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Sustainable Peri-urban Residential Settlement Development in China – The case of Tianjin

Thesis for the degree of Doctor of Philosophy

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Dedicated to my new born son Antu Li

Abstract

Fuelled by rapid urbanization, urban spatial expansion is increasingly encroaching on the rural hinterland of large metropolises around the world, making a type of spatiality referred to as the "peri-urban" an important focal point for urban studies. Peri-urban residential settlement development in Chinese cities has been put on a fast track in recent years, however, its current situation has been little documented and its implications for sustainability not well understood. The main contributions of this research to the existing literature is considered to be two-fold: Firstly, this research has filled the research gap by providing a more up-to-date empirical study of peri-urban settlement development in the Chinese city of Tianjin with a specific focus on residential settlements and presenting the current and emerging challenges that face sustainable peri-urban settlement development; Secondly, this research has also made contributions to research in the context of sustainability by adopting an integrated research methodology that combines case-study-based systemic evaluation with assessment of stakeholder perspectives and decision-making dynamics.

In this study, a theme-based evaluation framework is developed and used to assess the sustainability outcome of three recently developed peri-urban residential settlement cases in Tianjin, China, with each representing one typical peri-urban settlement type, i.e. rural resettlement project; affordable housing compound; and suburban commercial housing estate. Their specific approaches to achieving sustainable development are discussed, and remaining problems and challenges are identified and analyzed with suggestions for the complementary approaches and progression in the planning and management of peri-urban settlements. The evaluation framework is also used to examine the perceptions of the stakeholders of urban development on peri-urban sustainability. By making a comparison between the delivered sustainability outcome of the settlement cases and the stakeholders' perceptions on sustainability, it was revealed that lower levels of sustainability performance in the settlement development outcome coincided, to a large extent, with lower levels of conformation on the conceptions of sustainability between the decision-makers of the development and the residents of the communities developed.

List of Publications

Lu Sun, Chenguang Li, Julie A. Gwilliam and Phillip J. Jones, 2011, "*Challenges to Sustainable Peri-urban Settlement Development in China: an analysis by empirical evidence in Tianjin"*, Sustainability Today: WIT Transactions on Ecology and the Environment, Volume 167, pp. 3-14 (ISSN: 1743-3541)

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Chapter 1 _ Introduction

1.1 Research background

Human activities of building settlements began centuries ago. Now over a decade into the 21st century, with the high speed of urbanization worldwide, the world's cities are undergoing dramatic processes of regeneration and expansion. Ever since the definition of sustainable development was first published by the World Commission on Environment and Development (WCED): "development which meets the needs of the present without compromising the ability of future generations to meet their needs" (World Commission on Environment and Development 1987), sustainability has become a globally recognized key feature in the urban planning discourse. In the century of urbanization, the urban built environment plays a vital role in improving sustainability both locally and more widely.

The world is rapidly urbanizing with the developing countries being the main contributor to this process. Spatial expansion of growing cities increasingly encroaches on their rural hinterland, making a type of spatiality referred to as the "peri-urban" an important focal point for urban studies. The term "peri-urban" refers to "a zone around the built up area of a city, its perimeter or edge, the 'rural-urban fringe' where city and country land uses overlap" (Willis 2005). Since the 1980s, urban planning in China has favoured "decentralized concentration" growth management policies, which encouraged the development of planned peripheral settlements and the building up of the peri-urban interface around all Chinese metropolitan regions (Zhao, L ü and Woltjer 2009). In recent years, fused by urban population and economic growth, peri-urban settlement development in Chinese cities has been put on a fast track, which is often characterized by the building of large-scale and high-density peripheral gated residential estates. The peri-urban interface is undergoing huge environmental, social and economic transformations. Yet, its current situation is little documented and the implications for sustainability are not well understood.

This research seeks to fill this gap by providing a more up-to-date empirical study of peri-urban settlement development in the Chinese city of Tianjin with a specific focus on residential settlements and presenting the current and emerging challenges that face sustainable peri-urban settlement development. This research also seeks to make contributions to research in the context of sustainability by adopting an integrated research methodology that combines case-study-based systemic evaluation with assessment of stakeholder perspectives and decision-making dynamics. This study will be of interest to the academic community, and produce practical implications for the policy makers, planners and architects who are involved with China's peri-urban settlement development, to reinforce positive trends and enable policies to avoid mistakes.

The challenge of reconciling environmental, social and economic outcomes, called for by sustainability proponents becomes more apparent when sustainability is applied to urban systems. The quest for sustainable urban development is recognized as a "dynamic process responding to changing economic, environmental and social processes" (Haughton and Hunter 1994). This suggests that the meaning of sustainability should respond to different economic, environmental and social processes. Being interlinked with both the urban and the rural sectors, the peri-urban interface witnesses the interwoven issues of agricultural land, ecological system, employment, poverty and the built environment, which affect the sustainable development of both sectors. To understand sustainability in this context requires inquiry into its environmental, social and economic dimensions, as well as benefiting both the urban and the rural contexts.

Since China's Agenda 21 was published in 1994, sustainable development has been accorded national strategy, which proposes the integration of the social, economic and environmental goals of society. However, recent criticism of China's environmental record and performance combined with problems of a lack of social equity suggest that considerable challenges still exist for Chinese planners and policy makers striving towards sustainable human settlements. These challenges are echoed across the increasingly urbanized world. As Grant (2006)

pointed out in her analysis of Asian cities in general, they face a "double challenge", simultaneously experiencing both the problems associated with cities of the developing world and the contemporary dilemmas of the post-industrial city. She also observed that the western model of sustainable cities does not provide a universal prototype for Asian cities, and that they should "look for different solutions" (Grant 2006).

China is indeed in urgent need of the solutions now. Urban sustainability is particularly pertinent for China in that China has been undergoing dramatic changes over the last decade with economic success bringing with it significant transformations and challenges, particularly in the form of population increase, high urbanization rate and the consequential demand for housing and services. To find solutions for the emerging challenges facing sustainable urban development in Chinese cities, it is essential to first obtain a clear understanding of the current situation of urban development and their existing problems.

This study proposes an evaluation by outcome approach towards assessing the actual effects of the sustainability measures being undertaken in current peri-urban residential settlement development in Chinese cities. Three recently-developed settlement cases in the urban periphery of the city of Tianjin, North China are chosen as study cases to represent three typical types of peri-urban settlement development in Chinese cities. Their proposed sustainability strategies and design features are analyzed with detailed evaluation of the effect of their implementation.

The study also seeks to combine the evaluation of current development outcome with a comprehensive inquiry into the forces behind the making of these peri-urban settlements. It is proposed that an integrated professional perspective and household perspective be obtained to understand their perceptions on sustainability issues and explain the dynamics and conflicts in the decision-making of current urban development practice, which is directly linked with the successes and failures of sustainable settlement developments.

1.2 Research questions and objectives

The overarching research question this thesis is set out to answer is:

To what extent has the current peri-urban settlement development in China achieved sustainability and how has perceptions of sustainability affected the sustainability outcome of peri-urban settlement developments?

The main aim of this piece of research is:

To evaluate the perceptions and performance of sustainability in current peri-urban settlement development in China

To address this aim, five lines of research questions are raised:

1. What are the sustainability issues with peri-urban settlement development in the global literature and development practice, and what theoretical framework can be used to assess the issues?
2. What are the socio-economic and environmental impacts of peri-urban development in Chinese cities and what has currently been done to address the sustainability issues in the Chinese urban/rural development realm?
3. To what extent has the current outcome of peri-urban settlement development practice in China addressed holistic sustainability issues?
4. What are the stakeholders' perceptions on the sustainability issues and how has the dynamics of decision-making affected the sustainability of the outcome of peri-urban settlement development in China?
5. What is the relation between the stakeholders' perceptions of peri-urban sustainability and the sustainability performance of developed peri-urban settlements, and what implications does it have on planning and design of peri-urban settlements?

To answer each of the research questions, it is necessary to outline the objectives to be achieved in this study:

1. To identify the sustainability issues related with peri-urban settlement development and establish an evaluation framework for the assessment of development practice in China;
2. To examine the socio-economic and environmental impacts of peri-urban settlement development in China, and assess current progression on policy interventions in the area of sustainable urban/rural development;
3. To evaluate the sustainability of the outcome of current peri-urban settlement development practice in Chinese cities and identify the current problems;
4. To understand the dynamics of decision-making in the planning and design of peri-urban settlements in China and assess stakeholders' perspectives on issues of peri-urban sustainability.
5. To establish the relation between the sustainability performance of peri-urban settlements and the stakeholder perceptions on peri-urban sustainability, and identify the implications for the planning and design of peri-urban settlements.

1.3 Thesis structure

This thesis consists of eight chapters. Chapters 1 to 3 introduce the research background, raise the main research questions and the objectives, establish the theoretical framework, and develop a feasible methodology for the study as a whole. Chapters 4 to 7 constitute the main body of the thesis, which are focused on the empirical study of peri-urban settlement cases in Tianjin. The final chapter reviews major research findings, synthesizes all the conclusions in response to the research questions, and suggest possible directions for future research.

Chapter 2 aims to provide the theoretical foundations upon which this study rests. It contains four parts. The first part clarifies the definitions and conceptualizations of the "peri-urban" and their implications for sustainability evaluation before briefly reviewing the evolution of the ideas, concepts and theories that have influenced the planning and design of peri-urban settlements in a global context.

The second part reviews the socio-economic-political driving forces of peri-urbanization in Chinese cities before identifying the emerging forms of peri-urban residential settlements in Chinese cities and analyzing the process that have given rise to these forms. By combining the themes that continuously emerge out of the literature and practice of sustainable peri-urban settlement development in both developed and developing countries, the research themes for the examination of peri-urban settlement development in China are proposed. The third part focuses on reviewing the issues related with sustainability in the area of peri-urban settlement development. It first raises the idea that sustainability has become the main concern for urban development and argues that within the settlement development sector, the challenge of reconciling environmental, social and economic outcomes is especially fierce and in need of most effort. It then goes on to examine the evaluation frameworks for sustainable urban development worldwide and identify the main themes and issues to be included in the evaluation framework proposed for this study. The third part of the chapter focuses on a theoretical argument of the research approaches to take in addressing sustainability issues of urban development and identifies the research gap on sustainable peri-urban settlement development in the Chinese context and argues that this involves an integrated research approach that combines empirical study of current practice with an inquiry into decision-making dynamics and stakeholder perspectives.

Chapter 3 presents the research methodology. It first clarifies the integrated research approach adopted by this study. Based on the reviewed literature in Chapter 2, a theoretical framework is established for the assessment of three lines of elements, each addressing one of the research questions:

1. *assessment of current policies and regulations*;
2. *assessment of the outcome of peri-urban settlement development*;
3. *assessment of stakeholder perceptions on sustainability*.

The chapter then goes on to explain the research methods used in this research, which combines *quantitative research*, based on questionnaire survey, with *qualitative research*, based on document survey, site visits, observations, and interview.

Chapter 4 is focused on examining the progression of regulatory interventions in the area of China's urban/rural development to achieve sustainability. Based on the evaluation framework proposed in Chapter 3, this chapter assesses the progress of policy and regulation development pertaining to sustainability in the area of urban/rural development in China. It is argued that the current planning policies, regulations and design guidance have made considerable progress towards achieving sustainable development, yet the effect of their implementation remains to be evaluated based on more detailed empirical studies. This chapter is aimed to provide a comprehensive context for the more detailed case studies in Tianjin that will be addressed in the following chapters.

Chapter 5 focuses on the evaluation of the outcome of peri-urban settlement development in Tianjin, China. Three chosen settlement cases are studied, with each case representing one specific type of peri-urban residential development, and each laying claim to certain facets of sustainability. This chapter aims to examine in detail the outcomes of the development practice and the consequent impacts on the residents therein. The study cases are evaluated against the evaluation framework proposed in Chapter 3. The effects of the planning and design strategies are analyzed against the sustainability principles, and the existing problems and emerging challenges are presented.

Chapter 6 aims to examine the perceptions of stakeholders in peri-urban settlement development on issues of sustainability and understand the forces involved in decision-making on the planning and design for peri-urban settlements, the general approaches, as well as their capabilities and limitations in practice. The proposed evaluation framework is again used to structure the analysis. The professional and household perspectives on the sustainability issues are examined and compared.

Chapter 7 presents a discussion based on the findings of the previous chapters and establishes that the difference in the perspectives of sustainability between the different stakeholder groups is related with the outcome of sustainability performance of current settlement development practices. It then explains the implications for the planning and design practice of peri-urban settlements in

China to achieve better sustainability.

Chapter 8 summarizes the major research findings and draws conclusions relating to the research questions put forward at the beginning of this thesis. Based on the findings, recommendations are then made for future peri-urban settlement development in Chinese cities to establish a long-term commitment on achieving sustainability. Finally, the limitations of this research are analyzed with suggestions for potential future research themes.

Chapter 2 _ Literature review: sustainable peri-urban settlements - definition, development and related issues

2.1 Introduction

The world is rapidly urbanizing. Spatial expansion of growing cities increasingly encroach on their rural hinterland, making a type of spatiality referred to as the "peri-urban" an important focal point for urban studies. New settlement developments in the peri-urban areas outside the existing boundaries of urban built-up areas are becoming increasingly significant for the sustainable future of cities and their residents.

Human settlement development has undergone generations of evolution in response to transforming environmental, social and economic circumstances and changing human needs. In the twenty-first century, the sustainability agenda has bequeathed new meanings on human activities of settlement development and calls for tailored interventions to mitigate the impacts of such activities on the limited resources of the earth and the well-being of the current and later generations.

This chapter reviews the existing literature related with the area of peri-urban settlement development. It clarifies the conceptualizations of "peri-urban" and their implications for the sustainability agenda and addresses the significance of peri-urban settlement development to urbanization and sustainability. The chapter investigates the issue of peri-urban settlement development as a global phenomenon, which takes on different theoretical and practical focuses among developed and developing countries, while also demonstrating common challenges pertinent to the long-term viability of modern day cities.

While sustainability has become a global catchphrase, the challenge remains for it to establish true depth and validity, and avoid becoming an empty concept. This

chapter also reviews some of the definitions of "sustainability" and investigates its implications for urban planning and urban settlement development. It finally goes on to address the issue of evaluation of sustainability in the context of human settlement and community development and identifies the critical themes and issues that would need to be considered in order to understand the sustainability of peri-urban settlement development. The last section of this chapter focuses on a theoretical argument of the research approach to take in addressing sustainability issues of urban development.

2.2 Conceptualizing the "peri-urban" and its implications for sustainability

The peri-urban interface of a city is characterised by increasing population density, a mix of rural and urban functions, heterogeneous social composition, coexistence of middle-class suburban housing compounds and squatter settlements, diverse sources of income, fragmentation of regulation and management, uncoordinated conversion of farmland into commercial developments, pollution and environmental degradation, intensified resource exploitation, and a lack of service and infrastructure provision (Friedberg 2001, Allen 2003, Adell 1999, Dupont 2005, Webster 2002, Hudalah, Winarso and Woltjer 2007, Douglas 2006, Marshall et al. 2009). Most conceptualizations of the "peri-urban" interface focus on its "transitional" aspect. It is often depicted as featuring intermediate and ambiguous spatial characteristics. The peri-urban has been described as "a transition zone between fully urbanized land in cities and areas in predominantly agricultural use" (Adell 1999). The term "Peri-urbanization", therefore refers to the process in which "rural areas located on the outskirts of established cities become more urban in character, in physical, economic, and social terms" (Webster, 2002). Therefore, the peri-urban has no specific space, but rather an interface where the urban and rural functions interact. This process-based conceptualization of the peri-urban focuses more on the socio-economic and political forces behind the dynamics of the peri-urban interface, rather than the outcome of developments therein. The lack of spatial recognition of the peri-urban is believed to have come from the long-existing conception of a rural-urban dichotomy, as expressed by

either an urban or rural “bias” (Adell 1999). The former views the peri-urban as fundamentally integrated into urban contexts and sustained by urban economic dynamics, while the latter focuses on perceived degradation of rural natural resources as a consequence of urban spatial expansion. The definition proposed by Allen et al. (2006) that the peri-urban interface is “where rural and urban features co-exist, in environmental, socio-economic and institutional terms” suggests a paradigm shift from viewing the peri-urban as a “place-less” periphery to a more “place-based” spatial conceptualization.

Conceptualizations of the peri-urban have major implications for addressing issues associated with the evaluation of sustainability. Regarded as a place, the peri-urban presents a context that exhibits a heterogeneous state that both rural and urban features juxtapose and present challenges to environmental integrity, social justice and economic viability that require tailored mitigations from a new perspective. The requirement of sustainability of integrated social, economic and environmental goals calls for a holistic perspective and interdisciplinary interventions, as issues within each of the three dimensions interrelate and interact with one another within a specific locale. The process-based conceptualization fails to address the issue of sustainability in that it does not reveal how the specificities of place and location shape the relationships between environmental specificities, economic practices and social institutions (Marshall et al. 2009). Past experiences have shown that problems in the peri-urban interface have arisen from the ambiguity of space and the fragmentation of governance, as exhibited by serving benefit to some people while disadvantaging others and ensuring urban economic growth at the expense of environmental degradation. Thus the theorization of the peri-urban as a specific place type will overcome the problems raised by the urban and rural biases, and provide a tangible subject for evaluation. This study hence adopts the definition given by Allen et al. (2006), and seeks to evaluate current developments in the peri-urban space of a Chinese city against the requirements of sustainability.

2.3 Global peri-urban settlement development

Urban population growth and urban spatial expansion have been global phenomena observed in countries all over the world. The building of settlements outside the central city area occurs in suburbanized post-industrial cosmopolitans as well as rapidly-developing Third-world mega-cities. However, due to the differences in economic status and social driving mechanisms, peri-urbanization demonstrates different characteristics between cities in developed and developing countries. This section reviews the literature on peri-urban settlement development in developed and developing countries, with an emphasis on the theories and practices in response to sustainability.

2.3.1 Peri-urban settlement development in developed countries

Existing literature on peri-urban settlement development in the developed countries mostly uses the term "suburb" rather than "peri-urban". According to Falk (2006), suburbs can be crudely characterized by garden cities and semi-detached villas in Britain, by walk-up tenement blocks in much of continental Europe, and by free-standing houses in the United States. Simon (2008) argued, suburbs should be distinguished as principally residential areas already forming part of the built-up urban area. However, he also noted that there is clearly an overlap in the concepts of "suburb" and "peri-urban" and the actual usage of the terms (Simon 2008). As this study has a residential focus, it is considered to be appropriate to use the term "peri-urban" to embrace "suburbs" and equate "suburbanization" with "peri-urbanization" in the discussion on developments in the developed countries.

Building and residing outside the city is not a recent trend, but can be dated back to ancient times. In terms of influences on today's practice, the Garden City Ideals proposed by Ebenezer Howard in the early twentieth century UK was the beginning of generations of planning theories that led to what is held as sustainable development today (Birch 2002). In this section, the evolution of ideas and practices pertaining to peri-urban settlement development that descends from

the Garden City movement is analyzed.

2.3.1.1 The Garden City Ideals

Urban community planning had undergone generations of evolving conceptions and changing practices. Throughout the twentieth century, garden cities and garden suburbs were a dominant theme in residential development projects in the Anglo-American world. Many researchers have pointed out the continuum between Howard's Garden City concepts and the changing paradigms in the twentieth century leading to the sustainable urban development model (Birch 2002, Clavel 2002).

At the beginning of the twentieth century, the centralized industrial metropolis increasingly presented itself as a "whirlpool" that continues to suck in and diminish the liveliness of the society. In an attempt to escape from the crushing density of the centralized industrial metropolis, Ebenezer Howard proposed a vision to distribute the population and functions of the metropolis throughout the countryside while maintaining the efficiency of a modern society - a "married country and city" as described by Howard himself. Howard's idealistic vision and the later practices that aimed to realize it has left a rich and long-lasting legacy for later generations of city planners. As Birch (2002) had recognized, since Howard generations of planners have adapted his ideas to form their residential schemes, "attempting to find formulas that would marry town and country yet still be politically, economically, and socially feasible"- a paved way that would eventually lead to the sustainable city model.

By the end of the nineteenth century, social and environmental problems accumulated in large city environments. The urban planning profession was in the forefront of the search for ordered, structured, zoned environments to replace the chaos of the unplanned city and control the processes of urbanization spatially. Lower densities and structuring of the urban configuration became a standard approach. The planning of new settlements on the urban periphery commenced (Freestone 2000). The garden cities concepts were proposed among this trend of decentralization and tried to solve rural and urban problems of employment and

housing simultaneously by clearing away inner city slums. Howard proposed clusters of cities, self-contained and encompassed by a green belt yet connected together by adequate transport networks. The aim behind this concept of a "Group of slumless, smokeless cities" or "Social City" was to relieve the overcrowding of economic activities and people in the big cities. The movement of people to garden cities would relieve tension in urban areas; and the green belt would help to prevent urban sprawl and, by limiting the growth of individual garden cities, help to decentralise the population into further self-contained settlements.

In a special edition of the Journal of the American Planning Association in 1998, commemorating the 100th anniversary of the publication of Howard's "To-morrow: A Peaceful Path to Real Reform" (republished in 1902 as "Garden Cities of To-Morrow"), Schaffer (1998) summarized Howard's prescriptions for his garden cities: "Keep your settlements compact… provide for open space; separate residential areas from industrial zones but not from commercial establishments; build housing that people can afford; provide opportunities for secure employment; and create a plan … that is flexible and responsive to people's needs." The famous diagrams by Howard illustrate the essentials of his ideas (Figure 2-1). As observed by later researchers, the Garden City proposed by Howard is a form of planned decentralization that had the potential to restore community and health to modern life, to overcome urban inequities and class division, and even to save the countryside through "greenbelt" preservation (Fishman 1998).

Although Howard's diagrams seemed somewhat abstract and idealistic, the influence of their main principles was evident in the garden cities developed. Raymond Unwin and Barry Parker's work at Hampstead Garden Suburb and Letchworth Garden City both incorporated the compactness, green space, affordability, functional separation, community facilities, and transportation features that were central to Howard's idea. The Garden City movement had led to the spread of planned new towns, which became an important spatial development pattern in UK cities. The term "new settlement" was also used, mostly denoting a smaller version of new towns. In "Sociable Cities", Hall and Ward proposed that clusters of new settlements together constitute "social cities" of 250,000 people as advocated by Ebenezer Howard (Hall and Ward 1998). They argued that the

central concern in building any new settlement should be the impact of development on human beings – through both human society and the wider ecological system within which they live (Hall and Ward 1998).

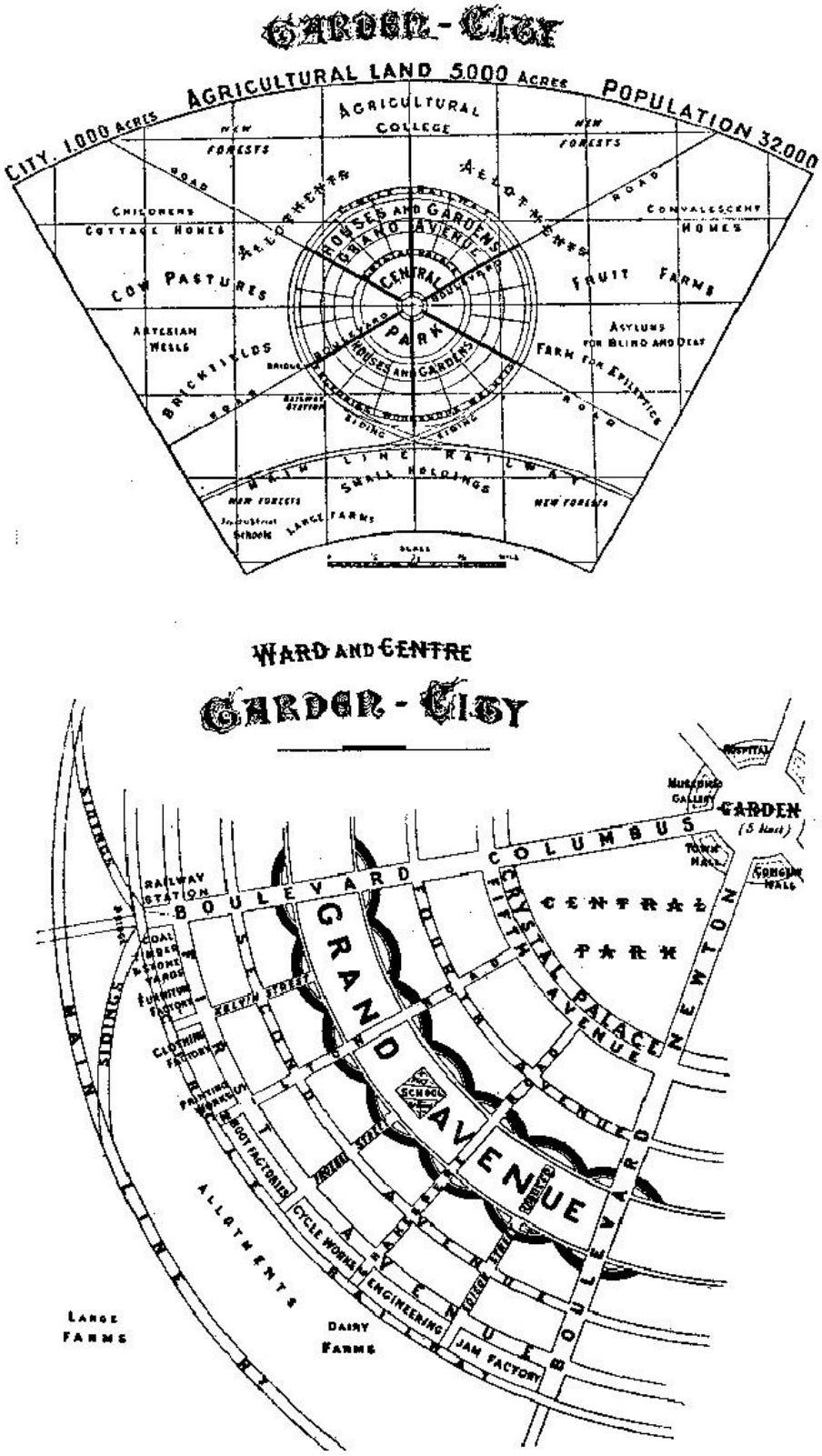


Figure 2- 1: Howard's diagrams showing the essentials of the Garden City ideals, Source: (Howard 1946)

Figure 2- 2: The plan of Radburn, New Jersey - neighbourhood units with residential cul-de-sacs and segregated transport modes, clustered around a centrally located high school,
Source: http://www.cmhpf.org/surveymecklenburgpaper.htm

The garden city movement had also significant influence on urban planning in the United States, where the issue of planned urban expansion was explored primarily in a suburban context. The plan of Radburn (Figure 2-2), New Jersey by Clarence Stein and Henry Wright in 1928 marked the Americanization of the Garden City concept (Freestone 2000). Stein and Wright's creation of the residential cul-de-sacs and the segregation of modes of transport responded well to the then fast-emerging mass-motorization and the design was widely adopted worldwide in the planning of suburban settlements (Freestone 2000). Clarence Perry's neighbourhood unit theory was also put to practical test at Radburn. Three neighbourhood units of 25,000 inhabitants had been planned with each unit serviced by an elementary school located within walking distance and all units clustered around a single high school.

