact, it is more difficult for market actors' voices to be heard by policymakers due to the government-led political culture of the Chinese society (Li and Shui, 2015), when compared to western and liberal contexts. As a result, this leads to a range of policy implementation issues and can make Chinese green housing policy instruments inefficient and ineffective when introduced into the market.

Therefore, it is suggested that improving communications between state and market actors and getting key market actors – developers and other stakeholders such as suppliers and consumers - into the policy making processes will help to improve the feasibility of the policy operation in the market.

11.5.3 Improve the incentive instruments

This research reveals that reducing costs and getting 'payback' is seen by Chinese developers as important factors in delivering green housing projects (Section 7.6). Although many of local governments have issued their incentive policies to stimulate green housing delivery, interview respondents indicated that the governments often did not meet their commitments and developers did not get the promised subsidies (Section 9.5). This issue

further verifies one of the institutional weaknesses in the Chinese institutional environment which is the power imbalance between state-market actors.

Therefore, it is suggested that policymakers should focus on making more attractive incentive policies: for instance, reducing the capital costs of green housing development by creating economic efficiencies in the materials and building processes and through the establishment of green housing financial mechanisms such as low interest loans in the financial sector (Moore et al., 2014). The government should work with the financial sector to develop innovative economic levers to achieve these changes in the market (Tambach et al., 2010). In order to achieve this, the Chinese banking sector is suggested to approve higher loans for developers or other related market actors to cover the extra costs of entering green housing production.

Policymakers should also focus on strengthening supervision and monitoring to ensure the effectiveness of these incentive policies: for example, by introducing third-party organisations to supervise the implementation of green housing incentives.

11.5.4 Improve the Evaluation Standard for Green Building (ESGB)

As an important basis and minimum requirement, it is suggested that the ESGB should extensively promote and favour the implementation of green housing strategies. This research has revealed that there were many issues with the current two-stage green housing evaluation system in the ESGB settings (Section 9.6). It is suggested that the current two-stage green housing evaluation system should be changed to a single stage evaluation which can be processed on the completion of green housing development. This means that developers and their construction teams would have to strictly observe all the terms and conditions in the design and planning documents in order to obtain green building labels. In terms of the operation stage of green housing, a post-evaluation mechanism is needed which will be suggested in the following sub-section.

11.5.5 Strengthen the post-evaluation of green housing projects

In addition to the above suggestions, policymakers should change their current understandings of green housing costs to a more comprehensive way from the perspective

of the whole-life-cycle costs and benefits, rather than only focus on the capital costs of housing design and planning. The findings of this research have shown that there is a responsibility gap between developers and property management companies during green housing completion and later operation (Section 9.4.3). Thus, it is not unusual for Chinese developers to choose to reduce the cost of a building's functional effectiveness in order to save on the costs of achieving green certification. But it is important that both energy saving and comfort should be achieved in green housing (Shi et al., 2016). To solve this conflict, one solution for policymakers to consider is establishing a post-evaluation mechanism to be followed in the operation stage of green housing.

It is suggested that policymakers could establish a life-cycle-led supervision framework to calculate and evaluate the full range of economic, social and environment impacts of green housing. For example, a supervision team could periodically examine green housing projects by taking users' comfort, building energy efficiency and green equipment performance into consideration. The policymakers could evaluate the overall performance of green housing and provide valuable feedback for building operation as well as future design.

11.5.6 Improve public awareness and demand for green housing products

This research has shown that wider social awareness and demand for green housing products are essential elements in the green housing transition (Section 9.3). Institutionally, the research has highlighted the need for a focus on developing an understanding of existing and potential consumer demand and requirements to policymakers to a green housing future. Thus, it is suggested that policymakers could provide integrated social and technical requirements in policies and regulations which include links to broader social elements such as improve users' living standards.

Moreover, policymakers could stimulate consumers' green housing demand in the housing market either by 'changing prices' or by 'providing information'. 'Changing prices' could be the most effective demand-side policy approach in the short run. In China, the supply-demand imbalance in the housing market have fuelled a concern with 'affordability', which has in turn dominated debate regarding housing provision and green housing demand (Moore et al., 2014). Combined with the developers' suggestions in this research (Section

9.7.1), policymakers could introduce incentive policies such as reducing loan interest rates for consumers purchasing green housing - the higher the standard of the green housing consumers choose, the lower the loan interest rates they could be. Other incentive policies could include providing financial subsidies, lower interest rates of loan for consumers who purchase green housing.

At the same time, to realise green housing transitions, people will need to radically change their values, norms of behaviour and lifestyles (Jin and Hunter, 2013). Therefore, it is important to 'provide information' for the public. For example, to introduce programmes of public education to improve understanding of green housing.

11.5.7 Support for the green housing supply chain

In the house building industry, a mature supply chain is the precondition for achieving green housing transitions (Kesidou and Sorrell, 2018). However, this research has shown that green housing professionals and skilled employees, qualified consulting companies and high quality green suppliers are still scarce in the Chinese housing market (Section 9.4). A lack of professionals with green knowledge has become an obstacle in green housing development. Therefore, it is necessary for a successful green housing transition to build a mature and comprehensive green housing supply chain to support the transition.

Due to the 'diversity, complexity and fragmentation' (Kesidou and Sorrell, 2018) of the existing green housing supply chain as highlighted by the developers interviewed in this research, policymakers should seek to support the establishment of supply chain and increase the integrations between different stakeholders to reduce the fragmentation issue. There are three key ways in which this can be achieved. First, policies should encourage greater collaboration in green housing construction through public procurement practices based on relational norms. Secondly, establish green knowledge networks and cross-firm and cross-stakeholder partnerships which connect developers, supply chains and consumers could be promoted and safeguarded. Thirdly, training in green technologies, processes and management practices for all construction occupations could be provided.

11.6 Summary

In summary, this discussion chapter has addressed the research aim, objectives and research questions, with the discussion of literature (Chapter 2 to 4) and the conceptual framework (Chapter 5), methodology (Chapter 6), and the empirical results presented in Chapters 7 to 10.

It has shown what new knowledge from this research can contribute to the current green housing policy/market literatures. These new areas of knowledge include: the Chinese developers' dilemma within the green housing transition; the institutional weaknesses in China when promoting the green housing transition; an evaluation of the feasibility of the green housing transition in China; and a range of policy recommendations to address these issues in order to facilitate China's green housing transition.

The research conclusion in the following chapter highlights the key findings of this research; what original contribution has been made by this research; research limitations; and recommended future areas of research.

Chapter 12. Conclusion

12.1 Introduction

The final chapter draws this thesis to a close. First, it summarises the key findings by answering the research questions raised at the beginning. Secondly, it highlights the original contributions of this research to a number of specific fields of academic literature. Thirdly, it outlines and reflects critically on the limitations of the research; and finally, it suggests directions for continuing research on this topic.

12.2 Key findings

The central aim posed at the outset of the thesis was: to investigate the institutional constraints on the green housing transition in China by evaluating the capacity of Chinese developers to deliver green housing in the Chinese housing market. To address this research aim, seven research questions were raised in Chapter 1. This section of the Conclusion summarises the key findings, using the seven research questions as a framework. Each question is answered in turn, and the implications of the findings of each one are evaluated.

RQ 1. What is the current status of carbon regulation and green housing policies in China?

This research question has been mainly targeted in chapter 2 and 3. This research has reviewed that the Chinese government has realised the importance of implementing carbon regulation in its housing sector and has established national strategies, gradually transferring its policy attention to a low carbon context. However, China has a unique context of urban and climate governance, which includes state-led regulations and ‘fragmented authoritarianism’ (Lieberthal and Oksenberg, 1990), which distinguish its carbon regulation from Western countries.

Carbon regulation and climate governance in China influences policy-making and implementation of green housing policies. Currently, the Chinese government has released a number of policies and regulations to promote green housing development. These policies and regulations are driven by national green housing strategies such as the 13th Five Year

Plan (2016-2020) and China's New-style Urbanisation Plan (2014-2020) which have strengthened green housing development. It has been reviewed that the majority of local governments have responded to the national strategies and issued green housing policies and regulations. In addition, the Chinese government has also issued the Evaluation Standard for Green Building (ESGB) as the main technical basis for carrying out and evaluating green building practices in China.

Carbon regulation and green housing policies play a crucial role in guiding and giving incentives to housing market activities and performance of developers (Zeng et al., 2011; Chang et al., 2014; Ye et al., 2013). However, some scholars have argued that there is a 'lack of policy rationality' in Chinese green housing policies (Li and Shui, 2015; Shen et al., 2017). The efficacy and validity of current Chinese green housing policies have been questioned for a variety of reasons including the lack of post-policy supervision of green housing (Huang et al., 2015); lack of incentives to foster market-based mechanisms to develop green housing (Li and Shui, 2015); and overlapping and unclear standards and regulations (Zhang, 2015). This research contributes to this knowledge and reveals that current green housing policies are lacking market attractiveness which discourages developers from delivering green housing.

RQ2. What are the potential drivers and challenges faced by developers to the implementation of carbon regulation and green housing policies in China?