2.3.1.2 The New Urbanist Movement

The Garden Cities had been criticised as the cause of the urban sprawl that threatens most of the megacities in today's world. Jane Jacobs claimed that Howard's garden cities only focused on "the provision of wholesome housing" and arranged them into "self-containment" devoid of urban functions (Jacobs 1961). However, other scholars defended the garden city ideals by claiming that they need to be separated from what is presented by the prevailing suburbs (Mumford 1961). Nonetheless, the urban trend, especially in the post-war period has tended towards greater decentralization – promoting low-rise residences, commuting by car, the use of private cars, the development of shopping malls along city edges, new commercial and industrial zones, and so on. The principle urban challenge had shifted from the crushing density of the centralized industrial metropolis in Howard's time, to be the low-density "anti-city" that has sprawled out over whole regions and has de-concentrated the central cities far more radically than the garden city activists ever envisioned. In the United States, the movement known as the New Urbanism has been especially concerned with devising, on greenfield sites at the edge of cities, new towns that would address the "failure" of modern urban planning, which was dictated by the predominance of car use and the seduction of modern suburbia. New Urbanism is anti-sprawl and promotes the creation and restoration of diverse, walkable, compact, vibrant and mixed-use communities (Duany, Plater-Zyberk and Speck, 2000; Calthorpe, 1993).

The New Urbanism, has been observed by researchers as having emerged from an American adaptation of the Garden City ideals (Fulton 2002, Freestone 2000), and was really the New Suburbanism (Scully 1994). The new urban approaches originated from several different themes that constituted the principles of New Urbanism. These include: Traditional Neighbourhood Design (TND), Transit-Oriented Design (TOD), Urban Villages and Smart Growth. As it turned out, practitioners of TND principles had a strong focus on recreating traditional urban forms and vernacular building styles. This often left TND subject to criticism that its shallow urbanism merely facilitated prettier sprawl (Leung 1995). TOD on the other hand, did better to recognize the economic and environmental limits of

current development patterns. TOD proposes to use public transportation systems to structure the region and the neighbourhoods within it. Where TND approaches had strong appeal for those keen on classical design, TOD approaches resonated with those concerned about making cities more environmentally responsible. The main principles of TOD include (Calthorpe and Fulton 2001):

- mix of uses and housing types structured in an area within walking distance of a transportation node
- compact form
- walkable streets
- civic and commercial centres along transportation corridors
- open space networks
- attractive public spaces

In the UK, the Urban Village Forum shares many aims and values with the New Urbanists. The Urban Villages movement adopted many of the principles inherent in TOD but stressing more on the self-sufficiency of the communities created. Job creation and brownfield development are the main focuses of the Urban Villages advocates. Promoted by the Prince of Wales Foundation, the Urban Villages concept was officially adopted by the UK government in the 1990s and has since contributed to what in the UK is called the Urban Renaissance, influencing the renewal of town centres and main streets in communities. The central notion of the Urban Villages movement is that by revitalizing the urban centre the trend of sprawl will be twisted and people will start to concentrate towards the centre once again. The principles promoted by the Urban Villages include (Neal 2003):

- Mixture of uses alongside housing
- Mixture of tenures including commercial properties
- An appropriate density of development that encourages non-housing activities
- A strong sense of place with basic amenities within walking distance of all residents
- High level of involvement by local residents in planning and management

of the development

While in the United States, urban growth is still seen as inevitable, by the end of the 1990s, the American model of cities had become a warning against which to be avoided, as urban sprawl and associated social and ethnic divisions had been at its worst. As inner cities continued to decline and become desolate, peripheral growth, which Joel Garreau called "edge cities" (Garreau 1991), flourished.

Since 1995, when the manifesto "Beyond Growth" was published by the Bank of America, "Smart Growth" had become public policy in the US, which also supported New Urbanism principles. Although "Smart Growth" was targeted at curbing sprawl, it does not seek to limit growth, but rather, it aims to shape growth in ways that lessen the impacts of growth. It was underpinned that if managed properly and with correct principles applied, smart growth will prove healthy for the economy and the community. "Smart Growth" is a development concept that targets at the contemporary patterns of land conversions, which are characterized by an increase in dispersed, low-density urban fringe development, and offer to mediate the increased service costs on communities, reduced local production of high-value crops and disrupted social structure associated with landscape changes.

In the housing realm, "Smart Growth" concepts target at the Suburbia, and promote the development of better and higher density housing. Yet, developing at higher density is not simply creating denser versions of existing auto-oriented suburban subdivisions, but represents a type of high-density development, in which land uses are mixed in such a way that people benefit from greater built densities (Danielsen, Lang and Fulton 1999). The principles proposed include that (Danielsen et al. 1999):

- Reuse existing infrastructure and land resources
- Encourage alternative transit modes and reduce the number of vehicle miles travelled
- Improve an area's jobs/housing balance

- Mix land uses to the finest grain the market will bear and include civic uses in the mix
- Concentrate commercial development in compact centers or districts.

2.3.1.3 The sustainability and low carbon agenda

Entering into the 21st century, the sustainability agenda, faced with the daunting facts of climate change, has shifted towards a resource- and energy-efficiency orientation. In the UK, deadlines were scheduled to meet a zero-carbon emission target in housing development. In Washington, D. C., United States and Ottawa Canada, it is government policy to reduce greenhouse gas production by 80 percent by 2050 (Condon 2010). With growing awareness of environmental issues, governmental strategies for sustainable development of urban housing are proposed by many cities. Government agencies in the UK, U.S. and European countries are starting to adopt approaches in the hope that these will lead eventually to a situation where environmental considerations lie at the heart of government decision-making. This would have far-reaching effects on urban and rural settlement development.

As argued by Barton (2000), the implications of the principle of sustainable development for neighbourhood development are fourfold: Firstly, sustainable development demands viewing the development context as an ecosystem, and that the design of an area needs to respond to its locale in terms of landscape, ecology, water and energy; Secondly, sustainable development points to localization and the reduction of car reliance, which is the cause of health impacts and excessive use of land/energy resources; Thirdly, it is vital that the developed community maintains the "social capital" by revitalizing local activities; and Fourthly, citizens and community groups need to be involved in the process of devising plans and programmes for their neighbourhoods.

Although early New Urbanism and Urban Villages advocates were somewhat non-specific about their ecological goals (Barton 2000), later practitioners of sustainable communities, focused more attention and were much more specific on achieving environmental targets with their design. The BedZED project

(Beddington Zero Emissions Development), located in the southern suburb of London was developed in 2001 (Figure 2-3). From its name, one can sense an explicit emphasis on tackling carbon emissions. The aim of the scheme was to use only energy from renewable sources generated on site, while minimizing energy demand of buildings through a series of passive design strategies. Besides its apparent energy-efficiency characteristics, the development scheme also took a "whole system" approach to building a sustainable community, which includes: reducing reliance on cars and providing alternatives through a car pool; reducing the need to travel by providing home working spaces; using materials sourced from local areas and from natural, renewable and recycled sources; collecting rainwater for reuse and installing recycling bins in every home. The success of the BedZED project had set an example for later housing developments by demonstrating a prototype to achieve sustainability with suburban housing development, and showing that environmental friendly buildings can be economically successful.

Figure 2- 3: The Beddington Zero Emissions Development, Source: http://inhabitat.com/bedzed-beddington-zero-energy-development-london/

In as much as the housing industry has started to change it has been because of regulations and planning permissions. Part L of UK Building Regulations covers

energy use in buildings and the standards required have been increased in 1996, 2000, 2006 and 2010. Through the bidding process and conditions on the sale of land, government agencies have imposed higher environmental standards and developers have been forced to comply. One of the vehicles for this has been checklists such as the Code for Sustainable Homes. The Code is the national standard for the sustainable design and construction of new homes. It sets minimum standards for energy and water use at each level of a 6-leveled rating system, and measures the sustainability of a new home against categories of sustainable design, which include: energy, water, materials, surface water run-off, waste, pollution, health and well-being, management, and ecology (Department for Communities and Local Government 2006).

With sustainability and low carbon as widely recognized national development strategies, both state and local governments in developed countries have been actively involved in promoting new settlement schemes that aim at addressing a variety of issues related with the sustainability and low carbon agenda.

Faced with housing shortages and determined to avoid sprawl, the UK government proposed for new settlements and urban extensions to be developed in England, which are called the Eco-towns. Starting in 2007, the Eco-towns program was intended to achieve high standards of sustainability while maximizing the potential for affordable housing. The main features of eco-towns were set out in the "Eco-towns Prospectus" published by the Department for Communities and Local Government (2007):

- places with a separate and distinct identity but good links to surrounding towns and cities in terms of jobs, transport and services;
- the development as a whole to achieve zero carbon and to be an exemplar in at least one area of environment technology;
- a good range of facilities within the town including a secondary school, shopping, business space and leisure;
- between 30 and 50 per cent affordable housing with a good mix of tenures and size of homes in mixed communities; and

- a delivery organisation to manage the town and its development and provide support for people, businesses and community services.

However, the Eco-towns programme had aroused much controversy. Critics claimed that the Eco- towns would erode the green belt, destroy valuable wildlife sites and increase traffic pollution (Daily Mail Reporter 2009). In the United State, scholars, practitioners and the public seemed to be much more tolerant of green field developments, and the focus is on the way to shape new developments effectively, so that they are friendly to the environment, offer a wide range of mobility options, accommodate a diversity of uses and household types, generate cohesive communities, and provide jobs and amenities to local residents. In recognizing that the majority of urban development in the United States is new settlements on the edge in green field sites (Heid 2004), the so-called "master-planned communities" are viewed as a development tool that is based on the "smart growth" ideology and provides definitive routes to balance the prevention of sprawl and the creation of high-quality and sustainable living environments. These planned green field new settlements, are argued, if designed properly, would be a testament to show that exurban can still be sustainable (Heid 2004).

The development of sustainable communities has also been put forward at the local authority level. The Lothian Structure Plan Review in 1995 identified that "the development of Edinburgh can no longer be accommodated within the existing boundaries of the city" (Deakin 2003). Therefore the Lothian Regional Council proposed to develop new settlements at the periphery of Edinburgh and in an area known as the South East Wedge. A series of design principles were developed to guide the development, which emphasized a distinctive urban culture; a spatial compact form; a balance of land use, economic and social structures; an energy-conscious public transportation network; and, a financial structure that is viable in the short-, medium- and long-term horizons. The development at South East Wedge took a plan-led approach and stressed environmental-friendliness. It was projected at the outset of the project that this experimental development model would produce a pattern of settlement that is sustainable (Deakin 2003).

The Department of Environment, Heritage and Local Government in Ireland had proposed in 2008 a draft guideline for sustainable residential development in urban areas, aiming to facilitate the new urban growth by "providing for high-density residential development in the right locations which are well-serviced in terms of public transport and community facilities and which are built to the highest possible standards." The planning objectives at the district/neighbourhood scale are put forward under four themes: Provision of community facilities; efficient use of resources; amenity/quality of life issues; and, conservation of the built and natural environment (Willis 2005).

2.3.2 Peri-urban settlement development in developing countries

Rural-urban migration and the natural growth of urban population have led to an increase in the concentration of population and human activities on the fringes of many cities in the developing countries. Foreign direct investment in manufacturing also triggered peri-urbanization in the vicinity of large Third-World cities (Webster 2002). In post-colonial era Africa, rural-urban migrants overwhelmed the capacity of public authorities to provide shelter and essential services, and set up informal settlements at the urban fringe (Chirisa 2010). In East Asia, both up-scale residential developments and low-income, self-built housing sprang up around large metropolitan cities (Hudalah et al. 2007).

The development of settlements on the urban-rural fringes continues to impact upon the urban and rural patterns of production, consumption and mobility, as well as the livelihoods of an increasing number of inhabitants in the peri-urban areas. The current literature on the peri-urban area of the Third-World cities is focused mainly on two areas of issue: one is dealing with socio-economic issues such as poverty, and the other is dealing with environmental issues such as pollution and resources implications. The problem of institutional fragmentation is also considered as relevant for understanding the emergence of social and environmental problems in the peri-urban interface.

2.3.2.1 Socio-economic issues

The association of peri-urban settlements with poverty, illegality and slums comes mainly from the literature in developing countries of South Asia, South America and Africa (Allen, da Silva and Corubolo 1999, Shenck 2005, Chirisa 2010, Hudalah 2010). The poverty issues are often interlinked with environmental issues, in that the poor are more exposed to the shocks and stresses of rapid urbanization such as inadequate water and sanitation arrangements (Allen et al. 2006) as well as health hazards (Chirisa 2010). Enclaves of slum communities in the peri-urban surroundings are associated with risk, vulnerability and susceptibility to diseases and contaminations, which can be attributed to a general lack of infrastructure investment in peri-urban areas and the inadequate regulation and control by planning (Chirisa 2010).

The peri-urban population is shaped by two forces of migration: one comes from the urban side with people seeking a more rural lifestyle or cheaper accommodation; the other comes from the rural side with poorer rural people searching for work and better chances for their children (Douglas 2006). In a study on the peri-urban dynamics in India, Shenck (2005) noted that the rich and poor settlers in the periphery of Delhi are clearly spatially separated, and the resettled urban poor have lost access to their traditional places of work to be employed in "informal" conditions, thus resulting in the segregation of different social groups as well as between working and living. Segregation between socio-economic classes leads to the creation of gated communities and inequity in environmental quality, shelter and access to natural and social resources and may result in the marginalization of the resettled urban poor and social conflicts (Hudalah et al. 2007).

Low density middle-class urban sprawl is increasingly becoming a major issue in developing countries. Large scale peri-urban housing estates are occupying farm land and increasing food prices for rich and poor alike (Douglas 2006). The process of "de-agrarianisation" is claimed to be an important process in explaining the causes and dynamics of poverty and environmental degradation (Allen et al. 1999). As Hudalah et al. (2007) noted, peri-urbanization in East Asia

has resulted in degradation of peri-urban agriculture. Firman (2000) had documented that uncontrolled land conversion has been responsible for the loss of fertile agricultural land in Greater Bangung, Indonesia and reduced its productivity.

Land conversion from farmland to residential use has also posed threat to the households and individuals who had relied on the access to land as the main resource for survival and improvement of welfare. As noted by Allen et al. (1999), because agriculture plays a major role in the local economy, farmers in the peri-urban area of Kumasi, Ghana, whose land has been sold or whose security of tenure is threatened by the development of new residential areas represents the vast majority of the peri-urban poor. They went on to maintain that due to the rising land prices and rents associated with peri-urbanization, emerging problems of growing unemployment and landlessness have been causing increasing vulnerability for the poor (Allen et al. 1999).

2.3.2.2 Environmental issues

The Peri-urban ecosystem has been significantly modified by activities of manufacturing and urban building, which lead to air, soil and water contaminations. Poor sanitation and drainage facilities in the peri-urban areas exacerbate these problems. As noted by Douglas (2006), around Karachi, Pakistan, water supplies and waste management cannot cope with haphazard urban growth, especially in peripheral squatter settlements. Pollutants in air, soil and water adversely affect food production in the peri-urban areas and pose health threats to local people.

Urbanization in peri-urban areas has also been found as having exerted pressure on the cities' environmental conservation areas. In Jakarta, for instance, peri-urban development has encroached on the city's upland water catchment area causing periodic flooding downstream (Firman and Dharmapatni 1994). The study by Torres et al. (Torres, Alves and Aparecida de Oliveir 2007) claimed that one of the most significant environmental impacts of the urban sprawl of Sao Paulo is the massive deforestation of the green belt of Atlantic Rainforest surrounding the city, which is one of the most endangered eco-systems in the world. As observed by

Torres et al. (2007), satellite images indicated that Sao Paulo, Brazil had lost 53.4 square km of green coverage in the last decade, with the majority (56%) of the loss concentrated in the ten most deprived suburban districts. Environmentally protected areas such as watersheds and wetlands are also impacted by the intensification of agricultural and non-agricultural land uses in the peri-urban interface and the loss of singular and habitat and biodiversity in these areas is often irreparable (Allen et al. 1999).

Urban growth leads to increased demand for water resources for domestic as well as industrial use. Water scarcity has been observed in many developing countries undergoing fast urbanization, and the problem is aggravated by contamination (Allen et al. 1999). As Allen et al. (1999) also observed, "There is a strong relationship between land use patterns, overall transport demand and motor vehicle use, which results in greater air pollution and traffic congestion. Urban and peri-urban energy-intensive-use has dramatic ecological impacts, not only because of the depletion of non-renewable resources, but also because it is largely associated with the cause of severe environmental global problems such as climate change, acid rain and increased risk of radiation release or accidental oil spills" (Allen et al. 1999).

2.3.2.3 Institutional issues

Interventions to address poverty issues and environmental degradation point to improved institutional engagement and restructured management frameworks (Marshall et al. 2009), and call for approaches that will tackle poverty alleviation and social justice alongside environmental integrity.

The urban planning perspective addresses the fragmented institutional arrangements between the state and local governments and between public and private sectors in the peri-urban areas, by focusing on creating new institutional arrangements that encourage inter-local cooperation to address the political and spatial imbalances resulting from the core city primacy and global market hegemony, which hampers the achievements of sustainability objectives at a broader scale (Hudalah 2010). Allen (2003) argued that environmental planning and management of the peri-urban interface required the engagement of a broad

variety of actors, ranging from the local communities living and working in these areas to institutions operating at the local and state levels, and that the most important aspect benefitting the poor is related to the possibility of participation of the poor themselves in the definition of priorities and in decision making.

2.4 Peri-urban settlement development in China

It is estimated that peri-urban areas in East Asia will accommodate approximately 215 million of the expected 500 million additional urban residents in the East Asian Region over the next 25 years, with the majority of this incremental growth occurring in China (Webster and Muller 2004). The Chinese urban population is highly concentrated on its eastern coasts with the majority of metropolitan cities, where over 60% of GDP and 85% of GDP growth is generated (Wang 2009a). The Tenth National Development Plan (2001-2006) set a target of annual urban population growth to 4%, which will require a very substantial building up of the peri-urban interface around all Chinese metropolitan regions. They are an integral and critical component of larger metropolitan systems, which account for the majority of national GDP growth and will accommodate the majority of the growing urban population.

2.4.1 Driving forces of Chinese peri-urbanization

Peri-urbanization in Chinese cities is primarily driven by economic development and population growth. Since the ‘Reform and Open door’ policy embarked in the early 1980s, China has become one of the fastest growing economies in the world. In the pre-reform era, under pro-production planning of socialism, cities were constituted by work units with integrated factories, office buildings, housing and basic service facilities surrounded by walls (Friedmann 2005). The housing reform beginning in 1982 has lifted the burdens of housing provision from work units and by allowing both domestic and global capital into the housing market, has given rise to a variety of urban housing arrangements (Ma 2004). The land reform that followed in 1987 allowed for land use rights to be obtained through negotiations, bidding and auction with the appropriate city government (Ma

2004). As a result of the reforms and also stimulated by rapid economic growth and the increasing mobility of financial capital, the importance of the geographic location of real estate parcels began to emerge. Manufacturing enterprises as well as real estate developers are increasingly seeking to locate in the urban peripheries where land costs are lower and the environmental regulations are less restrictive. Global capital's predilection for peri-urban areas instigated foreign investments to be poured into such regions, and by doing so, rapidly changes the peri-urban landscape and diminishes the rural-urban dichotomy. Rising incomes resulting from economic development fuel suburbanization and long distance commuting. The search for affordable housing or more spacious housing at better prices forces households to look farther from the city centres. Growing rates of car ownership facilitate suburban commuting and shopping patterns. Large cities such as Beijing, Shanghai and Guangzhou are changing from concentric zone cities of the industrial age to the decentralized multi-nuclei cities similar to the post-industrial cities such as can be seen in USA, Australia, and Europe today (Schneider, Seto and Webster 2005). In other words, many of the same pressures that led to sprawl in Western cities threaten Chinese cities today.

Since the economic reforms, the structure of the economy has shifted from one that is based on agriculture to one that is increasingly dependent on manufacturing and the rise of the service sector (Deng et al. 2008). The agricultural population which made up 80% of the nation's total population by the end of 1970s has become over abundant. By the 1980s, the surplus population in the rural part was estimated to have reached 0.1 billion. Some research shows that for every 1% of increase in the urbanization level in China (excluding the natural increase of urban population by 40million/yr) 25million rural population would become urban (Zou 2003), which means that by 2030, when the population of China is estimated to reach 1.5-1.6 billion, there will be 15 million rural population relocating into cities and towns every year. Although the central government is promoting for a "small town strategy" aiming at diverting the mass immigrants from flushing into the large cities (Fei 1994), large numbers of surplus farm workers, in their attempt to look for better job opportunities and higher living standards, still preferred the already over-crowded metropolitans and became the so called "Floating

Population". This phenomenon is similar to many other developing countries. Although the "squatter settlements" often seen at the urban fringes of Indian and Mexican megacities have not appeared in China due to strict restrictions on land ownership, large numbers of rural migrants are settled in the urban peripheries, often renting accommodation from local residents. The 11th five-year plan recognizes that urbanization is necessary for stimulating and sustaining growth and a key contributor to alleviating rural poverty. Given the limited potential for agricultural growth, only rapid urbanization can reduce the income gap by reallocation of surplus rural labor and enabling increased capital and technology inputs in agriculture. As can be observed, unprecedented spatial expansion and the building up of peri-urban areas are taking place in most Chinese metropolitan cities.

2.4.2 The process of Chinese peri-urbanization

The development of the urban periphery is in close relationship with the urbanization and industrialization process of Chinese cities. Before 1960s, the urban periphery was constituted of mostly farmlands, which functioned as suppliers of vegetables, foods and raw materials to the city. The difference between urban and rural areas does not diminish with increasing vicinity to city center. On the edge, urban building blocks and factories stand side by side with shanty farmhouses. The strategic urban-rural dichotomy in economic development has placed the main obstacle on the development of urban periphery. In the pre-reform era, under a national industrialization strategy, the share of industrial land continued to rise albeit the scale of the urban built up area was under strict control. The continuing demand for land to build new factories led to the first urban expansion after 1949. The new developments on the periphery instigated the construction of infrastructure projects such as the extension of ring roads and connection highways. This further promoted an axial development along the transportation lines.

The economic reforms in the 1980s have diverted the policy toward encouraging the industrialization of the rural sector, which is characterized by locally

originated collective and individual responses by villagers to opportunities resulting from the growing market economy (Leaf 2002). Because of their good accessibility to urban markets, information, and technological expertise and the convenience of obtaining land and labour at low cost, the town and village enterprises (TVEs), located in the peri-urban regions outside major metropolitan centres, prospered in the first decade of the post-reform era. The dichotomy between urban and rural began to weaken. Millions of farmers originally "fixed" to their lands under the socialist regime were accorded some mobility and transferred to industrial workers. However, the TVEs were soon overtaken by a second wave of rural industrialization, which was induced by the relocation of factories associated with de-industrialization of core cities (Webster and Muller 2004). From 1993 to 1999, the number of industrial enterprises in Shanghai city center, for instance, dropped by 30% whereas the suburbs saw an increase of 125% (Gao and Jiang 2002). The relocation of polluting industries to the periphery was seen as a way to improve the liveability of core cities through reduction of truck traffic, pollution, reduced risk of large-scale industrial accidents. However, the underlying rationale was the expected economic growth and employment creation from increased economic output and competitiveness associated with peri-urbanization (Webster 2002). As the secondary-industry-based urban periphery matured in the 1990s-2000s, tertiary industries soon picked up. In many of the more developed cities, new industrial parks that boosted innovative technologies and creative industries emerged in the peripheral lands. With transportation improved, large-scale residential districts were developed, and with them supermarkets and retail facilities.

Public policy also explicitly supported the dispersal of manufacturing away from the city core. As Li & Huang (2006) noted, with land lease becoming the main source of local government revenue, the development of "raw land" in the suburbs has become, for the municipal government, the most profitable source of income where potential large rent gap can be reaped. Since the 1980s, urban planning in China has favoured "decentralized concentration" growth management policies, which means reducing the population from the central city and concentrating facilities in the suburban new towns (Xue and Zhou 2007). Urban masterplans

prepared by municipal planning bureaus follow this principle, thus officially encouraged the development of planned peripheral settlements (Zhao et al. 2009).

Apart from industrial development, residential development acts as another important driver of peri-urbanization in Chinese cities, and is exerting increasing influence on shaping the peri-urban interface in recent years. The clearance of slum settlements out of the city centre has contributed to the major part of peri-urban residential development in the early post-reform era. Compared to other developing countries, where the informal sector played a significant role in accommodating the relocated population, China took a centrally-coordinated approach of building large-scale and high-density public affordable housing estates in peripheral locations outside the city core. In recent years, fused by the boom in commodity housing market and facilitated by increasing personal mobility, commercial housing estates have begun to take the lead in shaping the peri-urban interface, as the new emerging middle and upper-middle class groups, seeking more space and better living environment at affordable prices, often choose to live in peri-urban areas, even though they do not work there (Feng, Zhou and Wu 2008). Large property developers often single-handedly shape peri-urban localities by building large integrated residential complexes with new commercial centres to service them. These gated communities, often leapfrogged to situate in peri-urban green fields, are essentially privately financed new towns.