This research question has been addressed in Chapter 4. The review of existing literature on other economies showed what might become potential drivers and challenges faced by Chinese developers in green housing development. The potential drivers and challenges were grouped into four categories: financial factors; market factors; policy factors; and technological factors.

The findings in response to this question have also helped to define the questions about key drivers/challenges asked in the questionnaire survey and interviews for this research. The empirical findings support Nguyen et al. (2017) who show that although there are differences between green development contexts of developed and developing markets, the adoption of green housing in the different backgrounds generally faces similar barriers.

Taking both RQ 1. and RQ 2. into consideration, it suggests that although the Chinese government have employed a variety of approaches to encourage green housing development, Chinese developers face a variety of challenges to developing green housing. In the process of the green housing transition, these challenges interact, making the situation even more complex for developers to make changes.

RQ 3. What research theory and methods are most appropriate for analysing developers' capacity, state-market relations and institutional constraints during green housing transitions?

This research question has been mainly addressed in Chapters 5 and 6 which discussed the conceptual framework and methodologies. Institutional analysis has been chosen to establish the framework for this research because: (1) it is readily applied as a conceptual framework or analytical approach with which to investigate state-market relations to urban transitions (Payne, 2009; Payne and Barker, 2018); (2) In new institutionalism theory, scholars have flexibility to decide how to conceptualise institutions in their research, in the way they present their causal arguments (e.g. top-down or bottom-up), and what levels and features of institutions they choose to focus on (e.g. formal structures, informal practices or behaviours) (Powell and Bromley, 2013); (3) it offers invaluable insights in understanding what kinds of development or reforms of policy and regulations may be required to encourage the housing market to deliver low carbon goals (Adams et al., 2008).

In terms of the methodological approach to the research, a mixture of quantitative and qualitative methodologies have been adopted: a self-completion questionnaire survey; in-depth interviews; and work placement. These methods facilitated the collection information to provide a general overview of developers' attitudes, a detailed knowledge and understanding of Chinese developers' behaviours, and an examination of the institutional constraints of the green housing transition from developers' perspective based on the understand of state-market relations. These three different methods had different functions when addressing key areas for investigation.

The self-completion questionnaire survey was a quick and easy approach for gathering broad and more general attitudinal data from developers. In-depth interviews with

developers explored developers' behaviours in relation to green housing in China, and their opinions of the existing institutional context for the transition. In-depth interviews have been used to capture developers' perceptions, experiences and meanings made them well-suited for analysing developers' actions. work placement was chosen as a method to understand the role of the State / government by immersing the author in the milieu being observed (Silverman, 2006) in order to acquire a comprehensive understanding of the broader institutional environment of the green housing transition.

RQ 4. What are Chinese developers' attitudes towards the green housing transition?

This research question was mainly addressed in Chapter 7. The evidence from the questionnaire survey revealed that most of the respondents (91%) recognised that green housing would become one of the mainstream trends in the future Chinese housing market. Indeed, a majority of them have changed, or are changing, their attitudes towards the green housing transition in China.

However, their attitudes are influenced by different factors with various degrees. This research also found that the key drivers/barriers/incentives considered by the developers changed between the current situation and the anticipated future situation. Three words should be highlighted here to conclude the findings: 'reputation'; 'costs' and 'policy'. First, it has been revealed that developers are more driven to develop green housing by seeking 'increased company reputation' both currently and in the future. Secondly, they are struggling with the high costs of green housing development in the short run. If the current high costs, especially technology costs, could be reduced, they might be more willing to shift further towards green housing development. Thirdly, policy factors have been found to become more and more important in influencing developers' attitudes, as shown by the responses that policy factors in all the drivers/barriers/incentives results were highly ranked. Although the respondents are pushed by green housing policies and regulations, they do feel uncertainty due to a lack of confidence in the current green housing policies and regulations implemented by the government. Thus, how, and to what extent, green housing policies can be more supportive; extra costs can be reduced; and the effect of green housing development to the company reputation can be clearly shown, would have a great degree

of influence on changing developers' attitudes towards increasing green housing development.

RQ 5. What are Chinese developers' behaviours towards the green housing transition?

This research question was mainly addressed in Chapter 8. Developers' behaviours in the green housing transition in China were examined through in-depth interviews. From the interviews, seven types of developer behaviour have been identified in this research: 'changing to green development concepts'; 'producing green strategies for their enterprise'; 'balancing costs and benefits'; 'balancing government requirements and consumer demands'; 'building brands'; 'coordinating market resources'; and "cheating' in green development practices'.

The findings also revealed the extent to which developers changing their behaviours towards green housing development was dependent on their capacities in the institution. For example, it was found that the larger enterprises were more willing and able to invest in green housing development, while smaller companies experienced more difficulties and had less ability to undertake green housing investment. In addition, it was also found that state-owned development enterprises in China faced a different situation from private companies. For example, when balancing government requirements with consumer demand, respondents in state-owned enterprises were more inclined to seek to achieve government goals, while private developers were more likely to meet government green housing requirements in order to strive for legitimacy, while meeting consumers' green housing demands in order to maintain efficiency.

RQ 6. What are the key constraints faced by Chinese developers when delivering green housing?

This research question was mainly addressed in Chapters 9 and 10. Drawing on the conceptual framework, constraints were examined both at the level of 'institutions which govern transactions' and the level of 'institutional environment' where developers' capacity is influenced by the institutional elements at both levels. In-depth interviews with

developers explored the constraints at both levels, while work placement was incorporated to investigate constraints at the level of the 'institutional environment'.

At the level of 'institutions which govern transactions', five constraints were identified: 'Supply-demand imbalance in the Chinese housing market'; 'lack of consumer demand for green housing'; 'fragmented structure of the supply chain industry for the green housing transition'; 'inefficiency of green housing policy instruments'; and 'inefficiency of the Evaluation Standards for Green Building (ESGB)'. The first two constraints result from the current Chinese housing market system (market base) and the last three constraints result from Chinese green housing policy instruments (state base).

At the 'institutional environment' level, this research highlighted five important constraints that were caused by the Chinese government administration system. These institutional constraints include: 'absolute power in decision-making and lack of public participation'; 'lack of flexibility and efficiency of the existing governance system'; 'lack of long-term monitoring'; 'conflicts within different governments departments' and 'strong control over land resources'.

These constraints reflect a range of institutional weaknesses for promoting the green housing transition in China which have been discussed in Chapter 11. Some of these constraints were caused by the institutional environment of China's green housing transition, which is relatively deep-rooted and difficult to change. However, some of these constraints were caused by the lack of cohesion between the state and the market. If policymakers could aware of this issue and deal effectively with these constraints, it would be easier to promote the green housing transition in the housing market institution.

RQ 7. How can insights and knowledge from current research and theory and from the analysis of the empirical data for this thesis be used to provide potential policy recommendations for the green housing transition?

This research question was mainly addressed in Chapter 11. The developers' dilemmas and the institutional weaknesses discussed in Chapter 11 also reflect policymakers' blind spots when making green housing policies from developers' perspective. This research pointed

out the following seven potential policy recommendations for China's green housing transition based on the understanding of developers' capacity and institutional constraints found in this research: 'Establish long-term strategies in the housing sector'; 'improve stakeholders' participation'; 'improve the incentive instruments'; 'improve the Evaluation Standard for Green Building (ESGB)'; 'strengthen the post-evaluation of green housing projects'; 'improve public awareness of and demand for green housing products'; 'support for building the green housing supply chain'.

The policy recommendation set outlined in this research aims to be capable of achieving institutional changes for the green housing transition, resulting in the mixture of multiple policy instruments to address multiple objectives (Loorbach, 2010).

12.3 Original research contributions

This research is interdisciplinary and has made contributions to a number of research fields including: green housing literature; institutional analysis literature; and mixed methods research. The contributions to each research field are summarised in this section.

12.3.1 Green housing literature

Although much existing literature has focused on green housing, many evaluate green housing development from technological and political perspectives. The market actors' responses for green housing development, especially in developing countries, have been overlooked. This research has explored the green housing transition in the Chinese context and contributes to knowledge in the green housing literature in non-western and non-liberal contexts. Taking the Chinese housing market as a case study, this research has also emphasised that green housing transitions are complex processes not only involving green materials or technologies, but also and most importantly, the attitudinal and behavioural changes of housing market actors, that transition scholars should to examine (Payne and Barker, 2018).

The original contribution of this research is the examination of Chinese developers' capacity to deliver green housing and what they considered as the key constraints for the green

housing transition in China. This research on developers' attitudes and behaviours has contributed to investigating why the Chinese government's ambitions (NDRC, 2016) (requiring 50% of urban new buildings to be green buildings by 2020) are unlikely to be achieved and a green housing transition in the Chinese housing market is unlikely to be successful in the short term at least.

The research also helps policymakers better understand the market conditions of the green housing transition in the Chinese housing system and suggests what kind of new regulations might be needed to address the constraints.