2.4.3 Settlement development in the urban periphery of Chinese cities

As Chinese cities expand beyond their administrative districts, rural territories have been surrounded and absorbed by urban developments. Many of the rural villages at urban periphery are now encroached by urban expansion and are thus turned into ‘villages within cities’. The physical environment in many ‘villages within cities’ is in extremely poor condition (Liu and Liang 1997, Zhang, Zhao and Tian 2003). This can be attributed to a long history of dichotomy between the urban and rural sectors in terms of governance body, economic development level and living standards. The design and construction of buildings and the plans for the neighbourhoods are not constrained by the urban application. By making use

of this difference between the rural and urban land management systems, indigenous farmers are thus able to maximise their profits when letting out to migrants by constructing sub-standard housing units. Notwithstanding their positive role in providing housing for rural migrants, 'villages within cities' are of policy concern to urban authorities. With this attitude, many programmes have been adopted to redevelop these villages across Chinese cities. Most of these programmes have focused on demolishing villages, resettling native villagers and encouraging real estate companies to take part in the redevelopment projects. Rural village committees are then replaced and transformed into stock companies to manage the newly developed commercialised properties (Zhang et al. 2003). Industrial expansion and relocation into the urban periphery require large plots of rural land to be appropriated for urban use. Numereous rural villages face complete demolition and resettlement. The construction of new settlements to accommodate displaced rural residents has become an important part of rural development.

Adding to the complexity of understanding peri-urban settlement development are the inevitable changes brought by the transition from a command to a market economy. Market forces are increasingly becoming the dominant force behind urban processes in China, particularly in housing and land development. Under the reforms, housing is no longer a free public good to urban residents and commercial housing distributed through market mechanisms is increasingly becoming the main choice in cities. Housing often is developed with private capital, giving rise to a variety of residential spaces that are replacing the pre-reform cellular neighbourhood structure built around work units. Urban land, on the other hand, remains owned by the state and managed by municipal governments through a land leasing system. There is evidence that the importance of location, which was irrelevant in socialist cities without land markets, has led to the emergence of a land rent gradient similar to that of cities in capitalist systems (Ma 2003). In recent years, the great majority of the new housing projects are in the form of large residential estates located in the more peripheral areas. Cheaper land prices and the absence of demolition and renewal costs drive the developers towards such locations. With the increase of family income and the

emergence of urban affluents, a market demand for low-density, spacious villas with gardens in the suburbs is also driving investors and developers into urban hinterlands. In Beijing, for instance, as observed by Hu and Kaplan (2001), aggravated living conditions of the central city and real estate development propaganda has encouraged the urban affluent to move to the eastern and northern inner suburbs of the city. Ironically these are the same areas where the dilapidated enclaves of the largest number of migrants aggregate (Gu and Shen 2003). These developments feature Western styles, which have become fashionable and symbolize "good life" and "prestige" (Wu 2010, Pow and Kong 2007). "New Urbanism" concepts borrowed from the U.S. are favoured and extensively advertised as packaging a new way of life. Within the package, a whole range of services and amenities are promised. As observed by Wu (2010), luxury homes in suburban residential projects rely highly on second-home buyers. In order to stimulate the demand for a second home, it is important to produce the desire for their distinctiveness and even conspicuous consumption.

Worldwide, rapid urbanization has exerted huge pressure on housing provision, especially for the low-income groups. Housing affordability of medium- to low-income households has been greatly affected by the commodification of the majority housing provision (Mostafa, Wong and Hui 2006). Slum clearance and inner-city regeneration further deepened the conflict between the demand and supply of affordable housing by creating a massive population of displaced urban low-income families requiring resettlement while unable to afford commercial housing. The under developed private rental market did little to alleviate this problem. Due to the lack of public funding in subsidized affordable housing provision and the reliance of local government revenue on land leasing, the majority of affordable housing developments have been located in peripheral locations where land can be obtained with relatively lower prices. The affordable housing compounds are characterized with high density development with small units, which target the low-to-medium income families who cannot afford commercial housing at more central locations.

To sum up, under the forces of economic growth and the more recent acceleration of residential development, three distinct types of residential settlement are being shaped at the urban periphery. These are:

- *rural resettlement projects;*
- *public affordable housing compounds; and,*
- *private-sector real estate development of suburban commercial housing.*

With these new settlements, the future of the peri-urban of Chinese cities is now gradually taking shape. The rapid constructions that are going on in the peri-urban have exerted huge impacts on the environmental, social and economic systems of the once rural area, which require the establishment of a comprehensive research framework to address these issues.

2.5 Combined themes of sustainable peri-urban settlement development

Suburban development in the post-industrial cities obviously has many contrasts with the peri-urban development patterns on display in large Third-world metropolises. Being somewhat caught in-between the First and the Third worlds, China's peri-urban interface demonstrates characteristics of both. As has been discussed in the previous section, China's peri-urban areas witness the juxtaposition of wealthy suburban estates with low-income and rural communities, which means that the problems experienced in Los Angeles and in Jakarta are happening in one place. It suggests that the loss of environmental assets, agricultural land, congestion, energy crisis, environmental pollution, poverty and social degradation are interwoven issues that have all to be addressed at once. To examine the sustainability of Chinese peri-urban settlement development, a starting point would be to combine the research themes that have emerged out of the literature of peri-urban study in the context of the developed and the developing countries. Six research themes are summarized as follows, which are based on the incorporation of the issues described in this section and the requirements of integrated environmental, economic and social goals.

Ecological implications

The energy and resource implications arising from a continuing growth of urban population and spatial expansion are posing eminent threats to post-industrial cities and developing cities alike. For the most part of the twentieth century, cities world-wide have been planned and designed as if energy and resources that can be provided by the earth is infinite. When the daunting facts have shown that the truth is to the contrary, cities today need to reconsider their development patterns. This is relevant to the First-world cities, which rely on ecological foot-prints several times their actual land area, and to Third-world cities, which are still aspired to their First-world counterparts.

Reliance on automobile use

International agreements such as the Kyoto Protocol have set out objectives to tackle climate change and greenhouse gas emissions that require the combined efforts from countries around the world. This will significantly impact the developing patterns of cities globally. One related issue is the increasing reliance on automobile for travel, which can be observed in most major cities of the world. The development patterns of cities world-wide, which are demonstrated by increased decentralization and peri-urbanization, have been relying on and encouraging increased personal mobility based on automobile ownership. However, the trend can no longer continue without significant interventions if the targets of Kyoto Protocol are to be met.

Quality of life issues

World-wide, human settlements are responsible for providing the quality of life for their residents, which include adequate shelter, safety, security from hazards and pollution, amenities, well-being and health. Because the economic status and social development differ among different parts of the world, the basic requirements for quality of life vary between countries. Nonetheless, the pursuit of a higher quality of living is human nature, and a basic theme for all settlement development, albeit it needs to be considered with the awareness of a limited global resource base.

Land issues and development density

The issue of land has been the most associated with urban spatial expansion. The

encroachment on rural land by urban development aroused concerns over the patterns of urban growth, which can be summarized into debates of sprawl vs. compact development, and brownfield vs. greenfield development. Although the yardsticks of development density and the measurement of compactness vary among different cultures and countries, it is equally critical that both developed and developing countries find the appropriate pattern of urban growth that satisfies the demand of the expanded population and economy and minimizes the impact on natural environment.

Community building

Both suburbanization and peri-urbanization described in the contexts of the developed and developing countries show the tendency of population stratification as a result of spatial decentralization. New settlements developed on urban peripheries play a big part in driving this tendency by presenting forms of self-containment and exclusion. Social cohesion needed for the building of a sense of community and elimination of poverty remains to be generated by means of careful planning and creative designs.

Public participation

World-wide, decisions on urban planning and settlement development have been dominated by urban authorities and planning professionals. However, in recent years, a growing consensus has been obtained in recognizing the importance of public participation in the decision-making process of developments that affect people's lives. Call for public involvement in urban planning decision-making has appeared to be a common theme among discussions on urban development in both developed and developing countries, especially when sustainable development is aimed for.

2.6 Understanding sustainability of peri-urban settlements - a themed approach

2.6.1 Sustainability as an axiom

There exist seemingly innumerable definitions of sustainable development, with the most widely cited one being the definition proposed in "Our Common Future", the report of the United Nations World Commission on Environment and Development:

"Sustainable development is development that meets the needs of present generations without compromising the ability of future generations to meet their needs and aspirations.(World Commission on Environment and Development 1987)

The report challenged the view that economic growth should be given priority over environmental concerns by arguing that only by integrating environmental health with developmental objectives can the human world and its succeeding generations achieve "sustainable development". Although the definition has often been criticised as being vague (Bentivegna et al. 2002), the central concept of futurity expressed by the definition and the recognition of the need to integrate social, economic, and environmental concerns proposed by the report have nonetheless become hallmarks of the sustainable development literature.

Although a more precise definition of sustainability has yet to be developed, there is a growing consensus of the recognition that sustainable development issues need to be dealt with at a local level. Later definitions of sustainability have extended the concept and have given it a more local perspective. A commonly used definition in the UK: *"Social progress that recognises the needs of everyone, effective protection of the environment, prudent use of natural resources and maintenance of high and stable levels of economic growth and employment."* (DETR 1999), developed by the Department of Environment, Transport and Regions, made clear the three main elements of sustainable development, i.e. *social*, *environmental* and *economic* issues. These three elements are often referred to as the three "pillars" of sustainability or the "triple bottom line" (Hacking and Guthrie 2008). Social sustainability identifies the needs of individuals and considers their well-being. It covers a wide range of issues from health and safety to social inclusion and eradicating poverty; Environmental sustainability is concerned with protecting and conserving biodiversity and the

environment by reducing waste, pollution and using natural resource efficiently; Economic sustainability focuses on maintaining stable economic growth within the capacity of the natural environment. Sustainability is hence fundamentally an integrated process that aims to achieve social stability, environment integrity and economic well-being for the present and future generations.

2.6.2 Sustainable cities and settlements

Cities are increasingly being perceived as a key factor in defining and delivering sustainable development. In 1996, United Nations hosted Habitat II in Istanbul, Turkey. Representatives of 171 countries addressed two major themes: (1) adequate shelter for all, and (2) sustainable human settlements development in an urbanizing world. Habitat II concluded with the publication of the Habitat Agenda, "*a global call to action at the international, national and local level and a guide for the development of sustainable human settlement in the world's cities, towns and villages into the first two decades of the next century*" (Habitat II press release, June 3, 1996). As cities have become more and more the focal points for the world's sustainable development, the making of sustainable cities has become the main challenge for the new millennium.

"A sustainable city is organised so as to enable its citizens to meet their own needs and to enhance their well-being without damaging the natural world or endangering the living conditions of other people, now or in the future." (Girardet 1999)

This is a definition provided by Girardet in his book "Creating Sustainable Cities". Girardet's definition encompasses the environment, the prosperity of people and enhanced well-being and emphasises people and their long-term future. He sees the concept as encompassing local needs and local decision-making and, at the same time, being aware of the effects of the local on the planet.

Urbanization and city living can pose many problems. According to Cities Alliance, unconstrained urbanization can produce problems such as

unemployment, shortage of shelter, water, power and other necessities (Cities Alliance, 2007). Cities are also viewed as being subject to traffic congestion, environmental catastrophes, marginalized communities and diminished quality of life for the poor (Satterthwaite 1997). Rudlin and Falk (2009) held that, although cities may seem innately prone to environmental disasters, they can be part of the solution to global sustainability as well as part of the problem. In an increasingly urbanised world, it is inevitable that actions need to be taken in the urban areas if we want a more sustainable future. The United Nations Environmental Programme (UNEP) has declared that the battle for sustainable development will be won or lost in the world's cities and this highlights the potential role of the urban built environment for improving sustainability both locally and more widely.

As with sustainable development, sustainable city is a concept that is difficult to translate at the operational level. Attempts have been made to develop principles of sustainable cities and settlements. According to Satterthwaite (1997), a sustainable city has to meet three goals: provide a healthy living and working environment for inhabitants; furnish safe water, sanitary conditions, rubbish collection and disposal, drains, paved roads and other essential infrastructure for health and economic development; and remain in an ecologically-balanced relationship with local and global ecosystems. Other scholars maintained that certain types of urban forms are more sustainable than others, namely compactness, mix of uses and interconnected street layouts, a strong public transportation network, environmental controls and high standards of urban management (Williams, Burton and Jenks 2000).

Urban settlements come in a variety of scales and forms. As the United Nations Centre for Human Settlement (UNCHS) emphasized in its Habitat Report (1996), human settlement is not simply housing, but an integrated combination of all human activity processes including residence, work, education, health, culture, leisure, etc., as well as the structures needed to support them. Sustainable human settlement development should ensure economic growth, employment opportunities and social progress in harmony with the environment (UNCHS 1996).

As has been argued earlier, new settlements developed in the peripheral areas of cities have become increasingly critical in driving forward or backward a sustainable prospect for urban futures. Populations living on the edges of cities are gaining a larger share of the additional urban population projected for the decades to come. Achieving sustainable development in the peri-urban settlements is therefore crucial for the quality of life and continued survival of human communities. Questions remain that if the concept of sustainability can provide a better way of understanding the challenges of cities? And what is to become of the future of peri-urban areas? To answer these questions, we need first to understand the present situations of the peri-urban settlements already developed, and where do they stand against the criteria proposed by the sustainability agenda. For this purpose, we need to have tools to help evaluate that.

2.6.3 Evaluation of sustainability

2.6.3.1 A bridge between theory and practice

As the theory of sustainability is ambiguous and seems all-encompassing, it is difficult to be translated once it comes to be implemented. This is the problem often to be faced by practitioners of sustainable development at the local level. The evaluation of the sustainability of urban development provides a bridge between theory and practice. Measures of sustainable development serve to assess current status, monitor development trends, evaluate policy performance and set objectives for sustainable development (Mitchell 2000). Through the process of evaluation it can be made clear what is meant by sustainability in the specific context and how it can be applied in professional practice, therefore evaluation makes sustainable development a more operational act through assessing progress towards sustainability goals. Often evaluation criteria and assessment indicators become the proxy for the end-goal, which current development practice aims to achieve.

2.6.3.2 The emergence of evaluation frameworks

In the process of sustainability evaluation, a framework of evaluation criteria would need to be devised first, which set out the goals a city or a development

would want to achieve, and subsequently the issues that contribute to the fulfillment of the end goals. It is widely believed that the evaluation of the sustainability/non-sustainability of urban development needs to be based on viewing the settlement as a complex, dynamic system, whose components are economic, social and environmental subsystems in reciprocal relation (Newman 1999). Therefore achieving success in these three subsystems forms the basic goals of sustainable development. Under each subsystem, what Button (2002) referred to as key performance indicators need to be identified to further clarify the issues that are considered essential for achieving success in that subsystem. The major initiatives in the development of indicators have used three main conceptual approaches (Newton 2001): a policy-based approach, which is associated with issue and goal-based indicators; the thematic/index approach, which is essentially based on establishing broad themes or concepts; and the systems approach, which delineates linkages and causality between various sectors.

For the purpose of evaluating the practice of settlement development, it is considered appropriate to use the second approach identified by Newton – the thematic approach. The advantage of the thematic approach to assessing sustainability is that it avoids the hard-to-manage complexity that the concept of sustainability entails, and allows the evaluation to focus on a specific facet of the concept at a time. Yet, it maintains the holistic view that integrates all the themes to form an overall measurement of sustainability.

In the urban planning field, frameworks used for the evaluation of sustainability have been proposed, many of which took the thematic approach. The PICABUE proposed by Mitchell et al. (Mitchell, May and McDonald 1995) is a methodological framework for the development of sustainability indicators. It starts by reaching a consensus among stakeholders the principles and definitions of sustainable development, and identifies the main concerns or themes relevant to sustainability, it then uses a disaggregation process whereby the main themes are divided into sub-components that are more tangible for the purpose of indicator construction (Mitchell 2000). The methodology of PICABUE has been used in a number of sustainability evaluation frameworks, including the BEQUEST project,

which is funded by the Research Directorate of the EU Framework Four Programme, and aimed to develop a common language and framework for evaluating urban sustainability (Deakin, Curwell and Lombardi 2001). The BEQUEST framework was based on the principles of ecological integrity, equity, participation and futurity, and developed key issues of concern that cover environmental, economic, social and institutional dimensions (Figure 2-4). The framework also considers various spatial levels which urban development can take place and within various timescales (Curwell, Deakin and Lombardi 2005).

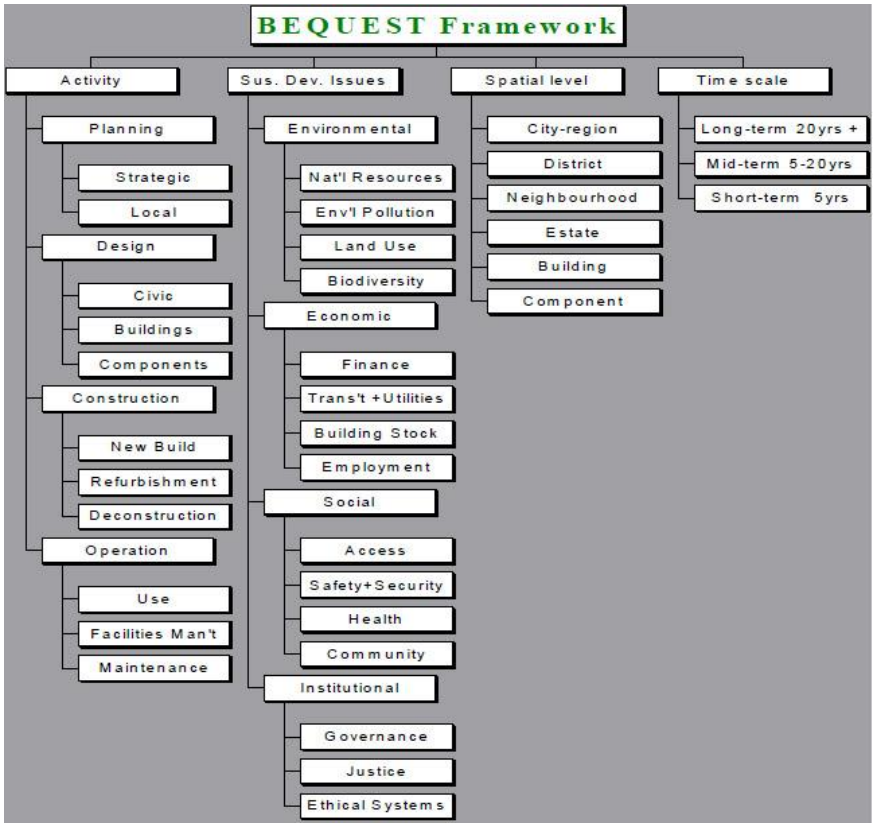


Figure 2- 4: The BEQUEST Framework, Source: (Deakin, Curwell and Lombardi 2002)

The SOLUTIONS (Sustainability Of Land Use and Transport In Outer Neighbourhoods) project, funded by EPSRC (Engineering and Physical Research Council), was focused on examining the economic efficiency, social inclusiveness and environmental sustainability of different patterns of urban growth and understanding the sustainability of new development in outer city areas in the UK (Echenique et al. 2010). Eleven evaluation themes were identified to cover the economic, social, environmental and resources dimensions of urban sustainability, which were: Net economic benefit, Feasibility (Economic dimension); Health,

Equity, Opportunities (Social dimension); Environmental quality, Environmental impact, Global climate (Environmental dimension); Materials, Energy, Land (Resources dimension) (Mitchell, Gawthorpe and Namdeo 2005). In the local design scenarios part of the research, ten assessment criteria were further proposed for the assessment of outer neighbourhood designs (Figure 2-5). These were: Productive land lost to development, Trip distance, Accessibility to local schools and shops, Accessibility to local public transport, Accessibility to open space, Trips by walk or bicycle, Vitality of retail services, Public and political acceptability, Market and institutional feasibility, Physical practicality and robustness (Barton et al. 2009).

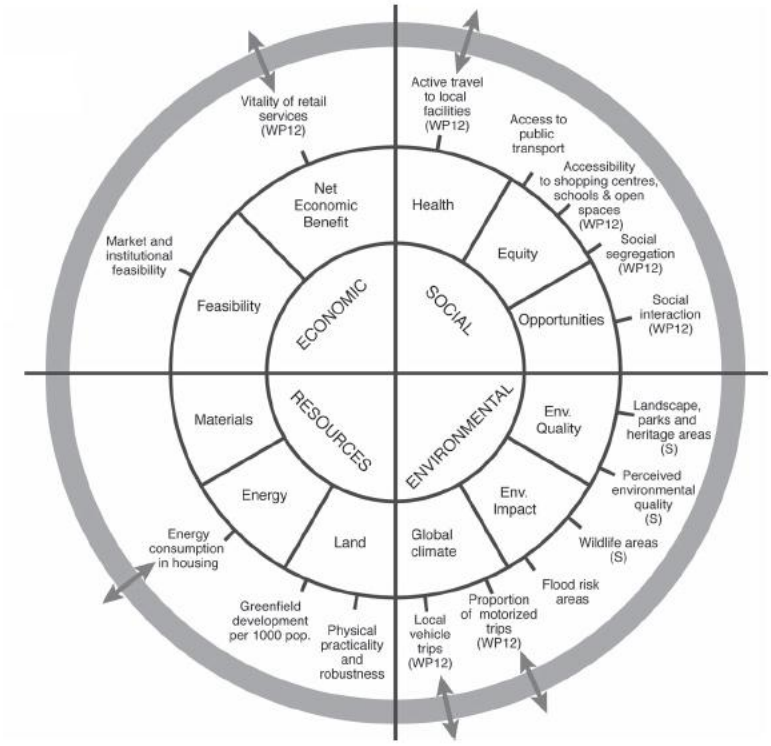


Figure 2- 5: SOLUTIONS Assessment Framework, Source: (Barton et al. 2009)

In recent years, a number of widely-adopted green building assessment standards have been extended and adjusted to the spatial level of urban neighbourhood, which demonstrates an increasing recognition of the neighbourhood as a basic unit for obtaining opportunities in carbon reduction and sustainability, and also as a response to the emerging approaches of planned sustainable communities. Both LEED in the U.S. and BREEAM in the UK have added new programmes to their existing green building standards to be developed into national standards for

neighbourhood design, which are called LEED-ND and BREEAM-Communities, respectively. These new sustainable neighbourhood design standards were developed to guide the building industry in the planning and design of new neighbourhoods. Based on the principles of New Urbanism, Smart Growth and green infrastructure and building, LEED-ND aims for a consensus-based standard to address the impacts of development projects and rewards healthful, durable, affordable, and environmentally sound neighborhood development practices (USGBC 2009). The standard rate development projects by rewarding them credits that address five topics, namely: Smart Location and Linkage, Neighborhood Pattern and Design, Green Infrastructure and Buildings, Innovation and Design Process, and Regional Priority Credit. The criteria for rewarding credits emphasize: *the location of neighbourhoods* (near existing development and infrastructure or infill), *walkability* (wide sidewalks with shade trees and other interesting features), *mixed use* (proximate location of housing, stores and workplaces), *multimodalism* (access to public transit, bike trails), and *water and energy conservation* (use of landscape features to minimize runoff, rain collection grey water recycling, solar panels, or other renewables).

A similar standard to LEED-ND, BREEAM Communities was launched in the UK in 2009. It was built on the existing Regional Sustainability Checklists and assesses projects across eight categories, namely: *Climate change and energy* (considers flood risk, energy and water efficiency, renewable energy provision and building services), *Community* (issues covered include social impact assessment, community engagement, community facilities management, sustainable lifestyles and affordable housing), *Place making* (issues covered include site selection, defensible place, legibility, active frontages, accessible play and green space, Secured by Design and density), *Buildings* (ensures that the design of individual buildings contributes to the sustainability of the overall development through high environmental standards), *Transport and movement* (walkable neighbourhoods, cycle networks, improved public transport provision, Green Travel Plans and transport during construction), *Ecology* (maintaining/enhancing habitat species, green corridors, ground/water pollution and planting schemes), *Resources* (considers land use and remediation, materials selection, waste management, energy/water use and Modern Methods of Construction), and *Business* (issues

considered include inward investment, local employment, knowledge sharing and sustainable charters) (see http://www.breeam.org).

2.6.3.3 Evaluation frameworks in China

Since China's Agenda 21 was published in 1994 (Department of Planning Committee of China, 1994), the Chinese Government has been actively promoting sustainable development at different administrative levels. However, sustainable development is considered more as a strategy than a set of indicators that could be used to measure the sustainability of current developments. Current studies of sustainability evaluation tools have a strong emphasis on the environmental aspect and mostly take on a national scale (Tong, Ye and Hu 2006, Zhao and Hu 1997).

Existing evaluation tools used for the meso-level of urban communities/neighbourhoods also have a technical orientation. China Eco-Community Technical Assessment Guide (Nie et al. 2003), which was first introduced in 2001, focuses on energy efficiency, indoor comfort, water efficiency, waste reduction, green materials and waste reduction. In the newest edition of the guide, the name was change to China Green and Low Carbon Community Technical Assessment Guide. An additional chapter was added on carbon auditing of energy and water consumption, green structure and transportation (Nie et al. 2011). Like its name, the focus was predominately on the environmental side of the sustainability agenda and issues such as social equity and economic viability, which are seen as equally important for urban sustainability, are not addressed.

In recent years, the sustainable development practice in urban planning in China has been focusing on building Eco-Cities. Examples include Dongtan Eco-City in Shanghai and Sino-Singapore Eco-City in Tianjin. During the planning stage, assessment indicator frameworks have been proposed to guide the planning and design process and gauge their sustainability once they have been developed. 26 quantitative and qualitative key performance indicators (KPIs) have been proposed for Tianjin Eco-City (Singapore Government 2012). These include environmental indicators such as air quality, carbon emission, green building and water consumption; as well as socio-economic indicators such as proportion of public housing, accessibility and employment-housing equilibrium (Figure 2-6).

The status quo of peri-urban development in China is so unique, that no existing research framework or assessment tools can be used here without major adjustments. Planning and policy making in future peri-urban settlement developments are in need of an informative and justified system of indicators to help gauge current actions and mitigate possible negative impacts.

Figure 2- 6: Tianjin Eco-city KPIs, Source: http://www.tianjinecocity.gov.sg/bg_kpis.htm

2.6.3.4 Evaluation by outcome

Urban development is a complex process, in which a variety of players involved and the practicalities of a series of external circumstances may influence the outcome that, by the time it is reached, may differ from what was proposed. Clavel (2002) observed that the Garden City concepts were never fully implemented in reality. What happened in reality was that "parts of his idea were picked up and eventually replicated, while others failed to survive". The parts that failed to survive include common land ownership and cooperative management structure, both seen as the crux of the Garden City concept. According to Clavel (2002), a reluctance of investors to take risk was a major reason. Parsons (2002) had noted an adaptation to vehicular traffic in the North American versions of the

Garden City, a lack of investment in pedestrian infrastructure had led to a forfeit of the friendly walking environment that featured the early Garden City models. In many of the post-World War II British New Towns, the expense of urbanizing the land often overruled the provision of desirable neighbourhood environments.

It is clear that the implementation of an idea faces many practical barriers, be it institutional, financial or lifestyle-related, and that there is a difference between the theory and practices that claim to be realizations of that theory.

One of the problems with current application of sustainability evaluation tools is that most of them are used to appraise development plans and designs against sustainability criteria, which means that what is being evaluated is the proposed outcome rather than the actual outcome. Such approach risks overlooking the interventions and adjustments made through the long process of implementation.

In the research on the Millennium Villages initiatives by the DETR (Department of the Environment, Transport and the Regions), an emphasis was put on the outcomes of sustainable community development in terms of measuring performance rather than the inputs of design proposals. It was argued that the outcomes of sustainable communities, which is represented by the actual effect of what's been proposed and implemented in terms of whether people enjoyed the benefits of the proposed sustainability features, guards against assuming that particular inputs will achieve what is wanted (DETR 2000).

2.6.4 Six themes of sustainable peri-urban settlement

In the discussions above, the development in the theories and practices of sustainable settlement development in the peri-urban areas of cities has been reviewed, as well as the emerging evaluation frameworks for the assessment of sustainability in urban settlement developments. This section focuses on the identification of the main issues considered of concern in the area of peri-urban settlement development to achieve long-term sustainability. In Section 2.5, six research themes were identified that emerged out of the literature of global peri-

urban settlement development. Here, these themes will be further explored and elaborated to identify the issues which form the basis of the evaluation framework proposed for the assessment of study cases chosen for this research. Based on the themes identified in Section 2.5, six research themes are proposed as the critical areas to be covered for the evaluation of sustainability in peri-urban settlements, namely:

- *Theme1: Ecologically responsible development*
- *Theme2: Reduced reliability on automobile use*
- *Theme3: Quality of life*
- *Theme4: Minimized land consumption and compact urban form*
- *Theme5: Social cohesion and sense of community*
- *Theme6: Public participation in development and management process*

These themes will run through this study in the following chapters. The six themes between them capture the main elements of the three pillars of sustainable development and respond to the definitions of sustainability and sustainable settlements. The themes are chosen so as to encapsulate the main features or problems of peri-urban settlements, which this research aims to examine against the requirements of sustainability. Some of the themes chosen are directly associated with the characteristics of the peri-urban context, such as the ecological concerns related with urban spatial expansion, the reliance on automobile use for accessibility and the loss of green field land to urban peripheral development. Other themes are more common among all types of human settlements and communities, such as quality of life, social cohesion generated by the sense of community and public participation in community plan and management. It is recognized that the amount of literature written on these issues is enormous. The following review is by no means a complete review on literatures regarding these issues, but more of a justification of the parameters chosen to be included in the evaluation framework for this specific study.

2.6.4.1 Theme 1: Ecologically responsible development

The continued rapid growth of cities inevitably exerts pressures on the ecological environment within which cities reside. There has been an evolving international

political consensus that the use of the earth's resources, energy consumption, environmental pollution and climate change are matters which require urgent actions. A series of international conferences, including the UN conference of 1987, at which the Bruntland definition of sustainability was first put forward, the Earth Summit at Rio de Janeiro in 1992 and the Kyoto Protocol of 1997 have resulted in the governments worldwide developing environmental aims, objectives and targets and making commitments to reduce CO_2 emissions resulting from energy use. The housing sector has been identified specifically as the key area in which interventions can be done to reduce energy consumption, provide healthier living environment and minimize waste. As a consequence, building designers and engineers have sought to reduce the environmental impact of the built environment through a range of building design principles, including: *minimizing energy consumption, minimizing the use of resources, minimizing waste* and *minimizing site impact*.

Minimizing energy consumption

The implications of urbanization and urban growth on energy consumption have been widely acknowledged (Jones 1989, Parikh and Shukla 1995, Knowles 1974). It is suggested that the energy consumption measured for a home should be the aggregate of three components: energy used in the home, transport fuel used going to and from home, and each resident's annual share of the energy used in constructing and demolishing the buildings (DETR 2000). The construction, use and demolition of settlements require the input of energy. The planning of ecologically friendly settlements has to start with the aim to minimize energy demands as a basic rule. The goal of ecologically friendly settlement is the realization of an energy cycle, which uses only renewable energies, which means: the energy demand of buildings during their entire life cycle (from construction to demolition) is reduced as much as possible by means of choosing materials with low embodied energy, minimizing energy use in the construction process, designing buildings with good thermal insulation, passive solar architecture, energy-conserving household appliances and using renewable energy sources (Schaper 1997).

Passive solar architecture is to reduce the need for energy from external sources to

a minimum, through minimizing heat losses and maximizing solar energy gain. This concept has been best interpreted in the design for the Passivhaus Standard (Figure 2-6). A Passivhaus is defined as: "a building, for which thermal comfort can be achieved solely by post-heating or post-cooling of the fresh air mass, which is required to achieve sufficient indoor air quality conditions – without the need for additional recirculation of air" (Mead and Brylewski 2011). The Passivhaus Standard has now been widely adopted in building industries around the world. The standard is achieved by "adopting a fabric first approach to the design, by specifying high levels of insulation to the thermal envelope with exceptional levels of airtightness and the use of whole house mechanical ventilation" (Mead and Brylewski 2011). A primary energy demand target is set to be lower than 120kWh/m^2yr, including space heating, domestic hot water, lighting, fans and pumps and also all of the projected appliance consumption (Mead and Brylewski 2011).

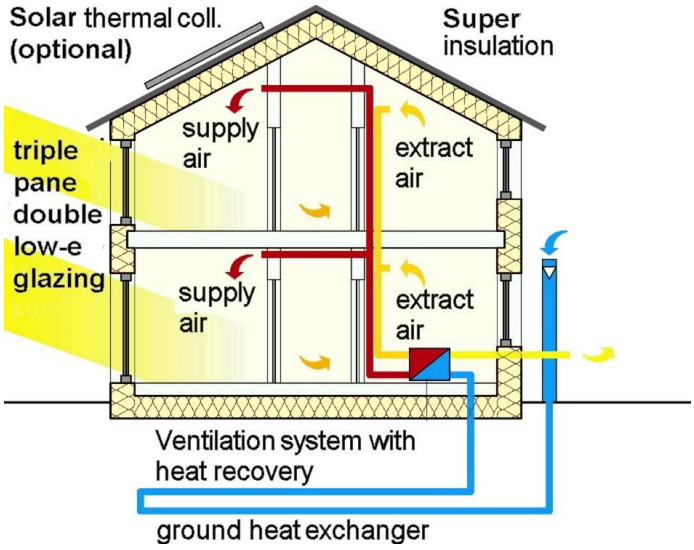


Figure 2- 7: Diagram explaining the principles of Passivhaus, Source: (Mead and Brylewski 2011)

Energy performance building standards are used world-wide as a measure to stipulate energy efficiency in building designs within different countries and climates. The Passivhaus Standard is just one such example. Other standards also include more overarching sustainability criteria, which address a wider range of environmental issues. The Code for Sustainable Homes (CSH) introduced in 2007 in the UK, for instance, measures sustainability against a range of requirements, including energy, resources, ecology, pollution and waste, health and well-being

and management (Department for Communities and Local Government 2006). Within the energy category, the CSH Level 6 has similar fabric specifications to Passivhaus, while requiring additionally the use of renewable energy to achieve the targeted energy efficiency.

The use of renewable energy sources is gaining increasing importance in achieving high energy performance in buildings, especially where a low-to-zero carbon target is set. The most common forms of renewable energy use in domestic buildings have been that of biomass boilers, solar-hot water and photovoltaic systems, all of which have been applied at the household as well as community scales. It has been argued that the use of these technologies should always be an integral part of the design of new settlements, on the condition that energy-efficient building fabric design is also applied (Schaper 1997).

Apart from the energy used to run a building, the embodied energy is also an important component of energy consumption in a building's life cycle. Embodied energy of a building is "the total energy required to construct it - that is to win the raw materials, process and manufacture them as necessary, transport them to site and put them together" (Newton and Westaway 1999). Measures to reduce the embodied energy in buildings include: choose building materials that require less energy to win and process, use locally-sourced materials to reduced energy consumption in transport, and recycle materials as much as possible. The construction of a building accounts for more than 10% of its total energy use in a life cycle (Rudlin and Falk 2009). More significant than this is the energy used in the construction of infrastructure. Making use of existing roads, and facilities can significantly reduce the energy and resources needed to provide them, however, peripheral greenfield developments away from existing urban services may not have the opportunities to do so.

Minimizing the use of resources

As cities grow spatially, one consequence is the sharp increase in water demand relative to supply. The destruction of natural landscapes, such as fresh water ecosystems, wetlands, and streams that served as water reservoirs, excessive levels of consumption, and the sealing of surfaces by roads, housing and large-

scale industrial projects, all contribute to the increasing scarcity of potable water. The large metropolises of developing countries are among the most hard-hit by this problem. Mexican City has been reported to be sinking due to excessive take of ground water reserves beneath the city (Marshall 2005). In cities of the developed countries, water also poses a severe problem with the continuing rise of urban population. In the United States, some state and local governments in arid metropolitan areas have tied the approval of residential development permits to the availability of adequate water supply (Kahn 2006).

A wide range of options are available for reducing water consumption in residential buildings. These include water-efficient fixtures and water-saving appliances, such as low-flow shower heads, low-flush toilets, and water-efficient washing machines and dishwashers. Savings made by installing water-saving appliances have proven to not only remove the burden from ground water reservoirs but also from sewage treatment plants (Kennedy 1997). Another important option for saving on drinking water is by using purified grey water or rain water for the usages that do not require potable water, such as flushing the toilet and watering the garden. Rain water accounts for nearly half the costs of disposing of sewage water, therefore, in order to achieved better sewage water management, many countries and municipalities subsidize decentralized rain water usage plants or require rain water seepage or retention on site in new developments (Kennedy 1997). Rain water and grey water would both need to be purified before reuse, often through flowing through planted filter-beds, purification ponds and streams. The investment in these measures may generate additional costs, however, the reward both ecologically and economically in the long run would more than justify the investment (Kennedy 1997).

Minimizing waste

Minimizing waste within the life time of the occupation of settlements can be achieved through recycling. Recycling of domestic wastes has been practiced in many countries for several decades now. In the UK, for instance, the recycling rate had reached over 30% by the late 1990s (Rudlin and Falk 2009). Planning and design implications for this environmentally-friendly practice may be the need for providing spaces and facilities required for the sorting and collection of

different types of wastes. Innovative inventions have been introduced in response. In Holland, for example, large underground containers are installed beneath ordinary waste bins so as to avoid need for additional storage space while maintaining easy access to all homes. Incentive measures have also been taken, such as incorporating scales to the bin to reward people for recycling while charging for unsegregated waste they throw away (Rudlin and Falk 2009).

Minimizing site impact

Peri-urbanization/suburbanization poses challenges to the natural environment by diminishing the ecological services of the land it replaces. For instance, the reduction of wetlands to suburban development would increase flood peaks in streams by four times (Kahn 2006). While wetlands are considered as functioning as the "kidneys of the city", green space are "lungs of the city". Research evidence has suggested that a 10% rise in tree cover in a city could cool urban temperatures by 4℃ (Gill, Handley and Ennos 2007).

The reduction of ecological function of natural land may lead to the extinction of endangered species. The growth of open space initiatives throughout the United States provides one implicit insurance policy against the environmental impacts of sprawl. Between 1998 and 2003, for example, New Jersey residents voted on 237 different referenda that sought to provide incentives for local governments to raise taxes for open space preservation (Kahn 2006).

Nevertheless, minimizing site impact does not necessarily mean resisting any change to the natural surroundings. Changes that do not damage the benefits of the environmental capital or changes that substitute for lost benefits can be considered acceptable (DETR 2000). Moreover, development that protects the natural geology of the site and integrate the built environment with the natural surrounding while enhancing environmental benefits and services already provided by the site should be encouraged.

From the above review, the main issues of concern, which are related with ecologically responsible development, can be identified. These include: passive energy-efficient design measures, such as building orientation, natural ventilation

and lighting, energy efficient building fabric; water-saving facilities; renewable energy systems; waste recycling; preservation of natural green/blue structures; protection of natural species; and protection of natural geology and integration of built and natural environment.

2.6.4.2 Theme 2: Reduced reliability on automobile use

The relationship between urban sprawl and the increase in automobile use, and the associated environmental implications has been widely documented (Kahn 2006, Kenworthy 2000). In the sprawling cities of U.S. and Australia, the adverse impacts on energy use, air pollution, traffic noise and congestion are the most evident. Even in developing countries, where the cities are more compact, the above problems are getting more severe as these countries undergo rapid motorization with auto-orientation policies. The UN Conference on Environment and Development held in Rio de Janeiro in June 1992 considers a change of behavior with regard to traffic and transportation as an essential step towards "sustainable" cities. Efficient and ecologically sound transport systems for public transport and non-motorized means of transportation are considered important (United Nations 1992).

Achieving a healthy balance between public and private transport systems in city planning is considered an important way to combat the adverse effects of automobile dependence. Around the world, many cities have proposed plans to provide better public transport for their residents. In Freiburg, Germany, for instance, light rail has become the backbone of the city's public transport, with buses being primary feeders to the light-rail system (Pucher and Clorer 1992) (Figure 2-7).

Figure 2- 8: Light rail in Feiburg, Source: http://www.lightrailnow.org/facts/fa_rapid-streetcar.htm

In fact, the belief that investment in public transport systems is expensive and may cost the city's competitiveness in the global economy may be a myth, as the study by Kenworthy (2000) showed that cities with more balanced private and public transport systems spend a less proportion of their gross regional product (GRP) on operating transport systems than auto-dependent cities, which means that they have more money available to invest in productive economic activities.

Along with the improvement in public transport, the provision of off-road facilities for cyclists and bike storage facilities has also played a big part in reducing the dominance of automobile use in Freiburg, which has dropped by 13% from 1976 to 1991, as reported by Pucher and Clorer (1992). Copenhagen and other European cities have encouraged biking and walking by providing an extensive network of routes reaching from downtown to the outskirts and traffic-calming devices to guarantee pedestrian and biker safety (Birch and Wachter 2008). Reduction on parking area can also discourage people from using private vehicles and encourage them to use public transport. In Freiburg, spaces used for parking have been reclaimed for civic areas and children's playground, which also serves to enhance the sense of community (Pucher and Clorer 1992).

Many believed that turning the trend over from over-dependence on private automobile requires more than just investments into public transport alternatives, but also changes in the ways and places in which people live. Having all the

necessary public services within a 400-metre radius to the home has now been considered a rule of thumb for sustainable community design, as 400 metres require on average five minutes of walking, which is considered the acceptable distance for one to choose walking over driving (Condon 2010). As Condon (2010) observed, when most of residents' daily commercial needs are met within walking distance, not only do they walk more but they use the car significantly less. The location of a community school within the walking distance is also considered necessary for the construction of a car-free community. However, current regulations and standards that often over stress the scales of schools have been found to impede with the concept of small schools within community centers where kids can walk to. It has been argued that it requires actions at the state or provincial level to remedy this problem (Condon 2010). One of the main causes to traffic congestion especially at peak times and subsequent CO_2 emission problems are the commutes to and from work places. Evidence from the experience of many countries has shown that the situation is unlikely to change even with continuous investments into road facilities. Communities that provide jobs and housing in equal balance, provide reasonable alternatives to the car and integrate jobs seamlessly into the network of complete communities are more desirable than the "bedroom suburbs" and provide the most promising solution to a reduction in automobile reliance.

From the above review, the main issues of concern related with the reduction of automobile reliance can be identified, which include: provision of convenient public transport; designs to encourage walking and cycling; reduction of parking space; good accessibility to public services, schools and work.

2.6.4.3 Theme 3: Quality of life

The concept of sustainable development has been associated with efforts to increase quality of life without endangering the natural resource base of the society (World Commission on Environment and Development 1987). As defined by WHO, quality of life is "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to

their goals, expectations, standards and concerns." In the planning literature, the quality of life provided by a community where people live is often strongly associated with the characteristics of its locale and evaluated based on such indicators as health, safety, and amenity.

There is a growing amount of evidence which shows that modern housing projects and urban and rural development programmes have yielded many improvements to living conditions (Lawrence 2000b). Cities have long been perceived as facing environmental problems. In the second half of the nineteenth century, the most defined urban problem was that of sanitation (Gullberg et al. 2000). In developed countries, much of the problem has been dealt with successfully through centralized, professionally-managed and technically sophisticated infrastructure systems. While in many of the developing countries, this remains problematic. The demographic, social, economic and ecological survival of the emerging mega-cities has been perceived as being threatened by the environmental and social conditions for large numbers of city dwellers. The squatter settlements in the peri-urban areas, specifically, often witness severe sanitation and health problems. Lower levels of economic development, smaller urban budgets, shortages of environmental infrastructure, shelter and basic services and high levels of urban poverty have resulted in environmental degradation which leads to unsustainability. The reduction of pollution and improved sanitation are, therefore, the basic requirements for building sustainable settlements in the cities of less developed countries, which would demand much increased infrastructure investment and improved management structures.

A sustainable settlement is required to be one that creates a safe place for its residents. The widely promoted principles of Secured by Design are such design principles as to ensure reduced crimes in communities. The main principles include restricted public access, well-lit and supervised communal areas, and enhanced surveillance (ACPO CPI 2004). A study in Yorkshire, UK had shown that Secured by Design principles had been proven to be an effective community design and management measure in enhancing safety in communities (Armitage 2004).

Public spaces provide for enjoyable indoor and outdoor public events and activities, and discourage crime, disorder and anti-social behaviours. Semi-public spaces can support and encourage community life and cohesion at the neighbourhood level (DETR 2000). Lasch (1991) argued that there is a link between the communal life of cities and the stability of family life. New estates are to be developed with neighbourhood units containing social facilities such as schools and other communal institutions. They are to help minimize crime and act positively against forms of deviant behavior.

As the average household devotes roughly one quarter of income to housing expenditures, while poor and near-poor households commonly devote half of their incomes to housing (Quigley and Raphael 2004), the affordability of housing is an important factor that affects a household's well-being and quality of life. To the other side of the coin of affordability is the space and quality that housing provides. For a good life quality, adequate living space and a substantial standard of quality are necessary factors that make housing desirable and sustainable. However, the space and quality of housing may have to be compromised for a higher affordability level, and conversely, the increase of which may result in higher housing prices. According to a study on housing in the United States, the Urban Renewal Program from the 1950s to the 1970s, which is characterized by quality enhancements, had driven the poorest households out of the housing market and increased the number of households that are homeless or at risk of becoming homeless (Quigley and Raphael 2004). The critical point, therefore, lies with ensuring through management controls, of a minimum standard of dwelling space per person and housing construction quality, while offering affordable housing for all and especially those at the lowest distribution of income levels.

From the above review, the main issues of concern related with the quality of life can be identified. These include: reduction of pollution and improved sanitation; safety; accessibility to public spaces; adequate dwelling space; good construction quality and affordability.

2.6.4.4 Theme 4: Minimized land consumption and compact urban form

In many countries, peri-urbanization or suburbanization has been associated with a significant decline in open space, especially farm land. As Kahn (2006) noted, between 1982 and 1992, urban and suburban growth caused the amount of farmland in the United States to fall by four million acres. The Council for the Protection of Rural England had reported that an amount of 11,000 hectares of rural land is lost to urban development each year (Rudlin and Falk 2009). Urban sprawl that is facilitated by high capacity extensions to the road system consumes vast quantities of rural and natural land resources (Kenworthy 2000). Kline and Wichelns (1996) identified four types of values associated with agricultural land protection, these are: agrarian values related to food production and protection of the agricultural heritage and traditions; environmental values concerning protection of wildlife habitat and other environmental services; aesthetic values focusing on the preservation of open space; and land protection values that safeguard against sprawl. In countries whose economies rely less on agriculture, the loss of rural land is of particular concern where it involves areas of natural beauty and ecological importance, whereas in countries where agriculture has a large share in national economy, the loss of agricultural capacity may have significant consequences on the countries' cultural traditions and economic competitiveness. In both cases, the protection of agricultural land is an important issue concerning long-term sustainability.

In countries such as the United State and Canada, "exclusive agricultural zoning" has been applied as an effective policy tool for the preservation of agricultural land, preventing them from being converted into uses other than agriculture (Alterman 1997). Besides zoning policies to preserve farmland, these countries also utilize beneficial property tax regulations to reduce farmers' financial burdens (Stobbe, Cotteleer and Cornelis van Kooten 2009, Alterman 1997). The rationale behind is to make farming lucrative and non-farming developments less so. In other countries, the preservation of the rural lands is more about urban growth containment rather the protection of agricultural land *per se*. The "Green Belt" policy in the UK and the "Green Heart" conservation policy in the Netherlands

are such examples (Alterman 1997).

Urban agriculture as a traditional part of urban areas has made a return to modern-time living, and is increasing rapidly in scale and popularity in many countries. Urban food growing can reduce the food miles for importing food and the need to travel to large supermarkets (Garnett 1996), and make substantial contributions to food production for the city. The Urban Oasis Project in Salford, UK, for example, has been successful in transforming the land around a tower block into an organic food-growing area, which maintains self-sufficiency in fruit and vegetable for the community it serves as well as providing a food crop for the wider inner city (Rudlin and Falk 2009) (Figure 2-8).

Figure 2- 9: The Urban Oasis Project,
Source: http://www.martinbondphotos.co.uk/going_green/image3.html

Ensuring compact development is important for urban containment and prevention from encroachment on rural land. Density is essential in achieving compactness. While overly-dense living environments are often associated with health damage, traffic congestion, exposures to pollution and overloaded sanitation problems, many countries, mostly post-industrial ones, have, in the latter half of the last century, turned to the other extreme of building low-density sprawling conurbations in suburbs. According to Rudlin and Falk (2009), higher densities can be achieved without compromising on space standards, when careful

design on development forms is practiced. They argued that the optimum form to maximize density without creating the perception of overcrowding is the three or four-storey terrace around squares and open spaces (Rudlin and Falk 2009). Density also affects the type of transport people choose. It is widely accepted that the higher the density in a service area the more likely it is that residents will use public transit (Condon 2010). A density of ten dwelling units per gross acre is the usual minimum standard for sustainable, walkable, transit-friendly, and low-carbon neighbourhoods (Condon 2010). However, the measure of appropriate density is dependent on cultural norms and economic development levels, and varies greatly among different countries (Burgess 2000). It is claimed that people in developing countries generally have a higher tolerance level of higher densities than those in developed countries (Richardson, Bae and Baxamusa 2000). In developing countries, the real challenge lies with achieving the balance between high intensity development and quality of life.

From the above review, the main issues of concern, which are related with the minimization of land consumption and compact development, have been identified. These are: minimization of the loss of rural land; opportunities to perform community agriculture; and appropriate development densities.

2.6.4.5 Theme 5: Social cohesion and sense of community

Human settlements not only provide physical environments for people to live in but they are also social compositions that generate interesting and complex communities, which are central to human development. The existence of a strong community is critical for the creation of a successful place, while many urban problems point to the lack of a sense of community, such as crime and social disorder. There have been many models of successful communities in the past that many planners and architects aspire to, one of these being the rural villages. However, as Rudlin and Falk (2009) argued, once they were translated into the tight courtyard council houses in the 1970s, the tightknit, homogeneous communities created were destined to fail. Neighbourhoods composed of only flats for lower income groups were seen to promote youth crime and vandalism.

For this reason, estates with a uniform social structure should be avoided. Inequitable distribution of quality of life benefits undermines the cohesiveness of a settlement as well as reducing the quality of life of those less well off (DETR 2000). This argument points to the issue of social-mixing and diversity. The creation of a diversity of housing and tenure types is often used as a proxy for achieving healthy social mix with settlement development.

Many scholars believe that creating mixed districts will enhance the living conditions and life-chances of their inhabitants, and promote more stable and cohesive communities (Bolt, Phillips and van Kempen 2010, Goodchild and Cole 2001). The provision of a more diverse range of housing types and tenures would improve the chance of social contacts between different groups of people, enable better-off households to remain in the area and thus benefit the community (Bolt et al. 2010). The creation of "balanced communities" has been a popular strategy intervention in many countries. In the UK, schemes had been implemented to introduce homeownership into areas which were exclusively social housing and encourage developers to build a percentage of affordable housing in all new developments (Minton 2002). There is a general agreement among researchers that low-income households can benefit from the integration of higher-income households, in terms of better physical environment, better facilities and services, and reduced crime, all of which are factors in enhancing a sense of community (Minton 2002). In other parts of the world, innovative design techniques that enhance community diversity are being implemented. In the design for the Pringle Creek Community in Salem, Oregon, the design team conducted an in-depth analysis of the demographic patterns of the region and used this as a basis for the design of housing types in the new community, the result of which is a mosaic of households that have homes both affordable and suit their needs (Condon 2010).

Scholars have also identified that there exist obstacles in the planning and development norms that may work against the creation of mixed and cohesive communities. Condon (2010) argued that current planning strategies in US and Canadian cities that favour zoning of urban functions inherently defies the definition of a sustainable society, in that they foster residential monoculture and enforce social inequality. He went on to show that the city of Vancouver had

achieved some level of success in terms of creating mixed districts by mainly two ways: one is through building new higher density, low-rise buildings that are compatible with existing low-density neighbourhoods and the other is by converting existing single family homes into multiple dwelling structures (Condon 2010). The increasing popularity of gated communities, which are estates fenced off by walls and state of the art surveillance and security, among development practice has also been worrying urban decision-makers. Policy interventions to resolve the problem point to more open and integrated community patterns.

From the above review, the main issues of concern, which are related with social cohesion and sense of community, have been identified. These are: diversity of household types and social mixing; integrated communities; designs to enhance the sense of community.

2.6.4.6 Theme 6: Public participation

Public participation is a necessity for social and environmental sustainability in urban planning, as it focuses attention on stakeholder and public interests (Enserink and Koppenjan 2007). Community participation can be defined as "where people living in an area are able to articulate their desire for change by being involved in the planning and enactment of that change and maintaining and building on that change in the future" (Rowe and Wales 1999). Public participation is fundamentally a democratic requirement allowing all people without discrimination the right to have a say in the decisions that affect their lives.