12.3.2 Institutional analysis literature

The theory of new institutionalism (DiMaggio and Powell, 1991; Hall and Taylor, 1996; North, 1991) was adopted as the theoretical lens for this research through which to interrogate the empirical findings in order to afford a deeper understanding of complex state-market interactions in relation to centrally-determined green housing targets shown to be important in previous research (Payne and Barker, 2018).

In turn, this research has provided insights to shed light on the use of the theory from a case study of the green housing transition in China. This research conceived that the green housing transition takes place under an institutional context and Chinese developers as market actors in pursuit of responding to specific green housing goals. Through the lens of institutionalism, the assessment of developers' capacity has been achieved and addressed, as well as how their capacity was constrained or enabled by the institutional conditions. The institutional analysis in this research supports that the institutional conditions and actual transactions have bi-directional influences: institutions form the 'rule of game' (North, 1991) which shapes developers' building activities, but developers also seek to change institutions in order to favour their own interests (Hall, 2010). This conceptualised the complexity and dynamics evident in market responses to state-led institutional changes from the institutional analysis.

In relation to the application of new institutionalism, this research has contributed by developing an analytical framework (see Figure 5.2, p.103) to explain how institutional

analysis can be adopted to investigate the green housing transition under the Chinese context. The analytical framework was developed based on Williamson's (2000) three levels of institution, which has been used by some transition scholars (e.g. Andrew-Speed, 2016; Kucharski and Unesaki, 2018) in other economies. It has been noted in chapter 5 that institutions can be examined at different scales and the scholars have flexibility to choose scopes of research when using institutional analysis (Powell and Bromley, 2013). The author acknowledges that whilst embedded institutions - social actors' traditions, customs and beliefs - can be an important element to consider when applying institutional analysis, they were not considered necessary in this examination of the Chinese green housing transition. Indeed, whilst embedded institutions could help develop a much deeper understanding of developers' traditions, customs and beliefs in relation to new forms of green housing practice, this level of institutional change is '...often extremely slowly, in the order to centuries or millennia' (Kucharski and Unesaki, 2018, p.8). The norms and beliefs that underpin Chinese society remain relatively stable, even as green housing policies, as the 'new rules of game' (Vatn, 2015), are introduced into its institutional context.

Further, this research has highlighted that the green housing transition in China requires the coordination of the State and the market. The extent to which they can coordinate effectively becomes critical in understanding the likely success of the transition (Kucharski and Unesaki, 2018). The research also therefore reveals that state-market coordination is an important consideration when analyzing institutional change in the Chinese green housing transition. On this basis, the level of institutional environment (the state governance) and the level of institutions which govern transactions (the market and policy context) can be determined to be of most relevant to, and influential on China's green housing transition. Therefore, the principal contribution of this research is on institutional change in China's green housing transition at these two levels and their effects on developers' capacities.

Although this research has not chosen to focus on the level of embedded institutions, it is suggested that further studies could incorporate embedded institutions to examine, in a much more nuanced way, the green housing practices of Chinese developers. Methodologically speaking, this research could use detailed interviews, participant observation and company-level case study approaches to investigate Chinese developer

traditions and customs in green housing development practices. Combined with the findings of developer capacity in this research, such a study could help to draw a comprehensive institutional picture of the complex dynamic changes that are taking place in the institutional context of green housing development in China.

12.3.3 Methodological Contributions

Based on the conceptual framework of institutional analysis (Payne, 2009; Payne and Barker, 2018; Andrew-Speed, 2016; Williamson, 2000), this research was conducted with a mixed methods approach (Philip, 1998) which makes a methodological contribution for further similar research.

Despite having markedly different functions, both quantitative and qualitative methodologies were applied in a systematic nature, addressing the research aim, objectives and questions. The data analysis was undertaken in different ways associated with the challenges of the used methods. On the one hand, the quantitative analysis of questionnaire, used the goal of green housing transition as the analysis focus, to drive a more institutional and dynamic qualitative approach. It has been found essential to reduce the complexity of the material to a series of quantifiable metrics (Bryman, 2016) that has defined the most significant factors of the transition.

On the other hand, the nature of institutional analysis is about the investigation of the interactions in institutional and actor systems (Cars et al., 2002). A great deal of qualitative data were used for capturing the complexity and dynamics of the transition system (Wagenaar, 2011). This mixed methodological approach can be used to balance understanding institutional complexity with actual transactions in different ways.

12.4 Research limitations

This section highlights the limitations of each of the research phases undertaken. First, there was lack of relevant Chinese literature on the green housing transition. Therefore, the literature review was undertaken from both Western and Chinese contexts to help understand existing research in this field. Although such reviews are necessary and enable the creation of a clearer logical framework, and there are some good lessons have been

learned from the overview of Western literatures, the transition pathways and policy instruments found from Western cannot directly be transferred into the Chinese contexts due to cultural differences.

Second, the research has attempted to make a contribution to the institutional analysis literature by operationalising the understanding of the green housing transition through research on developers. This only contributes to investigating a particular perspective of the green housing transition. In order to draw a fuller and richer picture of the green housing transition in China, other complimentary examinations are required, such as research on consumers or supply chain, or the interactions between these stakeholders.

Third, as is common in research, there were some limitations in the use of the methodologies. In terms of a questionnaire survey, the more responses secured, the more accurate results can be achieved (Bryman, 2016). However, developers were a difficult group to get in touch with, and it has been difficult to get responses from a significantly larger number of questionnaires. This limitation also applied to the interviews. In addition, one of the main limitations of the data collection phase was the issue of commercial sensitivity in the housing market which prevented the disclosure of developer -specific information, such as housing prices or profit margins, that may have otherwise been useful. This commercial sensitivity issue is largely due to the intense competition nature in developer group.

12.5 Further area of research

The link between green housing policy and carbon regulation of the housing sector, and market responses and key actors' activities remains an area of research interest to scholars. In the light of the varying responses by Chinese developers to regulation and the green housing transition, a number of research gaps remain. These research gaps reflect issues that this research has identified as requiring further academic and policy attention.

These research gaps are:

A. This research identified various existing institutional constraints of the green housing transition in China which need to be considered by the State and policymakers. However, it

does not provide pathways for overcoming these constraints towards the long-term vision. Thus, there is a need for additional work in this area.

B. This research used institutional analysis to investigate the green housing transition from developers' perspective. However, new institutionalism indicates that actors' interests vary across networks and in certain areas, may in conflict each other. Future research could examine other key stakeholders' interests (e.g. consumers, property management companies or banking sector), focusing on interpretations of the changes over time, and whether such changes (if observed) would affect decisions over stakeholders' selection and adoption choices. Given the relative novelty of the green housing concept in the Chinese housing system, this research has shown that the perceptions and understandings of those charged with delivery are in a state of flux: follow-up studies might pursue how such developing understanding will influence future selection and adoption of green housing policies and regulations.

12.6 Final summary

Driving back to the beginning of this research, the transformation to a low carbon future is essential. The Chinese housing industry is highly required to take response to the carbon challenge, but the transition toward green housing development likely to be 'incremental rather than radical' (While et al., 2010, p.83) and present a series of challenges. This research has contributed on investigating Chinese developers' response to the institutional changes of the green housing transition and the wider institutional constraints affecting their capacity. Key areas investigated in this research were: developers' capacity of delivering green housing; constraints at the level of 'institutional environment' from the developers' perspective; and constraints at the level of 'institutions which govern transactions' from the developers' perspective. Through the research, it has been revealed that Chinese developers did face a range of underlying sources of institutional weaknesses during the transition process that constrained their capacity to delivering green housing.

Ultimately, this research calls for a better understanding by policymakers of market actors' actual transactions and the wider institutional weaknesses constraining actual transactions in the housing market institution. In order to avoid sustained institutional rigidity, it suggests

that policymakers work closely with the market to produce more appropriate green housing policies and regulations in order to stimulate efficient and enduring institutional change.

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Appendix 1: Questionnaire

Green Housing Development Questionnaire

Dear Sir or Madam:

First of all, thank you very much for participating in this questionnaire survey, it should take no longer than 15 minutes to complete.

I am Han Jiang (Department of Urban Studies and Planning, University of Sheffield), I am conducting doctoral research into the Chinese house developer companies' response to the green housing transitions in the current China's housing market, focusing specifically on the impacts of increased government carbon regulations in building sector and the interaction between housing developers and the government.

All the information that you provide will be treated in a strictly confidential manner. All the information received will be aggregated and no comments made will be attributed to a particular company. This questionnaire survey will only be used in my academic research programme and the results of this research will be disseminated to the wider academic research community.

If you would like any further information please contact me (hjiang3@sheffield.ac.uk), Department of Urban Studies and Planning, University of Sheffield, Western Bank, S10 2TN. Or my supervisor Dr. Sarah Payne (s.payne@sheffield.ac.uk)

Thank you very much!