Conventional planning practice that has been dominated by the blue-print planning approach is increasingly being challenged by arguments for more participatory approaches in the planning process that devolve power to the grassroots and explicitly encourage professionals to make changes to their personal, professional and institutional values and practices (Chambers 1998). As Brohman (1996) argued, sustainable development strategies should favour

bottom-up over top-down approaches; redistribution over "trickle-down"; self-reliance over dependency; a local rather than a regional, national or international focus; and small-scale projects rather than grand-scale or mega-projects. In a word, urban development should be designed with extensive public participation; seek to improve society and the environment as well as the economy; and result in increased equity, equality and empowerment.

Studies have shown that the provision of public meeting spaces help to foster community collective activities and enhance empowerment. Be it a community group's new board room, a town hall, or a garden, access to appropriate space is often supportive of further empowerment (Feldman and Westphal 2000). As Saegert and Winkel (1996) observed, changes in the physical environment are integrally linked to changes in identity and efficacy, which are important elements for supporting empowerment.

Many studies have also emphasized the importance of information and awareness of sustainability issues as being of critical importance for lay people to take a proactive role in decision-making (Fagan 1998, Hopkins and McKeown 2002). Fagan (1998) claimed that, if given accurate information in a way which can be quickly understood, local people will make sensible, sensitive choices within sustainable parameters.

From the above review, the main issues of concern, which are related with public participation, have been identified. These are: public participation in the decision-making associated with the development and management of a community; provision of public meeting place in the community; and the dissemination of information on sustainability issues.

2.7 Sustainable peri-urban settlement development – an integrated process

A sustainable peri-urban settlement should embody all the above qualities and not compromise between partial achievements of each. It is crucial to reconcile and

combine them by way of integration. In actual practice, it is admitted that at times trade-offs would need to be made, however, the overall aim needs to be the pursuit of an integrated result. Settlements are complex interactive systems where environmental, economic and social facets bear on each other. For example, the issue of agricultural land stems from an environmental concern but also affects the socio-economic status of those dependent on it for their well-being. Therefore, sustainable development would require not just new techniques but new ways of thinking about social, economic and environmental goals and how to achieve them.

At the government level, a change of thinking has taken hold towards integration. The Obama administration's Livable Communities Partnership in the United States, have aligned, for the first time, the actions of the U.S. Environmental Protection Agency, the U.S. Department of Housing and Urban Development, and the U.S. Department of Transportation in order to coordinate their activities and look for synergies among their policies (Condon 2010).

The concept of an integrated approach of sustainable development may be politically accepted, but the translation of this concept into practice is still cumbersome. Citing a study done by OECD (Organization for Economic Co-operation and Development), Hacking and Guthrie (2008) argued that integration is compromised when the initiative is primarily designed to deliver social and economic outcomes and the biophysical concern is only needed for mainstreaming decision-making. However, in the developing countries, "integrated" approach would be more relevant in that environmental aspects take on a meaning beyond biophysical concerns to be more closely linked with quality of life and growth. The achievement of sustainable development requires taking a systems perspective that integrates considerations coming out of all three dimensions (social, economic and environmental) of the sustainability concept.

The goals that sustainable development aims to achieve often demonstrate contradictions between them. As Redclift (1989) argued in his book *Sustainable Development: exploring the contradictions*: "sustainable development is a concept which draws on two frequently opposed intellectual traditions: one concerned

with the limits which nature presents to human beings, the other with the potential for human material development which is locked up in nature". This raises the issue of resolving contradicting value systems and competing human demands. Achieving long-term sustainability in any city is a difficult task that requires knowledge-intensive input and close cooperation of a variety of stakeholders, which include the urban authorities, the planning professionals and the individuals living in cities. It needs to be recognized that different groups of stakeholders may hold different values and have different interpretations in terms of what is meant by sustainable living. Differences in the interpretation and value judgment of sustainable development exemplify the need for different stakeholders to specify their terms of reference and understanding of the sustainable development concept.

Sustainable urban development is fundamentally a matter of reconciling ecological requirements with the needs and values of people living in cities. In the process of reconciliation, a comprehensive integrated approach is needed to combine the evaluation of development outcomes with stakeholder perceptions in order to find the solutions to current problems that hinder sustainability.

2.8 Summary

This chapter has focused on setting out the global theoretical background against which detailed studies focusing on peri-urban settlement development in Chinese cities will be carried out. It started by clarifying the definitions and conceptualizations of "peri-urban" and their implications for an inquiry into sustainability evaluation. It then reviewed the development of the theories and practices that were documented in existing literature on peri-urban development in both developed and developing countries, and identified six research themes pertinent to the sustainability agenda.

To address sustainability in peri-urban settlement development, critical issues which are considered as central to the concept of sustainable peri-urban settlement development have been identified under the six research themes. These issues are based on broad lessons of urban settlement development, but they are considered

closely relevant and appropriate for the peri-urban context. Indeed, many are directly associated with the spatial expansion and population migration of cities. Evaluation frameworks used for the assessment of sustainability of urban development have been reviewed with an emphasis on themed approach, which is considered appropriate for the purpose of this study. It was argued that an outcome-based evaluation is to be aimed for, in that it represents the actual effect when a certain sustainability strategy has been implemented.

In the last section of this chapter, it was proposed that an integrated approach is to be adopted in the search for sustainable solutions to peri-urban problems. The integration requires taking a systems perspective that looks at environmental, social and economic aspects of sustainability and taking into account the perceptions of sustainable development of different stakeholders.

Chapter 3 _ Research framework and methodology

3.1 Introduction

The main aim of this research is to evaluate the perceptions and performance of sustainability in current peri-urban settlement development in China. Five research questions were raised for this study:

1. What are the sustainability issues with peri-urban settlement development in the global literature and development practice, and what theoretical framework can be used to assess the issues?
2. What are the socio-economic and environmental impacts of peri-urban development in Chinese cities and what has currently been done to address the sustainability issues in the Chinese urban/rural development realm?
3. To what extent has the current outcome of peri-urban settlement development practice in China addressed holistic sustainability issues?
4. What are the stakeholders' perceptions on the sustainability issues and how has the dynamics of decision-making affected the sustainability of the outcome of peri-urban settlement development in China?
5. What is the relation between the stakeholders' perceptions of peri-urban sustainability and the sustainability performance of developed peri-urban settlements, and what implications does it have on planning and design of peri-urban settlements?

To find answers to the research questions set out in the first chapter, this study firstly needs to establish a research framework within which practical research methods can be allocated to address the specific research questions.

3.2 An integrated approach

As has been explained in Section 2.7, an inquiry into sustainability issues of any

urban development requires the adoption of an integrated research approach. Hence this study takes on such an approach and seeks to address the research questions through a combined methodology of performance evaluation and stakeholder study.

In order to develop a meaningful proposition for peri-urban settlement development practice, this research requires a detailed inquiry into the performance and the decision-making of the current peri-urban settlements in Chinese cities. Accepting that sustainability is a broad subject that encompasses a myriad of issues covering social, environmental and economic angles, for anyone trying to develop a unifying and coherent theme to cover all of the scope of issues it is necessary to structure a suitable methodology or research framework to achieve that goal.

The first step of the integrated methodology of this study aims to develop, based on a systems approach, a set of objectives as an evaluation framework to assess the ***outcome*** (refer to Section 2.6.3.4) of current peri-urban settlements in a Chinese city. Based on the evaluation result, a second approach, which is focused on the perceptions of different stakeholder groups on peri-urban sustainability, is then carried out. The stakeholder groups under study include the institutions and professionals involved in the decision-making process of peri-urban settlement development together with the households and individuals that live in constructed peri-urban communities. This combination of approaches has hitherto been relatively neglected in the discussions on sustainable development. It is proposed here that such an approach will lead to new ideas and solutions in line with a development towards sustainable cities.

3.3 Research Framework

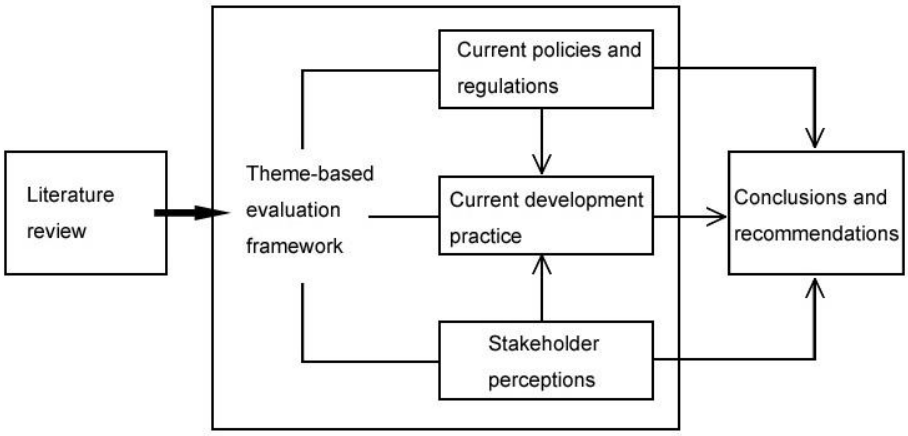


Figure 3- 1: The research framework

Figure 3-1 explains the research framework of this study. Firstly, a literature review is presented setting out the theoretical background, against which the evaluation framework is structured, which is carried through the whole of this study. Secondly, the evaluation framework is used as an analytical structure, within which a series of elements are assessed:

1. Current policies and regulations on sustainable development in Chinese cities
2. The sustainability of the development outcome of peri-urban settlements in Tianjin
3. Stakeholder perceptions on sustainability issues related with peri-urban settlement development

Finally, conclusions are drawn on the findings and recommendations are made for the improved sustainability of future peri-urban settlement development in China.

3.3.1 The evaluation framework

The starting point of the integrated approach is the concept of sustainable development. How can it be operationalized and broken down into criteria for the

evaluation and guidance of practice? The purpose of the literature review in the previous chapter has been to refine a working definition of sustainable peri-urban settlement development as a basis for developing a coherent set of sustainability objectives. This establishes the conceptual basis for this study in firstly summarizing the evolving theories related with sustainable peri-urban settlement development, before going on to discuss how this has informed the structure and content of the proposed evaluation framework. Six themes have been identified as covering the main issues of concern, namely:

- *Theme1: Ecologically responsible development*
- *Theme2: Reduced reliability on automobile use*
- *Theme3: Quality of life*
- *Theme4: Minimized land consumption and compact urban form*
- *Theme5: Social cohesion and sense of community*
- *Theme6: Public participation in development and management process*

There is little or no standardization of the process of evaluation for sustainable development, beyond a general acceptance of indicators as a suitable proxy (Mawhinney 2002). The discussions in the previous chapter have illustrated the main issues to be considered under each of the research themes. These are translated into the key performance indicators that work as tangible proxies to be employed as part of the evaluation. The key performance indicators, hereafter referred to as “parameters” and abbreviated as “PAR” in this study, are presented in a checklist (Table 3-1).

Table 3-1: Theme-based evaluation framework

Sustainable Peri-urban Settlement Evaluation Framework
Theme 1: Ecologically responsible development
PAR 1-1: Building orientation PAR 1-2: Natural lighting PAR 1-3: Natural ventilation PAR 1-4: Energy efficient building envelope PAR 1-5: Energy-saving products PAR 1-6: Water-saving equipment PAR 1-7: Renewable energy systems PAR 1-8: Provision of separate refuse collection/recycling systems PAR 1-9: Preservation of natural green land and water body PAR 1-10: Protection of natural species and habitat PAR 1-11: Protection of natural topography and geology PAR 1-12: Integration of built and natural environment
Theme 2: Reduced reliability on automobile use
PAR 2-1: Convenient and comfortable walking and cycling environment PAR 2-2: Reduction of parking space PAR 2-3: Proximity to public transport PAR 2-4: Access to work location PAR 2-5: Access to educational facilities PAR 2-6: Access to public service facilities
Theme 3: Quality of life
PAR 3-1: Adequate space PAR 3-2: Safety PAR 3-3: Access to public green area PAR 3-4: Access to outdoor activity space PAR 3-5: Affordable housing PAR 3-6: Construction quality PAR 3-7: Avoidance of glare PAR 3-8: Avoidance of pollution from domestic sources PAR 3-9: Avoidance of noise pollution
Theme 4: Minimized land consumption and compact urban form
PAR 4-1: Development design at appropriate community density PAR 4-2: Minimization of loss of agricultural/green land PAR 4-3: Provision of opportunities to perform agricultural activities
Theme 5: Social cohesion and sense of community
PAR 5-1: Diversity of household types in the community PAR 5-2: Integration with existing surrounding communities PAR 5-3: Design character and sense of community
Theme 6: Public participation in development and management process
PAR 6-1: Access to public meeting space PAR 6-2: Participation by residents in community management PAR 6-3: Participation by residents in the planning and design process PAR 6-4: Access for residents to knowledge of sustainability

3.3.2 Assessing current policies and regulations

It is recognized that applying the theoretical framework to the Chinese context needs to be done with caution. According to Friedmann (2005), developments in China are happening very fast and China's unique civilization deserves to be understood on its own terms. This part of the study hence focuses on setting out

the context of peri-urban settlement development in China. This is carried out through literature review based on documents from both printed and electronic resources. This part of the study examines the progression of current policies and regulations in the area of urban development in China on the sustainable development themes and issues set out in the evaluation framework. The aim of this part of the study is to answer the second research question raised in the Introduction and provide a general context for the detailed investigation of peri-urban settlement development in the study cases of Tianjin.

3.3.3 Assessing the outcome of peri-urban settlement development

This is done through case studies in the Chinese city of Tianjin. The use of case studies as a research strategy is essentially "an empirical inquiry that investigates a contemporary phenomenon within its real-life context" (Yin 1994).

The city of Tianjn is chosen as the urban center for the case studies for the following reasons: Firstly, Tianjin provides a typical context for peri-urban settlement development in China. Being the fourth largest city in China, Tianjin was one of the first cities to undergo an urbanization process during the economic reforms beginning in the 1980s. Many of its problems and characteristics of the urbanization process are typical of Chinese cities. Secondly, with the designation of the Tianjin Binhai New Area (BNA) as the new growth engine for North China, massive development is underway in the peri-urban areas between the city proper and BNA. New settlements with a variety of purposes and characteristics have sprung up at rapid speed. As the identification of sub-centres for economic growth and subsequent settlement development surrounding them is recognized as a strategic procedure to measure mega-cities against their economic ambitions and resolve population growth, the case of Tianjin, to a certain extent, represents the future of many Chinese cities. And thirdly, several rural villages in the outskirts of Tianjin city are undergoing experimental development into urban residential communities as part of a national strategy for rural urbanization. The success or failure of these new peripheral residential communities will have strong implications for similar developments to be carried out in other cities. Therefore,

the understanding of current development processes in Tianjin and their outcome are critical for informing planning and design decision-making in the future. These also present a reference for other cities in China and other developing countries.

The assessment of the outcome of peri-urban settlement development in Tianjin is based on the evaluation framework given in Table 3-1. Using the parameters as proxies for desired end goals the current outcomes of development practice of chosen study cases are assessed and the existing problems and challenges are presented and analyzed. The process of the evaluation is done through means of a questionnaire survey delivered to the residents of the chosen study cases, in which their evaluation on the outcome of the developed communities were obtained. It is held as a premise that the evaluation by the occupants of a settlement best reflects the effects of its actual outcome. The aim of this part of the study is to answer the third research question given in the Introduction, and paint the picture, in a fair amount of detail, of the status quo of peri-urban settlements in terms of their sustainability.

3.3.4 Assessing stakeholder perceptions on sustainability

Based on the evaluation of current development outcome, this study further seeks to assess the views of different stakeholder groups on issues related with peri-urban sustainable development. It has been proposed that a *professional* plus *household* perspective be adopted to achieve an integration of perceptions of sustainable development by the decision-makers and the general residents.

Planning is a process that integrates competing interests and values, builds consensus and generates collaborative visioning. "Planning is generally recognized as a collective activity, but an activity that marries process (communication and collaboration) and substance. The substance of planning encompasses social, ecological, political, and economic objectives, perspectives and knowledge" (Lawrence 2000a). Sustainability is not confined to the physical environment. Sustainability also includes the concept of stable, integrated

communities, and planning for such communities must embrace both tangible issues such as the built environment, and the intangible, such as people's perception of what constitutes an attractive and secure environment.

This study seeks to identify the interests and attitudes of the *professional* and *household* stakeholder groups towards sustainability issues by means of questionnaire survey and interview. Attitudes are of interest because of their potential to influence actions (Black 1999). Attitudes of administrant and planning professionals on urban sustainability shed light on their vision of a sustainable urban future and provide some explanation on the current practice in urban development; and attitudes of residents reflect their perceptions and demands of the urban built environment. The comparison of the attitudes of different stakeholder groups would allow an insight into the conflicts behind urban development decision-making that may be one of the reasons that hinder sustainable development.

3.4 Research Methods

This study adopts a method that combines quantitative and qualitative research. Quantitative research is done through means of questionnaire survey. Qualitative research includes using methods of document survey, site visits, observation, and interview.

3.4.1 Quantitative Research

Questionnaire survey is a widely used research method to gather information from respondents using standardized questions to simplify compilation of data (Gillham 2008). In this research, two stages of standardized questionnaires: Questionnaire A and Questionnaire B are devised to collect different sets of data.

3.4.1.1 Questionnaire A

The purpose of this stage of the questionnaire survey is to collect data for the

evaluation of the outcome of current development practice in the chosen study cases in Tianjin. Questionnaire A (Appendix I) is delivered to the occupants of the settlement cases chosen as study cases for this research. In the questionnaire, the respondent is asked to rate the performance of his/her community against the 37 parameters listed in Table 3-1 on a scale of 5, with 1 as "not well-delivered at all", 5 as "very well-delivered", and 3 as "neutral". An additional choice is given if the respondent does not have an opinion or the issue in question does not apply in his/her particular situation.

Each of the 37 sustainability parameters listed in Table 3-1 is turned into a question, asking the respondent "to what extent do you think this sustainability feature is delivered in your home/community". Recognizing that some of the designed questions may involve technical jargons that are difficult for lay people to understand, an explanation is presented within each question to de-jargonize it. For example: Question 3 is on "Natural ventilation", the purpose is to ask the respondent "to what extent do they think natural ventilation is delivered in the design of their home". An explanation is presented with the question: "e.g. the provision of natural ventilation in the home to ensure adequate amount of fresh air intake and reduce excessive heat".

To test the validity of the questions set out in the questionnaire, a pilot questionnaire survey was carried out before the actual survey was delivered. The pilot survey showed that the respondents understood well what they were asked by each question, and the time taken for each respondent to fill in the questionnaire was within a reasonable scale. Some modifications were made on the presentation of the questionnaire as well as on the wording of some questions according to the feedbacks from the pilot survey.

It is noted that there are limitations with performance evaluation based solely on user survey, especially for those issues related with the energy efficiency of buildings and the ecological friendliness of planned settlements, which may be more accurately evaluated using objective indicators such as energy consumption and ecological footprint. Yet, interpreting whether the result represents a good or bad performance may still be a subjective process. As the method adopted in this

study to evaluate the performance of developed settlements is a user-centered one and focusing on the experience of living in a developed community and using its service facilities, therefore, the use of subjective evaluation of the settlements, i.e. evaluations by residents, is considered appropriate for the purpose of this research.

3.4.1.2 Questionnaire B

This stage of the questionnaire survey aims to understand the perceptions and attitudes of different stakeholder groups towards peri-urban settlement sustainability. Questionnaire B (Appendix II) is delivered to the professionals involved with the urban development decision-making, including urban planning officials, real estate developers, planners and architects; as well as the households and individuals living in peri-urban settlements. The same list of parameters as in Questionnaire A is used to structure Questionnaire B. The respondent is asked to rate the importance of each of the parameter in terms of its relevance to peri-urban settlement sustainability. Again, a scale of 5 is used to measure the respondents' perceived importance of each parameter, with 1 as "not important at all", 5 as "very important", and 3 as "neutral". Questionnaire B complements the result of Questionnaire A by providing a comparison between the stakeholder perceptions on sustainability issues and the sustainability outcome of actual development practice. The opinions of what constitutes a sustainable peri-urban settlement expressed by different stakeholder groups allow for a better understanding of their values and interests. It makes possible the resolve of value conflicts that lay behind many of the failures of urban developments.

A pilot survey was carried out to test the validity of the questionnaire survey and identify any problems with the design of the questions. The pilot survey showed that the respondents were able to understand correctly what they were asked by each question. Some modifications to the questionnaire were made in response to the feedbacks from the respondents of the pilot survey. Like in Questionnaire A, an explanation is presented with each question, this time the focus is on stating the detailed requirements for achievement on each listed sustainability parameter. For example: Question 3 is on "Natural ventilation", the purpose is to ask the respondent "to what extent do they think natural ventilation is important for the

sustainability of peri-urban settlement". An explanation is presented with the question: "Requirements: Design for natural and mechanical ventilation to improve indoor air quality".

3.4.1.3 Sampling

The size of sample for any survey depends on the level of accuracy required balanced against the time and resources available to the researcher. As a doctoral research, time and budget are always limited. In this piece of work, the aim of the researcher is to achieve optimum accuracy of survey with the limited time and resources available, although it must be noted that a larger sample and subsequent better accuracy might have been achieved if more time and budget were available.

Questionnaire A

This stage of the questionnaire survey adopts the *cluster sampling* approach. Cluster sampling focuses on "naturally occurring clusters of the particular thing that the researcher wishes to study" (Denscombe 2003). This method of questionnaire sampling has proven to be time and cost efficient in that it saves the time and money spent on travelling to and fro otherwise scattered research sites. The selection of appropriate clusters for research needs to follow the principle of *probability sampling* method, that is, the sample people or events represent a cross-section of people or events in the whole population being studied. Cluster sampling allows the researcher to assert more control over the selection of samples compared with other methods of probability sampling such as random sampling and also requires that the researcher has the knowledge necessary to identify the appropriate clusters.

The samples in this study are chosen by the researcher based on a comprehensive review of different types of peri-urban residential settlements in Tianjin. Three study cases are chosen with each representing a particular type of peri-urban settlement development. All three cases are within vicinity to each other, so as to rule out the geographical differences that may influence the evaluations based on case comparison. Questionnaire A was conducted on-site at the three study cases to the residents therein. This stage of the questionnaire survey was carried out between July and August 2010. Two ways of questionnaire survey delivery were

adopted according to the different community management structures in different study cases. In Study Case 1 (Huaming New Town), because the development was managed by 6 residents' committees each covering one neighbourhood of approximately 4000 people, the questionnaire survey was delivered through the help of the residents' committees. A meeting with each of the heads of the residents' committees was made beforehand and 5 out of the 6 committees kindly agreed to lend their help to the survey. The questionnaires were distributed randomly to the residents by residents' committee members. In Study Case 2 (City Sunshine) and Study Case 3 (Dongli Lake Development), no residents' committee has been established due to a low occupancy rate and a single estate management company is in charge of daily maintenance and security. In these two sites, questionnaire distribution was carried out by the researcher through the form of a one-day event with assistance of the estate management company. Questionnaires were distributed to those residents who attended the event and collected at the end of the day. In both forms of questionnaire delivery, incentives were given to respondents in order to encourage participation. The distribution of questionnaires collected in the three cases is shown in Table 3-2.

Table 3-2: Distribution and response rate of Questionnaire A

No.	**Name of Study Case**	**No. Total Household Occupied**	**No. Distributed Questionnaire**	**No. Valid Collected Questionnaire**	**Response Rate**	**Sample Rate**
1	Huaming New Town	9190	500	211	42.2%	2.3 %
2	City Sunshine	1458	100	72	72%	4.9 %
3	Dongli Lake Development	1272	100	94	94%	7.4 %
Total		11920	700	377	53.9%	3.2 %

Questionnaire B

The sampling of Questionnaire B follows a principle that it should involve all the parties that are generally involved in a residential settlement development in the studied area. A typical development of this type generally involves three groups of professionals: the government planning officials, real estate developers, and planning and architecture professionals. As discussed earlier, this study seeks to combine and compare the professional perspective with that of households and

individuals, therefore a fourth group of residents residing in peri-urban communities is included in the questionnaire survey as part of the integrated research approach. The questionnaires were distributed at several institutions covering the three professional groups. To obtain the household perspective, the questionnaire survey was also conducted at the three chosen study cases, to the same respondents to Questionnaire A. The following professional institutions were included in the questionnaire survey:

1. Tianjin City Planning Bureau (TCPB): TCPB operates development control machinery and is responsible for granting planning permissions to all urban development/redevelopment proposals in Tianjin. The bureau is also responsible for the formulation of local planning guidance and evaluation criteria.
2. Tianjin Vanke Urban Development Group (TVUDG): TVUDG is one of the earliest real estate companies established in China and has been a forerunner in urban development activities for the last three decades. It specializes in peripheral urban development projects and has a reputation for delivering sustainable developments.
3. Tianjin Urban Planning and Design Institute (TUPDI): Once a subordinate body to TCPB, TUPDI now operates independently. It undertakes most of the major urban development projects in Tianjin.
4. Tianjin Architecture Design and Research Institute (TADRI): As the largest architectural design institute in Tianjin, TADRI dominates the local architectural design market. It is also responsible for devising local architectural design and technical guidance.

In each institution, a contact person was approached through the researcher's personal contacts. Consent of questionnaire delivery was obtained through this contact person and questionnaires were distributed randomly to the professionals within each institute with the help of the contact person or other appointed personnel. This stage of the survey was carried out between April and May 2009. A total number of 240 questionnaires were distributed at the four institutions and 157 valid responses have been collected. The household respondents for Questionnaire B were approached simultaneously as Questionnaire A was

delivered, i.e. the household respondents were asked to fill in Questionnaire A and B at the same time. Table 3-3 shows the distribution of the collected responses among the professional and household respondents.

Table 3-3: Distribution and response rate of Questionnaire B

No.	Respondent group		No. Distributed Questionnaire	No. Valid Collected Questionnaire	Response Rate
1	Professional	TCPB	40	11	27.5%
2		TVUDG	40	22	55%
3		TUPDI	80	67	83.8%
4		TADRI	80	57	71.3%
Subtotal			240	157	65.4%
5	Household		700	377	53.9%
Total			940	534	56.8%

3.4.1.4 Result analysis

Questionnaire A

According to Barton (2004), four types of data analyzing systems are available for dealing with complex assessments using multi criteria. These are: ordinal, reductive, weighting and directional systems. Ordinal systems involve, essentially, the simple ranking of alternative schemes, thereby avoiding the need for precise measurement but still giving clear messages to decision-makers; Reductive systems translate all criteria to a common item, e.g. money, thus allowing systematic summation and comparisons to be made; Weighting systems ascribe relative values to the criteria without using common units; Directional systems apply a "moving towards" or "moving away" judgments to the impact of policy on each criterion (Barton 2004).