Section 1: Background Information

1.1 In which of the following Chinese regions does your company operate? (please tick all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Northeast China | <input type="checkbox"/> Southwest China |
| <input type="checkbox"/> North China | <input type="checkbox"/> South Central China |
| <input type="checkbox"/> Northwest China | <input type="checkbox"/> East China |
| <input type="checkbox"/> All China Regions | |

1.2 What is your company size (whole company, not just regional office)?

- Large size property developer (total assets \geq 100 million)
- Medium size property developer (50 million \leq total assets < 100 million)
- Small size property developer (20 million \leq total assets < 50 million)
- Micro-enterprise developer (total assets < 20 million)

1.3 Since 2006, to what extent has your company been involved in designing and constructing green housing?

- A major extent
- A moderate extent
- A minor extent
- Not at all

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1.4 In a housing development project, which of the following would you consider to be a key characteristic of green housing? (Please tick all that apply)

- Use sustainable materials
- Land-saving & Outdoor environment
- Energy-saving & energy utilisation
- Water-saving & water utilisation
- Material-saving
- Indoor environment quality
- Construction management
- Operation management
- Other (please specify)

Section 2: Trends of Green Housing Development

2.1 Has the number of green housing units completed by your company changed over the past 10 years? (please indicate by ticking the appropriate box)

- Increased significantly
- Increased slightly
- Stayed the same
- Decreased slightly
- Decreased significantly

2.2 Do you think the number of green housing unit completions by your company will change in the next 10 years? (please indicate by ticking the appropriate box)

- Increase significantly
- Increase slightly
- Stay the same
- Decrease slightly
- Decrease significantly

2.3 Does your company think that green housing development will become a main construction trend in the next 5 years?

- Yes
- No
- Other (please specify)

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Section 3: Key Drivers of Green Housing Development

3.1 Current Drivers of Green Housing Development

To what extent has the following factors become a driver of green housing development to your company? (1: Not a driver/2: slight driver/3: moderate driver/4: significant driver/5: very significant driver)

		1	2	3	4	5
1.Financial factors	1.1 Greater return on capital					
	1.2 Attract more investment					
2.Market factors	2.1 Increased customers' demand					
	2.2 Increases company reputation and competition ability					
	2.3 More easier to get land from bidding					
3.Policy factors	3.1 Government mandatory regulations and policies					
	3.2 Government incentive regulations and policies (e.g. VAT)					
4.Technological factors	4.1 Introduced greener technologies					

Other (please specify)

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3.2 Future Drivers of Green Housing Development

To what extent will the following factors be considered as a driver of green housing development to your company in the next 10 years? (1: Not a driver/2: slight driver/3: moderate driver/4: significant driver/5: very significant driver)

		1	2	3	4	5
1.Financial factors	1.1 Greater return on capital					
	1.2 Attract more investment					
2.Market factors	2.1 Increased customers' demand					
	2.2 Increases company reputation and competition ability					
	2.3 More easier to get land from bidding					
3.Policy factors	3.1 Government mandatory regulations and policies					
	3.2 Government incentive regulations and policies (e.g. VAT)					
4.Technological factors	4.1 Introduced greener technologies					

Other (please specify)

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Section 4: Key Barriers of Green Housing Development

4.1 Current Barriers of Green Housing Development

To what extent has the following factors become a barrier of green housing development to your company? (1: Not a barrier/2: slight barrier/3: moderate barrier/4: significant barrier/5: very significant barrier)

		1	2	3	4	5
1.Financial factors	1.1 Higher material costs					
	1.2 Higher technology costs					
	1.3 Higher costs to training employees					
2.Market factors	2.1 Lack of household awareness					
3.Policy factors	3.1 Unclear building regulations					
	3.2 No uniform solution of green housing standard					
4.Technological factors	4.1 Insufficient technical knowledge and tools					
	4.2 Lack of availability of green technologies					
	4.3 Lack of skilled employees					

Other (please specify)

4.2 Future Barriers of Green Housing Development

To what extent will the following factors be considered as a barrier of green housing development to your company in the next 10 years? (1: Not a barrier/2: slight barrier/3: moderate barrier/4: significant barrier/5: very significant barrier)

		1	2	3	4	5
1.Financial factors	1.1 Higher material costs					
	1.2 Higher technology costs					
	1.3 Higher costs to training employees					
2.Market factors	2.1 Lack of household awareness					
3.Policy factors	3.1 Unclear building regulations					
	3.2 No uniform solution of green housing standard					
4.Technological factors	4.1 Insufficient technical knowledge and tools					
	4.2 lack of availability of green technologies					
	4.3 Lack of skilled employees					

Other (please specify)

Section 5: Key Incentives of Green Housing Development

5.1 Current Incentives of Green Housing Development

To what extent has the following factors become an incentive of green housing development to your company? (1: Not an incentive/2: slight incentive/3: moderate incentive/4: significant incentive/5: very significant incentive)