As Barton (2004) argued, reductive and weighting systems are not appropriate for research, in that their "attempt to reduce all criteria to a common means of exchange (whether money or weights) belies the uniqueness of each criterion." Directional system emphasizes the trend in which the situation is moving under impact of certain policy, which requires monitoring data for a period of time. This is neither possible for the scope of this research nor is it its purpose. For these

reasons, this research adopts the ***ordinal system*** for the overall judgment of the evaluation results.

The results of the quantitative research are summarized using both descriptive and inferential statistics. Descriptive statistics are presented in the form of proportions (i.e. the percentage) of respondents giving each answer and the mean values. A mean value of 4 or over would signify that a particular sustainability parameter was well implemented in the studied settlement case, whereas a score of 2 or less would signify that it was not well implemented. A mean score of, or around, 3 indicates a broadly neutral response. Inferential statistics focus on identifying the statistical differences between settlement cases on their sustainability performance and calculating the ordinal ranking of each settlement case on each sustainability parameter. The ordinal ranking indicates the relative performance of each study case on the specific sustainability issue, suggesting the relative effectiveness of certain sustainability measure being implemented. The Kruskal-Wallis Test was chosen as the statistical tool for analyzing the data. There are two reasons for the choice: firstly, the data set collected from Questionnaire A does not fit standard normal distribution, and secondly, there are more than two independent groups for comparison.

Questionnaire B

The results of Questionnaire B are summarized also using both descriptive statistics and inferential statistics. The descriptive statistics present the mean scores of the importance level given by the stakeholder groups on each of the 37 sustainability parameters. Inferential statistics uses the Mann-Whitney Test to identify the differences of perceptions among stakeholder groups on each parameter. This statistical tool was chosen because the data set collected from Questionnaire B does not fit the standard normal distribution, and there are two independent groups for comparison.

3.4.2 Qualitative Research

Qualitative research was undertaken both prior to and as a supplement to the quantitative research. The qualitative research carried out prior to the quantitative

research aimed to gain a thorough understanding of the study cases, including contextual conditions and the issues involved and to guide the development of the quantitative questionnaires. This involved mainly desk-top research of document survey, site visits, observation, and preliminary *ad hoc* consultation with various individuals. Interviews were conducted after questionnaire surveys were delivered to gain a more in-depth understanding of the respondents' opinions on the survey questions.

3.4.2.1 Document survey

The document survey involves a desk-top research of *planning and design documents*. These documents include the master plan and architectural design drawings of the development cases under study, the written planning guidance and urban design proposals. *News and reports from internet and local media* are also collected to provide the up-to-date information on the study cases. Information obtained from these sources is necessary for the full description of the study cases and is useful for the evaluation against the proposed sustainability framework.

3.4.2.2 Site visits and observation

Site visits to the study cases have been undertaken several times by the researcher between 2007 and 2010. During these visits, observations were made on the actual delivery of the sustainable features that have been stated in the planning and design proposals of the study cases. Preliminary *ad hoc* consultations were made to a small number of residents and contacts were set up with members of residents' committee/community management bodies to arrange for the conduct of questionnaire surveys and follow-up interviews.

3.4.2.3 Interview

The questionnaire surveys were complemented by interviews of a chosen group of respondents in each of the two questionnaire surveys.

The interviews conducted to the residents of the study cases were carried out in August 2010 and took two different forms. Interviews conducted to the residents of Study Case 1 (Huaming New Town) were made during one site visit following the questionnaire survey. Interviewees were spotted randomly on site and asked

for permission to answer the questions. In the other two study cases (i.e. City Sunshine and Dongli Lake Development), interviews were conducted during the one-day events when the questionnaire survey were conducted. Interviewees were chosen randomly with their consent to cooperate. The purpose of these interviews are to gain more insight into the residents' perception of their communities' sustainability performance and how they think it can be improved. Interviews were also conducted in the members of the residents' committee in Huaming New Town and members of the estate management companies in Dongli Lake Development and City Sunshine to understand perspectives from the community management bodies. Table 3-4 lists the names of the interviewees at the study case sites.

Table 3-4: List of interviewees (case study sites)

No.	Interviewee	Case Study Site
1	Director A	Residents' Committee, Huaming New Town
2	Director B	
3	Resident A	Huaming New Town
4	Resident B	
5	Resident C	
6	Resident D	
7	Director C	Dongli Lake Office, Vanke Property Management LtD., Dongli Lake
8	Resident E	Dongli Lake Development
9	Resident F	
10	Resident G	
11	Resident H	
12	Resident I	
13	Director D	City Sunshine Office, Tianjin Tianfang Property Management LtD, City Sunshine
14	Resident J	City Sunshine
15	Resident K	
16	Resident L	
17	Resident M	

Between April and May 2009, 18 interviews were conducted following questionnaire survey B to grasp a more in-depth understanding of the responses in the questionnaire and have a better understanding of the problems concerned with sustainable peri-urban development. The interviewees were chosen according to their expressed consent in the questionnaire and by the choice of the researcher.

The interviews were conducted by the researcher at the agreed time and venue through consultation with the interviewee. Interviews over the phone were also conducted when this was chosen as the preferred form. Table 3-5 lists the names of the professional interviewees and their institutions.

Table 3-5: List of interviewees (professional groups)

No.	Interviewee	Institution
1	Planning official A	Tianjin City Planning Bureau
2	Planning official B	
3	Planning official C	
4	Planning official D	
5	Urban planner A	Tianjin Urban Planning and Design Institute
6	Urban planner B	
7	Urban planner C	
8	Urban planner D	
9	Urban planner E	Tianjin Real Estate Development Co. Ltd.
10	Architect A	Tianjin Architectural Design and Research Institute
11	Architect B	
12	Architect C	
13	Architect D	
14	Developer A	Tianjin Vanke Urban Development Group
15	Developer B	
16	Developer C	Tianjin Real Estate Development Co. Ltd.
17	Official A	Tianjin Anju Project Office, Tianjin Municipal Construction Committee
18	Official B	Huaming New Town Administrative Office

3.5 Summary

This chapter systematically explains the methodology adopted for this research. Based on the argument made in the literature review, that an integrated research approach is needed for an inquiry into areas of sustainable development, this chapter further elaborates the integrated approach of this study. It rests on two aspects: the first is the integration of the environmental, social and economic aspects of sustainability in the evaluation of the outcome of current peri-urban settlement developments; the second is the integration of the evaluation of settlement performance with the examination of stakeholder perceptions on sustainability issues.

The chapter then goes on to establish the research framework for this study and explains each step of the research strategy. Three lines of elements are set out to be assessed using the evaluation framework:

- *Current policies and regulations on sustainable development in Chinese cities*
- *The sustainability of the development outcome of peri-urban settlements in Tianjin*
- *Stakeholder perceptions on sustainability issues related with peri-urban settlement development*

Finally, the specific research methods of data collection and analysis are discussed in detail. Both quantitative and qualitative research methods are adopted for data collection and analysis. Quantitative research methods mainly include questionnaire survey for data collection, and using both descriptive and inferential statistics methods for data analysis. This is used on the evaluation of settlement performance and stakeholder perceptions. Qualitative research methods are used to provide additional information to quantitative research. These include: document survey, site visits, observation, and interview.

Chapter 4 _ Peri-urban settlement development in Chinese cities and progression on developing sustainability

4.1 Introduction

This chapter is focused on answering the second research question: "What are the socio-economic and environmental impacts of peri-urban development in Chinese cities and what has currently been done to address the sustainability issues in the Chinese urban/rural development realm?"

For thousands of years China has been an essentially rural society. Its urbanization process started only fairly recently. Until the late 1970s, the rural population still amounted to 80% of the country's total population. Urbanization had been for a long time restricted by the so-called "*hukou*" ("Residential Registration") system in an attempt to keep the massive rural population outside the already over-burdened cities. Post-Mao economic reform since 1978 has brought about significant changes to the urban structure of Chinese cities. The reform is characterized by decentralization of management power and marketization of housing and land (Wu and Yeh 1999). As Wu (1997) has identified, the post-reform built environment is characterized by two changes: "land restructuring" and "polycentric development". The former involves the creation of embryonic central business districts (CBD), gentrified communities and the conversion of old residential areas to commercial use; the latter includes the emergence of large residential communities on the urban fringes. Significant spatial transformations and great social, environmental and economic turbulences are taking place in the so-called "peri-urban" areas of Chinese cities.

Existing literature on peri-urbanization in the Chinese context, more often than not, use the term "suburbanization" (Zhou and Ma 2000, Feng et al. 2008, Zhou and Logan 2008) to describe the process, albeit acknowledging its fundamental

difference to the Western suburbanization based on personal mobility-driven middle-class residential relocation: “suburbanization in China could not be based primarily on lifestyle choices by more affluent people” (Zhou and Logan 2008). The peri-urban dynamics in most Chinese cities differ from the “edge-city” (Garreau 1991) or “suburbanization” phenomenon in North America and Europe in that its economy is based on manufacturing rather than on services, although some researchers have noted edge-city dynamics in the more developed parts of China, such as the Beijing extended urban region (Webster and Muller 2004). The urbanization of the urban edge is driven more by industry than by housing. Due to policy restrictions on land use rights and informal construction, the “squatter settlements” that dominates the urban fringes of many Indian and Mexican megacities have not appeared in China. Although the suburban gated-communities in Chinese cities may seem similar to those found in Manila (Connell 1999) and Jakarta (Firman 1996), they are more of an extended tradition of enclosed settlement style rather than of concern over core city security.

The emerging new pattern of urban population distribution sees a changed ecological system of the city. In this chapter, the socio-economic and environmental impacts of peri-urban settlement development are discussed and the progression of policy and regulatory interventions in response to the call for sustainable development in Chinese cities are explained. Using the thematic framework of sustainable settlement development developed in the previous chapter, the progress and challenges of developing sustainability in urban China are discussed with an emphasis on rencent trends in the Post-reform era. This forms the background, against which more detailed evaluation of current development practices are approached in the following chapters.

4.2 Progress in sustainable urban/rural development in China: policies and regulations

The shift of population to large megacities and away from city centres has created concentrated population areas on the urban fringe. The need for rapid construction

of housing for the burgeoning population has seen depletion of land and local resources coupled with high levels of congestion, pollutants, and energy consumption. When villages and farmlands disappear under urban construction, it is not only the rural environment that is at stake, but also the well-being of the people there. Since China's Agenda 21 was published in 1994, sustainable development has been accorded national strategy, which proposes the integration of the social, economic and environmental goals of society. In the urban development field, sustainable development principles have increasing been held as the guiding principles to achieve the overarching goal of a sustainable city and harmonious society. In Chapter 2, six themes of sustainable peri-urban settlement development have been identified. They are:

- *Ecologically responsible development;*
- *Reduced reliability on automobile use;*
- *Quality of life;*
- *Minimized land consumption and compact urban form;*
- *Social cohesion and sense of community;*
- *Public participation in community development and management process*.

In this section, a discussion is made, using the six themes of sustainable settlement as a framework, on the socio-economic and environmental impacts of peri-urban settlement development in Chinese cities, and an elaboration of the progression of policy and regulatory interventions in response to sustainability principles is presented.

4.2.1 Theme1: Ecologically responsible development

As Friedmann (2005) noted, environmental damage and urbanization have come hand in hand in China. Belching smokestacks, dwindling ground water and malodorous rivers, are common characteristics of many urbanizing villages. Manufacturing activities, and the settlement patterns associated with peri-urbanization are not environmentally benign, given the very rapid and high magnitude of demographic, economic, and manufacturing output growth in these areas (Friedmann 2005).

Energy consumption

China has become the largest energy consumer in the world. According to UNEP, buildings account for 42% of Chinese energy consumption (UNEP 2007). In the post-reform era, an increase in total floor area, increasing electric appliance ownership, and an increase in demand for heating and cooling characterize the residential sector. With increased income, Chinese consumers are demanding larger residential units with greater personal comfort in winter and summer (Glicksman, Norford and Greden 2001a). With millions of potential rural population turning into urban residents and their villages into urban neighbourhoods, the use of air conditioners, better lighting, and other appliances is expected to increase as well as the demand on space heating. Energy consumption in the residential sector will continue to rise. From the energy resource point of view, with the relatively low price and long experience base of fossil fuel in China, the predominant use of oil, gas, and coal is likely to continue, leading to substantial levels of emissions and undesirable impacts on the environment and human health.

Adding to the problem is the poor energy performance of residential buildings, especially in the less regulated peri-urban areas. In cold regions of China, although there has been a marked improvement over earlier construction, buildings still suffer from inadequate insulation, leaky windows, and lack of attention to construction quality (Glicksman et al. 2001a). China's call for energy efficiency in the construction sector started as early as 1980s but impeded due to the lack of feasible technology and funding. The first energy-conservation standard, 'Energy Conservation Standards for Heated Residential Buildings in Northern China' came to effect in 1996. Meanwhile, the execution of energy efficiency regulation for new buildings remains inefficient. By the end of 2000, only 0.5% of the total urban and rural building floor area can be complied with the energy efficiency design standards (MOC, 2002). The management gap between the urban and rural administrative systems has led to sub-standard housing construction in peri-urban communities. Compliance to current standards is almost non-existent in many cases.

Boosted by a nationwide real estate boom since the early 2000s, huge investment has flown into the building construction sector. The spread of the energy-efficient concept, however, is still lacking. The Chinese government considers the adoption of energy-efficient technologies in buildings to be a promising path to ease the expanding energy crisis. The 11th national five-year development plan (2006–2010) calls for energy savings of 50% against the "General Design Guide (1980-1981)" standard for new buildings nationwide and up to 65% for new buildings in four large municipalities (Beijing, Shanghai, Tianjin, and Chongqing) as well as other major cities in northern parts of the country. The goal to achieve 65% energy saving in new buildings formulates the so-called "3rd step" of the Mandatory Building Energy Efficiency Standard, prior to which two steps of energy saving regulation have already been taken to reduce building heating energy use by 30% and 50% respectively. The "3rd step" standard requires heating energy demand of less than 14.4w/sqm and improved building envelope insulation and window detail specifications.

Water consumption

Because of rapid urbanization, steady increase of population and improving standard of living, domestic water consumption has been increasing significantly during the post-reform period. There is a considerable regional variation in the availability of water resources in China with the south being abundant while in the North China Plain water scarcity prevails strikingly. The per capita available water resource in Tianjin, for instance, is 160 m3 - only 1/15 of the national average. The overall water use in China has grown significantly over the last decades but has leveled off since 1997 (Liu and Chen 2001). According to statistical data, domestic water consumption in Beijing has increased about 53.8% from 1993 to 2001 with the rate of wastewater treatment remaining around 30% during the same decade (Chen, Ganesan and Jia 2005). With the continuous urban population growth and the increasing scale of the economy, aggregated demand for water is expected to continue its growth. Concerned with the increasing costs of developing new water supply and dealing with the existing inefficiency in the system, an initiative to adopt conservation and water use efficiency measures and a move towards demand management is urgently needed.

In some extremely water-scarce places like Beijing and Tianjin, water saving technologies and appliances, as well as recycling of water have been widely implemented, while at a larger scale demand management measures are still rarely adopted in China. Since 1997, a severe drought that lasted 8 years hit the North China Plain, causing the water shortage problem to be ever more significant than before. In 2001, Water Saving Offices were set up in 18 districts/counties in Tianjin with an aim to supervise water use and water infrastructure upgrading in all jurisdictions. In the same year, "Tianjin Water Saving Society Development Plan" was published by Tianjin municipal government, in which a water saving target was set for the year 2010. Following this, specific water saving targets and guidance were drawn for both the industrial and domestic sectors, including the "Code for Water Efficient Industries in Tianjin", the "Code for Water Efficiency in Residential Communities" and the "Transformation Plan for Efficiency Upgrading of Domestic Water Equipment". It was stipulated in the code that all new built residential developments should use water saving fixtures and grey water recycle system was made mandatory. All these have made a great impact: by 2009, the usage of water saving equipment in the domestic sector was recorded to have reached 40% across the city (Wang 2009b).

Natural environmental assets

China's rapid economic growth and urbaniztion have exerted huge pressure on the nation's natural environmental assets. While promoting economic growth, China has adopted an array of measures to strengthen environmental protection. The Environment Protection Law came into effect in 1979, making environmental protection one of China's basic national policiies. Recognizing the importance of environmental impact assessment during planning and construction, the EIA Law of China came into force on 1st September 2003, setting out the statutory requirements for EIA of plans and construction projects; and the legal liability in the EIA process. China has also established a system of environmental protection standards at both the national and local levels. National-level environmental protection standards include environmental quality standards, pollutant discharge (control) standards, and standards for environmental samples. Local

environmental protection standards include environmental quality and pollutant discharge standards.

National policies have also put emphasis on the preservation and protection of natural environmental resources and biodiversity under the pressure of urbanization. The Chinese government has promulgated the National Plan for Wetland Protection Action; formulated and implemented the National Program for Wetland Protection Engineering (2002-2030) and the National Implementation Program for Wetland Protection Engineering (2005-2010). The protection of urban wetland resources has drawn more attention and been strengthened; and the government has approved the establishment of ten urban wetland parks. Yet, scientific research on wetlands in China is still rather insufficient and data collection necessary to carry out such research is largely unavailable, which resulted in a lack of scientific guidance in wetland utilization and protection (Wang, Yao and Ju 2008). Under the pressure of urbanization, the exploitation of wetlands in urban areas has been extensive in the last three decades. As Zhai (2007) observed, urban wetlands in Tianjin had reduced by 80% since the 1950s, of which most were lost to urban development. This is largely due to the fact that the protection of wetlands lacks statutory and financial support. Since 2006, a series of research was carried out to assist the legalization of wetland protection in Tianjin, and “Tianjin Wetland Protection Guidance (Draft)” was piloted in 2009. The urbanization and hard surfacing of natural wetlands contributes to biodiversity loss. The State has formulated the “China Action Plan for Biodiversity Conservation”, followed by “China's Biodiversity: A Country Study and the Plan for the Protection and Utilization of the Resources of Biological Species”. At present, there are 250 bases for saving and breeding wildlife, over 400 centers for conserving and cultivating wild plant species or preserving wild plant genes in China. However, at present, biodiversity conservation largely focuses on key areas of nature reserves, while the wider impact on biodiversity of urban/rural development has been largely overlooked, and regulations and guidances of biodiversity conservation during urban/rural construction has yet to be developed.

4.2.2 Theme 2: Reduced reliability on automobile use

Historically, because housing was supplied by and closely located to the work units, transportation demand was small in Chinese cities. In 1988, only about 6% of China's energy use was attributable to the transportation sector (Glicksman et al. 2001a). However, as new residential projects are developed in urban peripheral areas far removed from the places of employment, longer commuter distance and new demand on transportation energy consumption are generated. Now 'urban working and suburban living' has been accepted by more and more residents in Chinese cities (Chen and Pu 2002). Decentralized housing estates location and increased commuter distance have substantially increased the traffic burden from city boundary to central area, which also contributed to the pronounced increase in automobile ownership and its utilization. In the last decade, the fast growth in the automobile industry has brought about benefits for both economic growth and personal mobility. The national passenger car sales have increased by 77% from 2002 to 2003, and from 1999 to 2004 motor vehicle production has increased by 117% (Ng and Schipper 2005). The costs associated with this were also evident. According to Ng and Schipper (2005), oil consumption exceeded production by approximately 30% in 2003, turning China from an oil exporter to a large net oil importer, and over one third of the consumption is contributed by the transport sector. The demand for crude oil is still expected to increase by 12% annually until 2020 (He et al. 2005). Environmental pollution associated with fuel burning in the transportation sector has also been made evident by research studies. According to Walsh (2000), 45-60 % of NOx emissions and 85% of CO emissions are from mobile sources in most Chinese cities. In China, various policies and regulations targeted at improving ambient air quality and reducing congestion in urban cities have been enacted while at the same time the development of the domestic automobile industry has been encouraged and supported. The challenge remains to resolve the tension between competing national priorities.

After a decade of fast motorization, Chinese cities have found themselves ill-adapted to the trend. Many city layouts, residential patterns and road infrastructures were designed in the pre-reform era, when virtually no citizen

owned private cars. Today, many urban roads are congested beyond capacity during rush hour; the average car driver in Beijing spends over 45 minutes commuting to and from work every day, with commuting times often as long as 90 minutes (Cohen-Tanugi 2008). In major Chinese cities such as Beijing and Tianjin, huge amounts of investment have been going into road infrastructure provision to meet the demand of a high forecasted motor vehicle ownership. However, traffic congestion situations have never ceased to accelerate. On 17th September 2010, a traffic jam that lasted 9 hours on 143 urban roads in Beijing once again reminded the city managers of the bitter reality despite their years of endeavours to curb congestion in the country's capital. Interestingly though, private car ownership in China is still comparatively low, with 13 cars per 1000 population in Beijing against 26-38 in Tokyo, London and Paris (Ng and Schipper 2005) and public transport provision level is comparatively high with 22 public transit vehicles per 10,000 persons and over 500 bus routes in Beijing (Cohen-Tanugi 2008). So what has failed the Chinese urban transportation to a seemingly moderate car ownership level with seemingly sufficient public transit provided? Cohen-Tanugi (2008) suggested it can be attributed to the segregation of urban functions that dominates city planning in China. Urban neighbourhoods are designated as commercial, residential or industrial without an appropriate mix of these functions. These univariate functional blocks are usually quite large, necessitating daily commute from one to another. Furthermore, in the process of central city regeneration, dilapidated neighbourhoods were transformed into central business districts (CBD) where jobs concentrate and land prices become too high for residential use. More and more neighbourhoods are displaced to peripheral locations and are accordingly forced to commute to work daily, causing massive traffic gridlocks between the urban core and its suburbs. As observed by Wu and He (2005), not only jobs are centrally located but other public services such as schools, hospitals, shopping centers and banks all tend to gather around the urban core and on the other hand, the peripheral residential communities developed are becoming increasingly extremely residential and deprived of convenient access to facilities.

The emerging situation of failed urban transportation calls for immediate interventions. However, "minimization of automobile use", a commonly accepted

concept for sustainable urban development in the developed countries is at much controversy in China due to the national economic development strategy that relies on automobile production and encouraged private car ownership. In the Chinese literature, the idea to curb congestion and associated pollution is often associated with a "green transportation" concept, which stresses meeting the increasing transportation demand brought about by economic growth; minimizing cost, energy and resource use and maximizing efficiency; while mitigating environmental impacts (Jiang and Guo 2009, Yang, Chen and Wang 2004, Wang and Shen 2004, Zhou and Shen 2009). To achieve these goals, the proponents of the "green transportation" system call for a diversified transportation plan that prioritizes public transportation options, and a polycentric urban land use pattern is considered as a more holistic way to combat problems of traffic congestion associated with urban expansion, in that it stresses the self-sustainability of each urban centre and reduce long-distance commutes.

4.2.3 Theme 3: Quality of life

The housing reform introduced in 1998 has resulted in a vigorous and fast-growing urban housing market and greatly improved housing conditions for urban residents. For example, the floor area per capita in urbanized areas increased from 6.7 square meters in 1978 to 28.3 square meters in 2007, and the home ownership rate reached 82.3 percent in urban China in 2007 (Man, Zheng and Ren 2011). New-built housing estates are planned with private kitchens and toilets, communal activity spaces and community gardens, which see huge improvement from the work-unit makeshift residential buildings and ghetto settlements. Urban infrastructure provision has also significantly improved. Clean water supply and sewage disposal systems have been complete in most parts of the cities. Health problems due to environmental pollution and poor sanitary conditions have been significantly alleviated. Although the general life quality has been significantly improved over the last three decades, there are still problems, some of which are existing unsolved problems, and others are new problems created by the newly emerging urban pattern.

Existing problems include the lack of public service provision and poor construction quality. Due to limited public funds available for public welfare and social construction, public service facilities, such as healthcare, education, public transport, culture facilities, etc., remain underdeveloped compared with the huge demand by the large population. On the other hand, the quality of building construction remains low. Many buildings face repairs within a few months of their completion. In his speech on the Sixth International Conference on Green and Energy-Efficient Building in 2010, Qiu Baoxing, the Vice Minister of the Ministry of Housing and Urban-Rural Development, announced that the average life-span of buildings in China is between 25 and 30 years. Homes built between 1949 and 1979, for historical reasons, were essentially makeshift and targeted at meeting only the basic needs for housing the population in a difficult time when the country's economy was at its worst. Housing construction in the Post-Reform era, due to the thriving economy and the introduction of advanced technology, has significantly improved both in design and quality. However, the lack of skilled labour, inadequate regulation, and supervision in the construction industry, together with the fact that the time required for completion of the construction is usually limited, has resulted in the quality of construction being undermined. As China uses 40 percent of the world's cement and steel each year, if these were to last for only 30 years, this would have a huge toll on the world's resources.

The newly emerged urban pattern, after three decades of economic reform and rapid urbanization, has created new problems which affect the life quality of urban residents. Although the per capita living space has significantly increased since the introduction of commodity housing provision in China, the affordability of an ordinary urban family to own a home has been undermined. Since 1999, the Socialist housing provision system based on the work-unit had given way to a market-oriented housing provision system, which means that the majority of the urban population could no longer enjoy public housing provision at very low rental costs, but had to turn to the housing market for renting or purchasing of a home. Since 2003, with further commodification of housing provision, property prices had begun to rise rapidly in many major cities. With the encouragement of local governments, whose main revenue comes from the lease of land, the real estate market became the most profitable investment channel, which in turn

further drove up property prices. In a study on "Housing price-to-Income Ratio" [1] for urban China in 2007, a national average value of 5.56 was found based on a sample of 600 Chinese cities, indicating that housing in Chinese cities are "severely unaffordable" according to the criteria proposed by UN-HABITAT (Man et al. 2011). Adding to this situation is the inadequate funding for social housing provision and the lack of policy measures to meet the housing need of lower and middle income groups (Mostafa et al. 2006). It has become increasingly costly for an urban family to own a home or to rent one, as the property rental market had also gone up due to the huge demand and limited supply. Thus the cost of shelter of an urban family encroaches on their other living costs, reducing their life quality.