		1	2	3	4	5
1.Financial factors	1.1 Reduce the cost of green materials					
	1.2 Reduce the cost of green technologies					
2.Market factors	2.1 Increase public advertise of green housing					
	2.2 increased company marketability and industry reputation					
3.Policy factors	3.1 Simplified carbon regulations in building sector					
	3.2 Development of a uniform Code or standard for green housing					
4.Technological factors	4.1 More research to produce green technologies					
	4.2 increased green housing technology or knowledge share					

Other (please specify)

5.2 Future Incentives of Green Housing Development

To what extent will the following factors be considered as an incentive of green housing development to your company in the next 10 years? (1: Not an incentive/2: slight incentive/3: moderate incentive/4: significant incentive/5: very significant incentive)

		1	2	3	4	5
1.Financial factors	1.1 Reduce the cost of green materials					
	1.2 Reduce the cost of green technologies					
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	3.2 Development of a uniform Code or standard for green housing					
4.Technological factors	4.1 More research to produce green technologies					
	4.2 increased green housing technology or knowledge share					

Other (please specify)

Section 7: Your details

Please fill in the following details (or attach a business card) *(For contact purposes only)*:

Name:

Position:

Company:

Email:

Thank you very much for your assistance in this research. If you are interested in this research, please don't hesitate to email me. A summary of the research findings will be sent to you on completion of the research!

Appendix 2: Interview question list

Part 1. Company green housing strategy & future trends of green housing

1.1 How do you understand green housing?

1.2 Has your company developed any green housing project? Could you please introduce some case studies? (ask about the design approach and construction process of those projects)

1.3 Does your company produce any green development strategy or plan? If yes, can you introduce about them?

1.4 Has your company do any satisfaction survey with customers who bought green housing? If yes, how do they think about the day-to-day use of green housing?

1.5 In the questionnaire, I found that when developers talked about green housing, the most important aspects you focused on were: how to achieve energy-saving; use sustainable materials; and how to achieve high quality of indoor environment. Can I ask why you would like to pay more attention on these aspects rather than how to reduce carbon emission during the housing construction stage or later operation stage?

1.6 In the questionnaire, 86% respondents believes that green housing development will become a main construction trend in the future. Do you agree with them and why? (ask about Market trend/Policy trend/Skills trends as well)

1.7 In the questionnaire, it is interesting to see that about 6% respondents want to slightly decrease their green housing projects in the next 10 years. What do you think about this result? Can you explain why would it happen?

Part 2. Questionnaire findings (main drivers/barriers/incentives)

2.1 What is the most important driver of green housing development do you think and why?

- *The questionnaire finding shows that the top 3 important drivers of green housing development are 'increase company reputation and competition ability', 'introduced greener technologies' and 'greater return on capital'. Do you agree and why?*
- *In your practical experiences, do you think 'green housing' can get more capital return and increase company reputation?*
- *Based on your answer, to what extent do you think government carbon regulation will be a main driver in the future?*

2.2 What is the most serious barrier of green housing development do you think and why?

- *The questionnaire finding shows that the top 3 serious barriers of green housing development are 'No uniform solution of green housing standard', 'Lack of skilled employees' and 'Higher costs to training employees' Do you agree and why?*
- *Based on your answer, why do you think the current green housing standard or regulations have become barriers of green housing development in China?*
- *In your practical experiences, how difficult to recruit or training skilled employees?*

2.3 Is there a need for an incentive? What would be the most useful incentive?

- *The questionnaire finding shows that the top 3 important incentives of green housing development are 'Increase public advertise of green housing', 'Simplified carbon regulations in building sector' and 'Development of a uniform Code or standard for green housing' Do you agree and why?*
- *To what extent do you satisfied with the current green housing policies and regulations and why?*

Part 3. Challenges of green housing development and how to overcome?

3.1 In your practical experiences, what are the biggest differences between traditional housing development and green housing development? (in different stages: planning, construction and management)

3.2 To what extent do you want to change your current traditional constructions skills and business strategies toward to build green homes?

3.3 In practice, what were the most serious difficulty you meet when you develop green housing project? How did you deal with them? What changes you made as a result?

Part 4. Institutional constraints (housing market and carbon regulation)

4.1 How do you think about the current roles of government in the green housing market?

4.2 How about the relationship between government and developers in the housing market?

4.3 How do you evaluate the current standard and regulations of green housing development?

4.4 If you think the green housing regulations and policies are not good enough, do you have any suggestions of how to modify them?

4.5 Except of the current green regulations or policies, what will be potential adaptation approaches or strategies adopted or likely to be adopted by developers and the extent to which these are envisaged or in operation?