In 2007, with the publication of the "Guidance on the Management of Affordable Housing" (MHURD 2007) , more regulated development and management of social housing was promoted to resolve the prevailing inefficient provision and chaotic management of public housing. "Affordable Housing", commonly known as "economical and comfortable housing" ("*jingji shiyong fang*") in China, is a type of public housing introduced in the late 1990s. This type of housing is provided through subsidized purchases, as the cost of building such housing is reduced through such measures as waiving of the land compensation fee, and reduction of other administrative fees applicable to the real estate business. At the same time, limits are placed on pricing, buyer eligibility and profit margin of developers, which is normally approximately 3%. Buyers are restricted to displaced inner urban residents and middle- to low-income households, whose eligibility is subject to official approval. These are usually developed in large housing compounds and located in peripheral locations away from city centers.

4.2.4 Theme 4: Minimized land consumption and compact urban form

Worldwide, regions identified as peri-urban play a vital role in providing fresh food to city populations, and a growing concern is that of residential expansion

[1] Housing price -to-Income Ratio (PIR) is the basic affordability measure for housing in an urban area. It is generally defined as the ratio of the median house price to the median family income. In the Global Urban Observatory Databases of UN- HABITAT, PIR is one of the important urban indicators, and a ratio between 3 and 5 is considered normal or satisfactory.

taking over agricultural land. Chinese cities have long been dependent on their intensively cultivated hinterlands for an important proportion of their food supply. In recent years, due to accelerated rate of urbanization, agricultural land is being converted to non-agricultural purposes at an unprecedented speed. A number of empirical studies have shown that a large percentage of the removal of cultivated land was due to rapid residential and urban expansion (Xu and Tan 2002, Zhou and Jin 2002). With increased demand for new physical and social infrastructure provision, this not only causes considerable degradation of the rural environment but also exerts great pressures on the existing supporting system of the city, and threatens the self-sufficient life styles of the rural population.

After the adoption and implementation of the 1997 National General Land Use Plan, land use control system has been set up and is effective in controlling and guiding land use. Agricultural land protection has been strengthened and government investment in converting developed land back to farmland has been increased. However, challenges are still intense - China is still at a critical point that a large population depends on limited amount of exploitable land. According to the first national land survey, by October 1996, the total amount of arable land is 1,950 million mu (1mu=0.164acres) nationwide, and by October 2006, this figure dropped to 1,827 million mu, showing a reduction of 12.4 million mu per year (MLR 2009). Per capita agricultural land in 2005 was only 1.4 mu - less than 40% of world average. However, misuse of development land, urban or rural, permitted or not, can still be seen commonly. In certain areas, land degradation and pollution are severe and illegal use/development of land is still a nationwide phenomenon. In 1999, the “National General Land Use Planning Framework (1997-2010)”, proposed by the Ministry of Land and Resources, came into effect, stipulating for the first time goals to preserve primary agricultural land as an inevitable means to secure China’s food safety. In 2006, the “Outline of the Eleventh Five-Year Plan of National Economic and Social Development”, passed by the Fourth Session of the Tenth National People's Congress, endowed statutory force on a 1,800 million mu “Red Line”, denoting the minimum limit on the amount of preserved farm land. This is a figure based on the calculated minimum amount of arable land needed for securing food supplies, economic safety, and social stability for the nation. In October 2009, China's State Council passed the

new "National General Land Use Planning Framework (2006-2020)", replacing the 1999 version. The new framework states national land use strategies, specifies government's goals and regulatory tools in managing land use, and guides the society to conserve and utilize land resources in a rational manner. It is the strictest governmental document in institutionalizing land management so far published and is also an important guideline for implementing large-scale land use control and urban-rural planning and development. In this framework, objectives are specified to maintain the "Red Line" nationwide. Non-agricultural development that requires the requisition of farmland is strictly restricted.

A concern for landless farmers' wellbeing is another reason behind the "Red Line" strategy. China's urban–rural household registration (*hukou*) system has resulted in an urban–rural dichotomy and uneven development, which is directly linked with the uneven entitlement of public goods such as education, housing, healthcare and employment. Exclusively offered to urban residents, the public goods are not accessible to rural *hukou* holders. Farmers, the majority of which are rural *hukou* holders, rely on their allocated farmland for social security. Since the early 1980s, the centrally-led and often enforced, requisition of farmland has created millions of landless farmers. With their social security exclusively attached to their farmland, these landless farmers were found to be vulnerable to impoverishment as their limited education attainment and skills, and the lack of information and networks rendered them handicapped in competing for urban-based employment (Liu and Wu 2006, He et al. 2009).

With the drive for urbanization still pressing on, new ways of development need to be found to resolve the conflict between the preservation of farmland and rural-urbanization. Innovative land use strategies were thus proposed nation-wide to achieve equilibrium between requisition and recultivation of farmland and implement rural urbanization with minimum public funds and minimum impact on relocated farmers. Among these, the "Exchange *Zhaijidi* for Apartment" (EZA, *zhaijidi huanfang*) programme has gained most attention and support from the authorities, and is being experimented in a number of regions. *Zhaijidi*[2] is a piece

[2] According to the PRC Constitution, China's rural land is divided into "*gengdi*" (farmland), "*jiti jianshe yongdi*" (collective construction land) and "*zhaijidi*" (house site).

of land that is collectively owned and granted to rural households to use as the site for the construction of their houses. The EZA programme was designed as an effective tool to resolve the widely claimed "bottlenecks" that hinder China's rural urbanization process, i.e. the lack of funds and the restrictions on farmland requisition (Chen and Lai 2009, Huang and Fu 2009). The EZA programme allows a rural family to exchange their *zhaijidi* for an apartment in a newly-developed conglomerated residential compound. The rationale behind the conglomeration is that by opting for a more compact form of rural settlement, more land can be released, part of which for agricultural use thus resolving the conflict between urbanization and the loss of farmland; and partly for commercial/industrial use, the income from which can be used to fund the development costs, thus minimizing demand on public funds.

On the other hand of land conservation, compact development that aims at efficient use of land has been strongly promoted. The National Ministry of Construction published the "Guidance Note for Developing Energy/Land Efficient Housing and Public Buildings" in May 2005, calling for a transformation to an efficiency-oriented land use strategy from the then prevailing trend of uncontrolled urban expansion and inefficient land use. The "Guidance Note" offers land efficiency the same status as energy efficiency in terms of the national planning strategy. The term "Energy/Land Efficiency" (*"jieneng shengdi"*) was seen to dominate the urban planning discourse in subsequent years. In June 2006, a so-called "90/70 Act" was enforced by the state council, stipulating that no less than 70% of all housing units within a development project must be below 90 sqm in floor area. The new policy aimed at steering the building industry towards a more compact development mode as the Act becomes a pre-requisite in land-use-right transactions. Although the enforcement power of the "90/70 Act" was criticized as having been diminished after the 2008 economic crisis, its impact on residential development is still recognizable.

4.2.5 Theme 5: Social cohesion and sense of community

The egalitarianism of the socialist regime and the associated work-unit-based settlement pattern allowed for a healthy mix of all social stratus in a community. After three decades of economic reform, residential differentiation and social stratification have emerged in China, accompanying commodity housing development with stratified standards (Fleischer 2007, Li and Wu 2006). Many scholars have noted the emerging and exacerbating socio-spatial differentiation in urban residential distribution in Chinese cities (Wu 2002, Yu 2006, Song and Wu 2010). With the retreat of welfare housing provision, individual households were given the freedom to purchase homes from the market. Residential disparity began to emerge with a strong correlation with residents' socio-economic status (Yu 2006). The spatial pattern of public infrastructure and service provision is a hierarchical system with a high concentration of facilities in the urban center and lower order facilities in the periphery. Thus the distance to the urban core plays an important role in the new pattern of residential differentiation as it implies differential access to urban benefits such as education, health infrastructure and employment. The emerging spatial redistribution of housing provision broke down the traditional urban pattern formed by mixed communities, and increasing homogeneity is observed in newly developed communities. Since the urban land-use right was allowed to be traded in the 1990s, land value has become predominately attached with its location. Thus the construction of luxurious commercial housing compounds in central locations and the building of public low-income housing in peripheral locations further drove the trend of residential spatial differentiation and social segregation in most large Chinese cities.

To date, little has been addressed on social mixing in residential communities in the Chinese literature, even less in practice. Due to the egalitarianism of the socialist regime, the classification of social strata and incomes has only emerged in the Post-reform era, accompanying the rapid economic growth, which has allowed a part of the population to obtain social and economic transition to prosperity while disadvantaging many others. The concept of a society with differentiated social classes has not yet been established among most people, including the decision-makers of national policies. However, the growing conflict between the various social groups increasingly challenges the slow-responding social management strategies, which has resulted in increasing events of

confrontations between members of different social groups. During the National People's Congress 2005, with the publication of the "National 11th Five Year Plan", a call for the construction of a "Harmonious Society" ("*hexie shehui*") was stressed as a new vision for the country's future. This indicates a conceptual change of the national development policy from focusing on economic growth to overall societal balance and harmony. Since 2005, advocates of social mixing in community building have started to be voiced mostly within the academic field (Wang and Wang 2005, Mo 2006). The relationship between the segregation of income groups on residential location and the exacerbating social stability has gradually been recognized among planning professionals. The building industry, on the other hand, has yet to develop consensus on the subject. In April 2011, the Municipal Government of Hangzhou announced a new regulation on commercial housing development, enforcing 10% public affordable housing on all new built commercial housing communities. This is one of the first governmental regulations requiring the mixing of low-income housing with commercial housing. This, however, has raised immense public debate, as both the real estate developers and the public have constraints on this issue. Until the time of this research, the debate is still on going.

The rapid transformation that is taking place in the spatial restructuring of the urban/rural landscape has enforced changes to the social structure of the traditional neighbourhoods that have been formed generation upon generation. A new order of social structure has yet to be established among new residential settlements both within the inner urban area and on the city fringes. In 2000, a blueprint was published by the Ministry of Civil Affairs promoting "community building" throughout the nation. The document describes "community building" as "a crucial tool in national efforts to promote social development, to raise living standards, to expand grass roots democracy and to maintain urban stability" (MCA 2000). In the document, community is defined as "a social collective formed by people who reside within a defined and bounded district", which is designated as "the area under the jurisdiction of the enlarged Residents' Committee" (MCA 2000). Thus the newly developed residential settlements and gated estates with well-defined boundaries and established Residents' Committees have become the basic units for community building in Chinese cities. Although

the determined physical space helps in fostering a sense of belonging among the residents, it is still difficult to construct the sense of community comparable to that of traditional neighbourhoods. It is noted that community organizational structures often remain week or even non-existent due to the lack of interest amongst the more affluent sections of the population (Bray 2006). In some places, "community building" is as much about constructing new forms of physical space as it is about building new kinds of organization (Bray 2006). Within the urban design field, there is a spatial strategy to place the community centres as close as possible to the center of the community territory that they serve. Community centres normally include office space for the management committee, meeting rooms, and other areas catering for community activities such as singing groups, exercise classes and social events. The community centres now play a vital role in enhancing the cohesion among community members.

4.2.6 Theme 6: Public participation in community development and management process

Under the socialist regime, the work unit acted as the core of the integrated social controlling system. Citizens' participation in public affairs was based on the work unit rather than on their residence. Therefore a citizen's political life, social life and welfare were attached with his or her work in the unit, while the place in which they lived was merely a "hotel" for rest (Chu 2004). It was not until the year 2002, that some of the major cities, such as Beijing, began to break through the work unit system and transformed the unit household committees (*jiaweihui*) into community residential committees (*juweihui*), thus formally terminating the administrative control of work units over residents' private lives (Chu 2004). However, a civil society, in which everyone has a say in affairs related to their lives, has yet to be formed. Social restructuring necessary for establishment of self-organization and self-governance has not occurred on a large scale. The management of cities and community-building are still solely dependent on government decisions. In the last decade, the state administration had begun to understand the importance of public monitoring and supervision over environmental problems to the enforcement of environmental laws (Zhao 2010b). This is reflected in a series of regulations being stipulated. The promulgation of

the Regulation on the Disclosure of Government Information in 2007; the Provisional Measures on Public Participation in Environmental Impact Assessment 2006; and the Measures on the Disclosure of Environmental Information (Trial Version) in 2007, have all worked towards enhancing public participation in decision—making associated with environmental issues. In practice, the most progress is made in the field of EIA (Environmental Impact Assessment), with the most famous example being the public consultation of the YuanMingYuan anti-seepage project in 2005 (Zhao 2010b). A public hearing was held when it was discovered that waterproof membranes were being laid at the bottom of the famous lakes of YuanMingYuan Park in Beijing without conducting EIA. It was the first public hearing held by the State Environmental Protection Administration (SEPA), although the EIA Regulation 1998 explicitly requires the developers of construction projects "to solicit the views of the work units and residents in the vicinity of the proposed projects when preparing the environmental impact report" (The EIA Regulation 1998, art 15).

In the field of urban planning, little progress has been made on public participation in general. In the face of increasing events of protests by farmers and land-owners against expropriation of their land and properties, China's state government has been forced to throw more attention on the exploration of public participation in urban development affairs. In the early 1990s, the concept of public participation was first introduced to the urban planning process in China. To date, public participation in urban planning decision-making has taken mainly three forms: public opinions survey; publicity of plan proposals; and consultation of experts and professionals from related disciplines. These ways of engaging the public have been proven to be limited and ineffective, as the main purpose of these sorts of public participation was aimed at compliance rather than consultation. Senior-level authoritative decisions, all in all, still dominate decision-making in affairs related with urban development. Community involvement was not directed towards identifying alternatives and minimizing any adverse impact of the development project, rather, public participation and consultation are used to justify already-made project decisions (Tang, Wong and Lau 2008). Although the Chinese local authorities are in a complimentary policy setting that can promote community involvement and public participation in

managing social and physical environments, the absence of a statutory framework and administrative procedures at the local level to fully integrate with national policies is a major obstacle for effective public participation in urban planning decision-making.

4.3 Conclusion

This chapter has focused on answering the second research question: "What are the socio-economic and environmental impacts of peri-urban development in Chinese cities and what has currently been done to address the sustainability issues in the Chinese urban/rural development realm?"

To ensure a sustainable future, one important challenge for Chinese urban planners and architects is to rethink old development models and follow a more environmentally and socially conscious path. Sustainable development is now gaining a rising profile in China's development strategy. National and local decision-makers are increasingly aware that creating an ecologically sound and socially harmonious environment is essential for achieving sustainable urban development. This chapter has reviewed, within the six-themed research framework set out in the previous chapters, the recent progress made in the area of urban/rural development of China to address the emerging environmental, social and economic problems challenging urban sustainability.

It can be argued that a strategic transition from unitary "pro-growth" towards more "pro-environment" and "pro-poor" is evident in recent policy design and regulatory interventions in the urban development practice. However, their effect of implementation remains to be evaluated upon close examination of development cases. In the next chapter, three development cases, each representing a specific development type, are examined against the principles of sustainability.

Chapter 5 _ Evaluation of sustainability in the outcome of peri-urban settlement development in Tianjin

5.1 Introduction

This chapter is focused on answering the third research question: "To what extent has the current outcome of peri-urban settlement development practice in China addressed holistic sustainability issues?"

In this chapter, three settlement developments in the peri-urban areas of the city of Tianjin are examined in depth. The research framework introduced in Chapter 3 is used to assess their performance in terms of sustainability. The study cases are chosen according to five criteria:

1. Recent development, i.e. developed within the last ten years;
2. Finished and occupied for at least six months;
3. Each representing a distinct peri-urban settlement type as described in Chapter4;
4. Each lay claim to certain facets of sustainability;
5. Located within a similar geographical region and of comparable scale.

The main value of studying specific projects at a particular location is the variation of detail that can be examined and less variation when making comparisons. It is also important to note that there are limitations of the single-embedded case study approach in that generalization drawn from it may be questionable. As has been discussed, the Chinese political and urban governance structure follows an authoritarian system with the major cities being seats of the top of the power hierarchy and setting templates for smaller cities and towns to follow. Tianjin is such a major city, whose experiences can be generalized to a wider region. Furthermore, the cases chosen are in each of them a prototype under experimentation with strong indications of generalized application.

This chapter aims to examine to what extent sustainable development can be applied in a peri-urban context with distinct development approaches and objectives. Some of the efforts China has made in recent years pertaining to sustainable development are also introduced.

5.2 The City of Tianjin

With a population of 11.19 million (2009), Tianjin is one of the four municipalities that have provincial-level status, reporting directly to the central government. Tianjin's urban land area is the fifth largest in China, ranked only after Beijing, Shanghai, Guangzhou and Shenzhen. 137 km southeast of Beijing and 50 km from Bohai Gulf in the Pacific Ocean, Tianjin is recognized as a major commercial and industrial center as well as the largest port in north China (Figure 5-1). The municipality of Tianjin administers a total area of 11,919.7 square km, which includes the central city covering 173 square km; four peripheral districts – Dongli, Xiqing, Jinnan and Beichen; the Binhai New Area (BNA); and five suburban districts/counties – Wuqing, Baodi, Jinghai, Ninghe and Ji (Figure 5-2).

Figure 5- 1(Left): Tianjin on the map of China
Figure 5- 2 (Right): Administrative map of Tianjin Municipality

Early settlements in the Tianjin region date back to the 12th century. The rise of nearby Beijing as the capital of northern nomadic dynasties and later of the

country brought prominence to Tianjin when it served primarily as a storage, sale, and distribution center for agricultural products from the south to the capital. By 1846, Tianji had become a city covering 5 square km of land with a 1.5 square km walled town center and thriving commercial markets on the periphery. In 1858, when British and French troops took down the forts guarding the River Haihe, Tianjin was forced to open as a business port to foreign trade. Between 1895 and 1900, Britain and France were joined by Japan, Germany and Russia, Austria-Hungary, Italy and Belgium, in establishing self-contained concessions in Tianjin, each with its own prisons, schools, barracks and hospitals. The urban area of Tianjin experienced significant increase in the early 20th century, with main growth along the banks of the River Haihe. In 1937, the Japanese invaded Tianjin and established the city of Tanggu (now center to BNA) on the west of Bohai Sea where the port was located, thus forming the basis for a dual-centric urban structure.

5.3 Tianjin's Residential Development

5.3.1 Pre-reform Development

The city of Tianjin before 1949 was a collaged city tightly settled along the River Haihe, with a population of 1.8 million and an area of 61 square km. It consisted of a declining city center, which kept its original shape since the 15th century; the concession areas, developed after the Second Opium War in 1860, when Tianjin was forced to open as a trading port; and the new district to the north of River Haihe, developed by Yuan ShiKai during his reign as a new political and commercial centre to counter balance the influence of the concession area in the early 1900s. In 1949, the total residential area was 10.8million sqm, with only 3.77sqm/person.

From 1949 to 1957, housing construction in Tianjin experienced a steady development period. In the first five years after Communist China was established in 1949, the impending tasks were to resume production and improve the living conditions of the population. In 1951, the central government stipulated that part

of the fiscal income would go into public facilities construction. Accordingly, the Tianjin Municipal Government started the construction of Factory Workers' Villages (FWVs) in 1952. Seven FWVs were constructed away from the city centre, in the urban outskirts, where most of the factories were located, and a heavy industry zone was developed on the southeast fringe (Figure 5-3). Each of the villages had a population of 30,000-50,000. The buildings were one-storey shanty houses that had poor infrastructure provision (Figure 5-4). Most of these villages had been demolished during later years to make way for the Soviet Union style Work Unit (*Danwei*) communities that had dormitory-like apartment buildings built next to factory buildings. Within the work units, basic needs were collectively provided and structured around production. In the first decade of Communist China, national industrial development was at the core, housing construction was a subordinate act to facilitate industrial development. Urban development adopted a so-called "project-specific" fashion, which means that industrial project development was itself responsible for relevant community developments inclusive of facilities and infrastructure (Yeh and Wu 1996). However, under the ideology that investment in infrastructure was "unproductive" and the policy of maximizing industrial output through suppressing urbanization costs, infrastructure was generally poorly provided and thus became a bottleneck in land development. The absence of land prices and on-site compensation to existing residents has led to enormous difficulties in redeveloping central districts. Redevelopment was virtually impossible under such a structure of land-development organization. Thus, industrial projects preferred rural land on which the state had the compulsory right of land acquisition from farmers. As a result, the urban built-up area saw a form of continuous and slow extension.

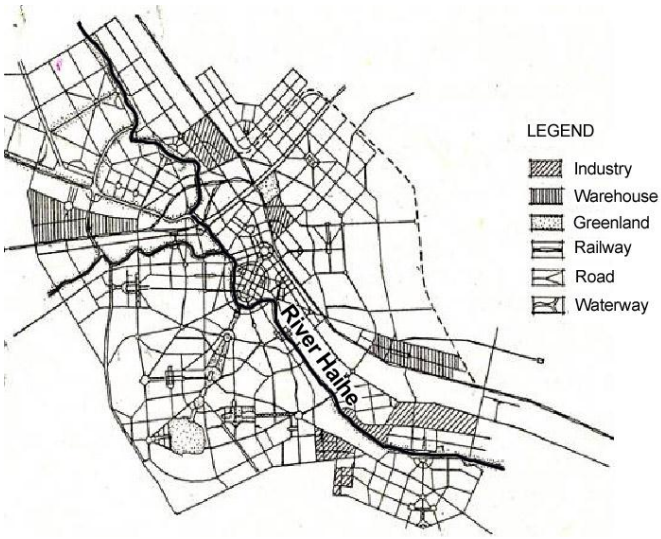


Figure 5- 3: Land use map, Tianjin 1954, Source: Tianjin Municipal Urban Planning Bureau

Figure 5- 4: Early Factory Workers' Villages in Tianjin, Source: Tianjin City Archives

In 1958, the "Great Leap Forward" initiated by Mao brought a fanatic crave for industrial boom. The area of industrial land in Tianjin rose rapidly. Ten industrial areas were planned and developed in the city's periphery, and more than ten residential areas were developed to accommodate the workers. Unlike in the first five years, the residential development ceased to be the main force behind urban expansion, but turned to infill the gaps between the industrial parks. However, this period of housing development was interrupted by the "Three Difficult Years" between 1960 and 1963. When the "Cultural Revolution" broke out in 1966, under the strategy of "Production first, life second", urban construction had almost come to a halt, and housing development was severely lagging behind the

demand of a growing population. In terms of urban spatial structure, the expansion of urban built-up area displayed evenness on all sides of the city centre, showing a concentric ring development pattern, with the inner circle being mixed commercial and residential zone; middle circle mixed residential and light industry zone; and the outer circle mixed heavy industry and residential zone.

5.3.2 Post-reform Development

In 1978, under the "Reform and Open up" policy, market economy was introduced to China, and it has brought a boom to housing development in Tianjin. Under pressure from bursting demand, new residential developments sprung up on the urban fringes, and became once again the leading force driving towards urban expansion. In 1990, the area of Tianjin city proper was 234 sqkm, showing an increase of 73.11 sqkm compared to 1976, of which 29.41sqkm were residential. During the 1980s, 14 large-scale residential quaters had been developed, filling the spaces between the outer ring road (the boundary of Tianjin city proper indicated in the 1996 master plan and the outer limit to urban residential development) and the middle ring road. Once again, the urban fringe areas are filled with residential quarters.

In the 1990s, with the publication of the "Regulation of Assignment and Transfer of State-owned Land Use Right", residential development was beginning to operate under market forces. Twelve residential quarters with total area over 100 hectares were planned in the 1996-2010 Tianjin City Master Plan, engulfing land towards the outer ring road, which was identified as the boundary of Tianjin City Proper in the same plan. The new residential constructions were ever further from the city centre than before. The out-ward development is underpinned by the central city regeneration campaign between 1993 to 1998, aimed at clearing the slums within the old city centre and freeing the land for commercial development. In 1993, the Tianjin city government designated 164 plots within the old city center as sites for slum clearance. The residents were displaced to the peripheral areas. During the same period, centrally-located industries and warehouses were also being relocated to the city periphery. The freed-up land was leased according

to market principles but within state control. A vibrant CBD area began to emerge at the urban core. In this decade, not only has residential development increased in total area but also in area per person. By 1998, the living area per person has risen by 115% compared to 1949. In terms of urban structure, while the concentric-zoned urban land use structure is being strengthened, the land price effect is starting to show, with the central core becoming more dense and commercial. The inner city saw the relocation of industry and warehouses and the intensification of residential function. This area has become the most attractive living area. The peripheral area displays a mix of industry and residential uses. The relatively low property price has attracted many people there.

Entering into the twenty-first century, the land within the outer ring road continued to be filled up, witnessing the disappearance of the green wedges and the water bodies designated in the 1985 master plan. With diminishing central land to develop and ever increasing housing demand, it has become evident to the city planners that it was necessary to start to think beyond the outer boundary.

The decentralization of urban space in Tianjin is different from the outward urban sprawl in western cities in that, the central city still shows a strong magnetism to the areas surrounding it, providing adequate infrastructure, job opportunities and cultural amenities which are far less accessible outside the center. In her study on the residential development in Tianjin, Zou (2000) found that the majority of the relocated population in the urban periphery are a result of the planned economy era and mainly come from three sources: the displacement campaigns under political pressure, the conversion of the household registration policy and the industrial relocation campaigns. The scale of population, quality of infrastructure, commercial and culture amenities, job opportunities, education and healthcare facilities and transportation conditions in the urban periphery are all lagging behind what is available in the central city area.

The phenomenon of peri-urbanization in China has been discussed by many Chinese scholars (Gu and Sun 1998, Gao and Zhang 2002, Ye 1998, Liu 2001, Meng 2000, Xie and Ning 2003). The majority of the literature on this subject concludes that it is an inevitable and even a positive trend of urban development

in Chinese cities, in that: the relocation of polluting industries from the central area has relieved the environmental burden from the city center; the restructuring of urban land use has served to optimize urban structure and function; the population relocation to peripheral areas will stimulate the urbanization of suburban and rural areas. In the city planning profession, the discussion is around finding proper ways to assist peri-urbanization. A "core city + peripheral clusters" pattern have been proposed as an ideal urban structure and has been widely accepted (Zhai 2007).

5.4 Tianjin's new urban trend

In order to restrain the sprawl of urban areas, plans have been proposed to follow a polycentric urban structure. In fact, as early as 1986, a city master plan was put forth to make four of the coastal counties to the east of the city (Tanggu, Junliangcheng, Yangliuqing, Xianshuigu) the state of satellite towns, and the Binhai New Area (BNA), centered around the Tanggu town and home to TEDA (Tianjin Economic-Technological Development Area), was planned to be the sub-center, which was connected to the old city center through the River Haihe. The new dual-centric plan was described as "a pole shouldering two baskets" (Figure 5-5). All the later city master plans of Tianjin followed this pattern.

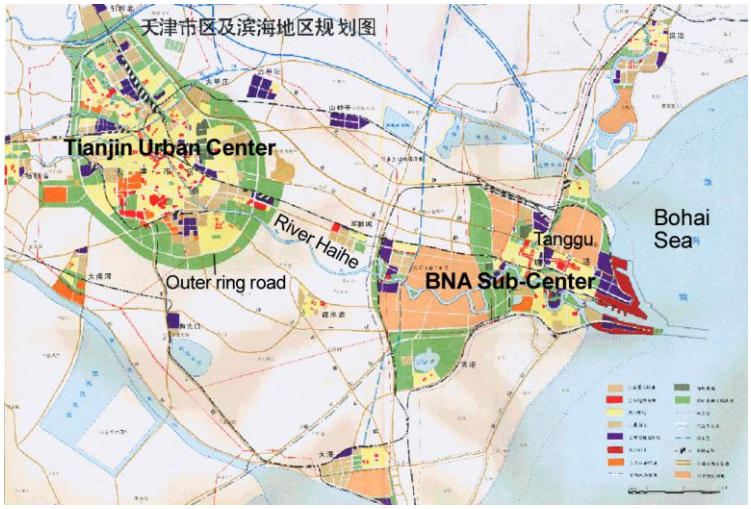


Figure 5- 5: Tianjin Urban Master Plan 1986-2000, Source: Tianjin Municipal Urban Planning Bureau

Figure 5- 6: Tianjin Urban Master Plan 1996-2010, Source: Tianjin Municipal Urban Planning Bureau

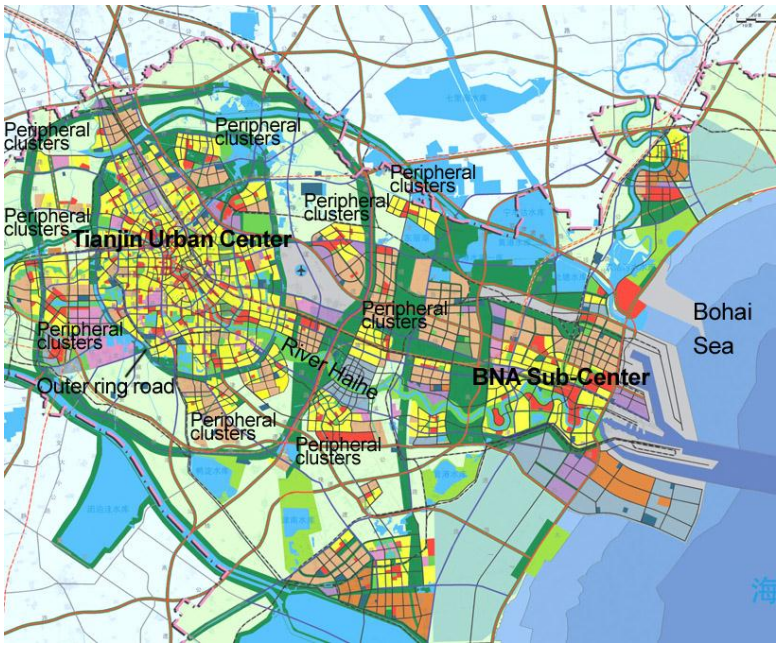


Figure 5- 7: Tianjin Urban Master Plan 2006-2020, Source: Tianjin Municipal Urban Planning Bureau

"The 1996-2010 Tianjin Urban Master Plan", which came into effect in 1999, followed the "core city + peripheral clusters" strategy and planned eight peripheral clusters outside the greenbelt of the outer ring road (Figure 5-6). The land between the clusters was planned to be orchard, woodland, vegetable farms, water bodies and parks. The plan proposed to strengthen the "a pole shouldering two baskets" structure and emphasized the development of the BNA. In 2005, a

new plan "Tianjin Urban Master Plan 2006-2020" was put forth (Figure 5-7). In this plan the creation of an eco-city was proposed stating the importance of environmental protection in the time of rapid economic growth, however it did not specify how it should be achieved. The development of the peripheral clusters was further strengthened and the function of each of the clusters specified (Table 5-1).

Table 5- 1: Planned Location and Land Area of Peripheral Clusters (Tianjin Municipal Government 2006)

Type of Cluster	***Planned Location***	***Planned Total Land Area***
Residential	*Dasi, Xinli, Shuangjiang, Xianshuigu, Junliangcheng, Shuangjie, Xiaodian, Yangliuqing, Dongli Lake.*	*1510ha*
Industrial	*Dasi, Xinli, Shuangjiang, Xianshuigu, Junliangcheng, Shuangjie, Xiaodian, Yangliuqing,*	*1910ha*
Logistics	*Tianjin Airport Industrial Park*	*4600ha*
Technology Park	*Huayuan High-Tech Park and Beichen High-Tech Park*	
Educational	*The 2nd and 3rd Higher Education and Research Park*	*3500ha*
Tourism	*Nandian Park, Qujiadian Park, Yinhe Park* *Dongli Lake*	*650ha* *1800ha*

In the 2006 master plan, the development of the BNA was designated to take shape within a decade. As the city's polycentric urban structure gets strengthened, it is inevitable that much of the resources and development investments are drawn towards the east coast. The vast area between the central city and the BNA was envisioned as the next hot spot of urban development, which was clearly illustrated in the new master plan. Fourteen peripheral settlements have been planned to accommodate a projected additional population of 1.41 million by 2020. In the recent years, settlement development has begun in the peripheral land. With a speed that is even extraordinary by Chinese standards, some have already taken shape. In this study, three of the new peripheral residential communities developed in the urban periphery of Tianjin will be examined. In their master plan proposals, sustainability objectives were defined, yet a post-development evaluation has neither been specified nor carried out. In this section, the recent development of the peri-urban residential settlement in Tianjin is discussed, using the three exemplar cases, each representing one of the peri-urban settlement types defined in the previous chapter, and all of which being large-scale "flagship" developments proposed and developed between 2000 and 2010 (Figure 5-8).

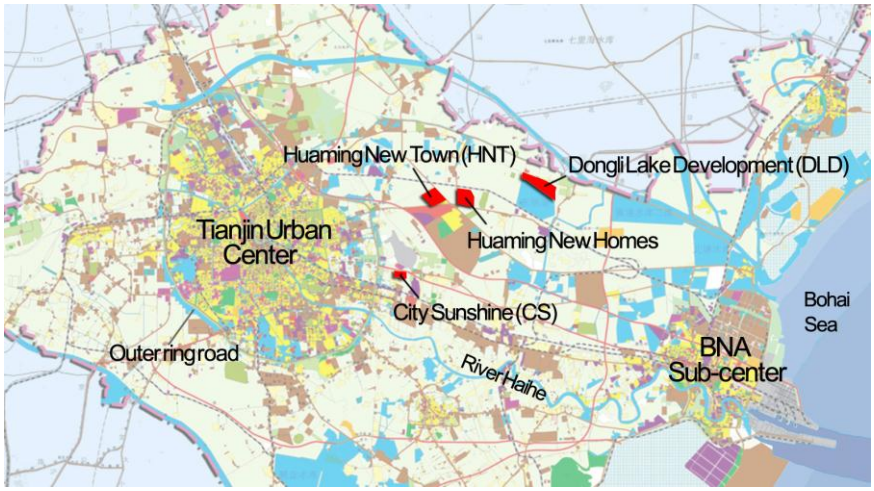


Figure 5- 8: Location of study cases on the metropolitan map of Tianjin

5.5 Description of Study Cases

In this section, the study cases are described, each representing one of the peri-urban settlement types identified in the previous chapter, i.e. *Rural resettlement project; Affordable housing compound*; and *Suburban commercial housing estate*. Their general development contexts and specific approaches to address sustainability issues are explained.

5.5.1 Study Case 1: Rural resettlement project - Huaming New Town (HNT)

The Township of Huaming covers a total area of 150.6sqkm. It administers 15 villages and has a population of 50,000. Located in the midway between the urban centre of Tianjin and the BNA (10km from the BNA and 13km from the city centre), its unique location has provided it with an advantage in economic development. Tianjin Airport Industrial Park (TAIP) is located right to the south of Huaming Town, separated only by the Jinhan highway. The TAIP is a foreign-oriented economic zone specializing in manufacturing, logistics, hi-tech research and development, and international trade.

In 2005, Huaming was appointed as the laboratory for the EZA programme (for a description of the EZA programme, please refer to Section 4.2.4). The programme was put directly under the leadership of the Deputy Mayor of Tianjin and its implementation was administered by the local authority of Dongli District. A

development company, Tianjin Binli Small Town Construction Development and Investment Ltd., was established under the direction of the Construction Committee of Dongli District to carry out the appropriation of land and the supervision of the development. A new settlement was developed within the administrative area of Huaming town, and the new development (hereafter referred to as Huaming New Town) is a new urban-rural integrated residential community that is aimed to present a future model for Chinese peri-urbanization. Aimed at creating "a successful model of peasants' happy life that is ecological, harmonious and habitable" (People's Government of Dongli District 2007), Huaming New Town was exhibited as an Urban Best Practice Area in the World Expo 2010 to showcase its achievements to the world.

In August 2005, the Tianjin Urban Planning and Design Institute was appointed to undertake the master planning of Huaming New Town. The planned new conglomerated settlement was to follow an "integrated triple-zone" pattern, encompassing: a residential estate with 1.5 million sqm of apartment buildings accommodating 42,000 rural residents relocated from the old township; a 7.3 sqkm industrial park featuring high-tech and innovative industries to the west of the residential estate; and an agricultural zone based on re-cultivation of the reclaimed *zhaijidi*. Six objectives are to be achieved in the master plan proposal (Huang and Fu 2009):

1. the efficient use of land
2. the efficient use of energy
3. create employment opportunities
4. increase the farmers' annual income
5. reduce the urban-rural difference
6. integrated urban and rural lifestyles

Construction broke ground in April 2006, and by September 2007, the residential estate had been completed. From the outset, the new settlement resembled a typical metropolitan compound with: residential 5-6 storey building blocks; a few 9 to 11-storey high-rise blocks; and a central commercial street encompassing retail shops, banks, a food market, restaurants and a post office, many of which

were relocated village businesses (Figure 5-9). The physical structure of the new town was designed to reflect the physical pattern of the previous farmland (Huang and Fu 2009). By preserving the farm-edge trees and water bodies, the site was dictated by a grid pattern with 170mx170m cells. Within each cell a neighbourhood of approximately 400 households was settled in, and six to eight such neighbourhoods formed a community centred around a communal garden with convenience shops, child care and a community centre (Figure 5-10). Such design adheres with the administration structure of the township with 400 households as the lowest village administration level, thus providing convenience in terms of the preservation of the spatial distribution and administrative structure of the previous villages (Huang and Fu 2009). Huaming New Town was among the first large-scale housing developments to adopt the new energy-efficient building regulation which came into effect in 2004 and stipulates that 65% energy saving must be achieved of all new-built housing compared with the 1980's design standard. This is by far the strictest energy-efficiency design standard implemented in the nation. Every housing unit in the new town is serviced with solar hot water systems, with a bio-gas system installed for every neighbourhood to provide alternative cooking fuel.

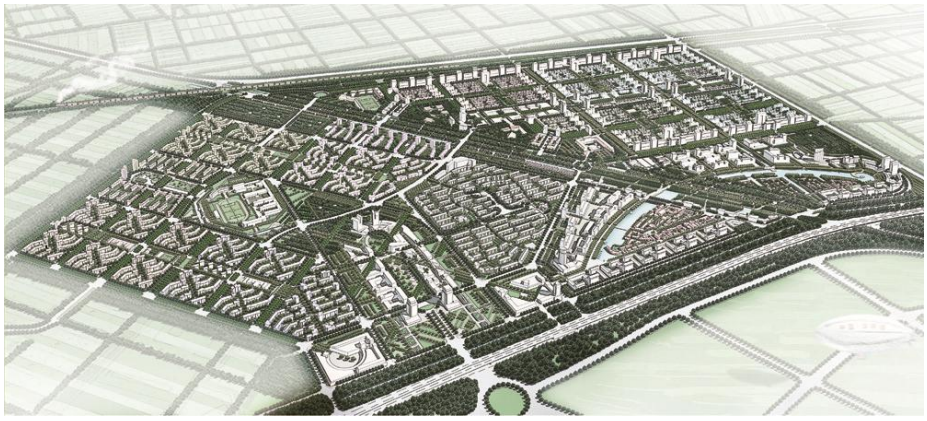


Figure 5- 9: The master plan of Huaming New Town residential estate,
Source: Tianjin Urban Planning and Design Research Institute

Figure 5- 10: Huaming New Town: modern building blocks among preserved farm-edge trees, Source: photo taken by author

By August 2010, over 400 companies had settled in the industrial park to the west of the residential estate. The re-cultivation of *zhaijidi* started in 2007, and following the levelling of 142 hectares of former *zhaijidi*, 427 greenhouses have been established, growing vegetables and fruits to sell to the city market all year round. The lease of the industrial park and the agricultural park, together with the rent collected from the commercial properties within the residential estate are estimated to generate 120 million yuan (1yuan=0.09British Pound) of annual revenue for the town government and provide 8000 jobs for its residents. Meanwhile, the local government uses the value-added gains from the land to buy social insurance for the landless farmers, equivalent to a pension of 400 to 500 yuan a month when they meet the statutory age. Public participation was given emphasis in the programme proposal, requiring public hearings at the village level, and overall villager consent before initiation of the programme (TDRC 2007).

5.5.2 Study Case 2: Affordable housing compound - the New Homes and City Sunshine (CS)

Worldwide, rapid urbanization has exerted huge pressure on housing provision, especially for the lower-income groups. Since the housing market in China has been activated in 1998, public housing provision as part of the work-unit-based state welfare system has been gradually abolished. Homes are now predominantly

privately-owned and overall the housing industry is becoming more market-driven. Housing affordability of medium- to low-income households has been greatly affected by the commodification of the majority of housing provision (Mostafa et al. 2006). With rocketing property prices accompanied by accelerated inner-city regeneration, the increasing demand for affordable housing for the poor has met with inadequate public funding and the reluctance of implementation on the local government's side, as much of their revenue comes from the profit of land leasing to private developers. Criticisms of the pro-profit housing policies and calls for government interventions in speeding up affordable housing provision have been voiced widely in recent years.

In response to this, the Tianjin Municipal Government launched the "New Homes" ("*xinjiayuan*") programme in March 2007. Ten residential communities were proposed to be developed in the outskirts within 5-10km to the green belt of the city's outer ring road, totaling an area of 4824 hectares and housing a total of 819,600 residents by 2017. The developments were to form part of the "*anju*" (meaning "secure homes") project, which was initiated in 1995 by Tianjin municipal government and aimed at providing affordable housing for key workers and low-income families. Unlike social housing programmes in the UK, properties under the "*anju*" project still need to be bought, albeit at controlled prices subject to the stipulation of the government. The "New Homes" developments comprise of 70% commercial housing and 30% "*anju*" housing. In 2007, *Tianjin Anju Project Development Company* (TAPDC) was established under instruction of Tianjin Anju Project Office of Tianjin Urban and Rural Construction Committee to supervise the development of the "New Homes" communities. The first of the "New Homes" projects, Huaming New Homes, started construction in 2007 and was finished in 2010. The rest of the ten communities are to be developed in the next 8-10 years.

Albeit called "communities", the sheer sizes of the "New Homes" are in fact comparable to that of new towns. Huaming New Homes was planned on an area of 345.2 hectares of agricultural land just east to Huaming New Town. Because the land was acquired and transferred into construction land use before the "Red Line" regulation (for a detailed description, please refer to Section 4.2.4) came

into effect, the acquisition met with little regulatory restriction. The former fertile farmland had been left obsolete for years before any construction work started on it. The 9577 village residents that once lived and farmed here had been granted monetary compensation for their loss of land and relocated elsewhere. Huaming New Homes incorporates 11 neighbourhoods of 1000-3000 households each. Within each neighbourhood, a primary school, kindergartens, local food markets, community centre, clinic, bank, post office and bus terminals were planned. In October 2009, the first two neighbourhoods were completed and were ready to welcome their new residents. Each neighbourhood constituted around thirty 11- to 20- storey apartment buildings, with 2 to 3-bed units of 50 to 60 square metres each (Figure 5-11, 5-12). Under the requirement of "Tianjin New Homes Community Development and Management Guidance 2007", the quality of construction and building energy efficiency is to be regulated by the 2004 building energy-efficient design standards; a grey water recycling system was required to be installed and the use of renewable energy sources is recommended; infrastructure such as road and public transport lines should be constructed and planned simultaneously with the development; and all services such as electricity, water, gas and district heating were required to be ready when the residents move in.

Figure 5- 11 (left): Master plan of the Huaming New Homes (Phase 1), Source: Tianjin Urban and Rural Construction Committee
Figure 5- 12 (right): Huaming New Homes – completed but largely unoccupied, Source: Photo taken by author

At the time of the case study site visit in August 2010, ten months after the intended date for residents to move in, only less than 20 families had settled in Haming New Homes. An interview with the representative of Tianjin Anju

Project Office revealed that two main reasons had led to the delay: firstly, the resettlement plan had met with negative response from the targeted displaced inner-urban residents, whose work places are mostly in the urban centre and are therefore reluctant to accept the options available to them mainly due to the peripheral locations of the "New Homes" projects; And secondly, without government subsidies service infrastructure provision faces difficulty due to the high costs associated with the remote location of the "New Homes" (personal communication with Official A). Although they sell for lower prices than normal commodity housing, the inconveniences caused by the lack of services appear to be too much of a compromise, especially when the majority of the targeted market cannot afford private vehicles. As a result of the market failure, further "New Homes" developments have been put on a hold, questioning the strategy of the use of cheap, peri-urban land for affordable housing development.

For a creditable evaluation to be carried out, at least 30 responses need to be obtained from each study case. Under the situation described above, it was evident that the amount of responses possible to be collected from Huaming New Homes is unable to meet the need of this research. Therefore, an alternative study case representing the same settlement type was needed to be found to provide the data needed for quantitative analysis. Despite this, it was considered necessary to keep the case of the New Homes for qualitative analysis purposes, as the case reveals many of the issues related with current practices of peri-urban settlement development.

City Sunshine was chosen as the replacement study case for the New Homes projects for the conduction of the quantitative study. City Sunshine is considered as representing an earlier version of the New Homes projects. City Sunshine is a peri-urban affordable housing project developed by Tianjin Real Estate Development Co. Ltd. (TRED) in 2003. TRED has a strong government background as it is state-owned and its real estate development projects are exclusively government-invested projects. TRED is also one of the main development companies involved in the development of the New Homes projects. City Sunshine is located in the suburban district of Dongli and about 9 km from the city centre. The estate consists of twenty 11- to 17-storey residential buildings,

which house 1458 household units. The housing units are kept small with mostly one to two bedrooms units of 50-80 sqm (Figure 5-13). There is a commercial area at the centre of the estate serving the residents with shops, supermarkets, restaurants, a pharmacy and a daycare centre. The development was completed in 2005 and current occupants are predominately relocated low-income urban and rural residents. The estate is currently being managed by a real estate management company subordinate to TRED.

Figure 5- 13: City Sunshine – an early version of the New Homes projects, Source: Photo taken by author

5.5.3 Study Case 3: Suburban commercial housing estate - Dongli Lake Development (DLD)

Dongli Lake Development is a new residential development located midway between the urban center and the BNA. It is 28km to the city center and 25km to the center of BNA. China Vanke Co. Ltd. (hereafter referred to as Vanke), the development company of Dongli Lake Development, is one of the forerunners in China's embryonic real estate development. Its success story and development approaches are celebrated and copied nationwide. Dongli Lake Development, at

the time of its construction, was the largest development that Vanke has ever undertaken and it was aimed to be Vanke's flagship project demonstrating sustainable development concepts. In Vanke's description of the Dongli Lake development, it was featured as an "exotic, low density and luxurious housing development incorporating residential, education, tourism and leisure facilities". On a land area of 273 hectares, a total floor area of 1,370,000 sqm of housing are being developed on the north bank of Dongli Lake, the largest of the seven ecological conservation areas of Tianjin (Figure 5-14).

Starting in 2003, an 8-10 year development plan was devised to turn the area into a new town that incorporated residential, education, tourism and leisure facilities. New Urbanism concepts were proposed for the plan. Whereas the country is somewhere to escape to for Western urbanites, an "urban environment" appeals more to Chinese residents. This market preference is reflected in Vanke's proposal for Dongli Lake Development. Although situated in a complete rural surrounding, the planners and architects tried everything to give it an "urban feel". This includes a mixture of housing types from detached European-style villas to contemporary-looking high-rise apartment blocks, and a range of commercial facilities that provides the convenience of urban life.

The whole development is being carried out in eight phases. Encouraged by the successes of low-rise housing development in the suburbs of the southern cities such as Shanghai and Guangzhou, Vanke started the first phase with detached and semi-detached European-style villas. As industries expanded in the BNA and the nearby Tianjin Airport Industrial Park (TAIP), there was more demand in the housing market for commuter workers. A mixture of mid- to high-rise apartment blocks with 2 to 3-bed units were the main housing types built for the later phases as a response to the new market demand. Low density detached and terraced houses are mixed with the high-rise towers to cater to the holiday home market. In 2006, in an attempt to put a stop to the race over housing unit area in the commercial housing market and declining affordability for the mass majority, a so-called "90/70" policy was put forth by MOHURD, stipulating that "within a new commercial residential development 70% of the units must be below 90sqm in floor area". The policy came as turmoil for developers like Vanke, who

specialize in building large, luxurious apartments and houses. As a consequence, the plan for Phase five was adjusted and 11- to 18- storey towers with small units were built. At the time of the site visits of this study, five phases have been completed and further development is still in progress.

In 2005, with the publication of the "Tianjin Urban Master Plan 2006-2020", 2200 hectares of the Dongli Lake wetlands were listed as "Natural Wetlands Conservation Area (County-level)" (TMUPB 2005). Under the requirement of the new urban master plan, Vanke reassessed their initial plans and emphasis was put on the protection of the wetlands that were within the development site. International teams specializing in sustainable engineering and ecological design were invited to inform the new site masterplan, and provide technical and wetland design support. The international experts worked together to development a design approach that captures and treats storm water from the entire site in a series of wetlands, which also serve as an aesthetic focal point of the community. The result is a total of 300 acres of wetland and open water marsh that surround and penetrate into the community (Figure 5-15). Wildlife habitat was also explicit in the design, featuring the first "bird privacy" area integrated into an urban development in China. A community education centre was built at the edge of the marsh to exhibit how the wetland works and to educate people on the science and engineering behind wetland treatment.

Figure 5- 14: Master plan of Dongli Lake Development, Source: China Vanke Co. Ltd.

Figure 5- 15: Dongli Lake Development: mixed-density community with treated water marsh, Source: Photo taken by author

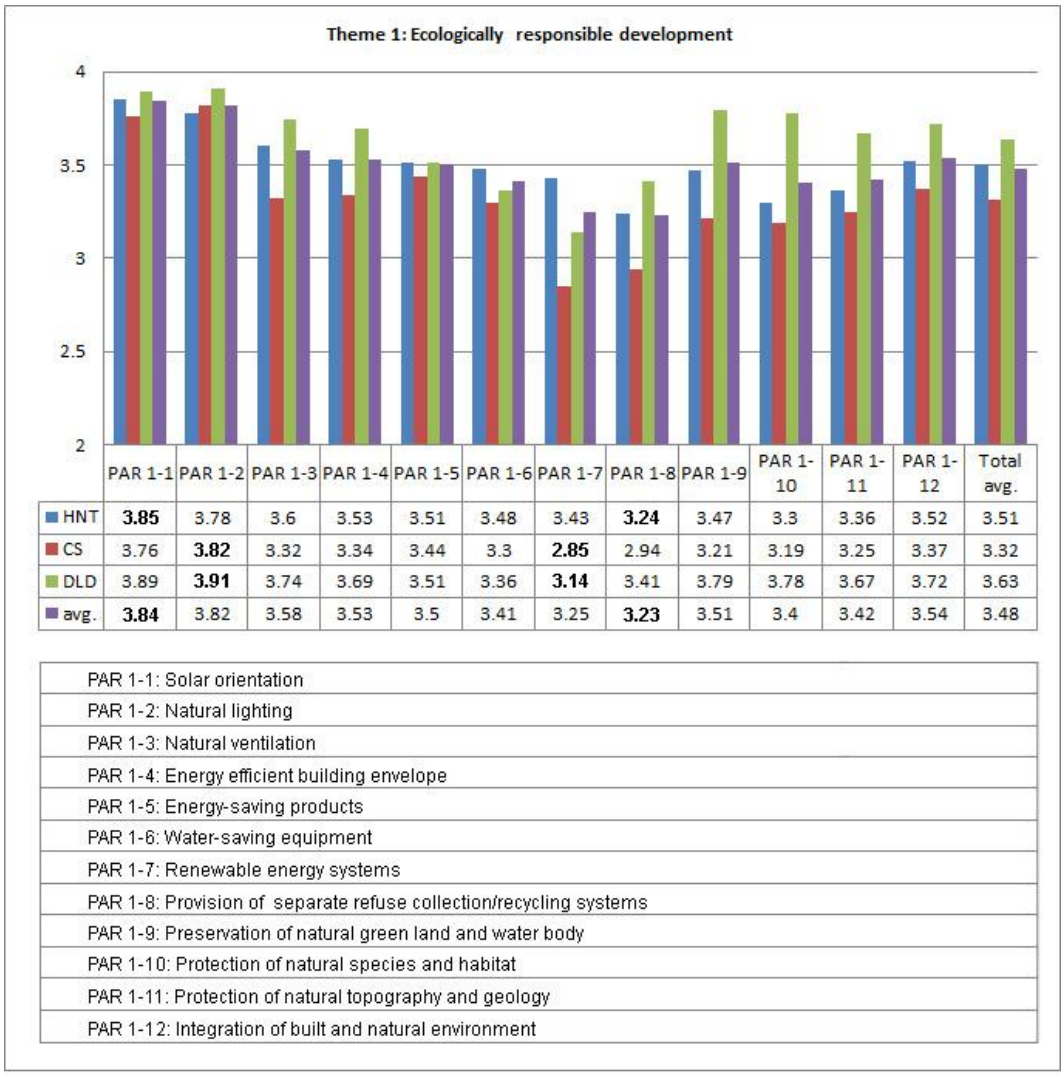
5.6 Evaluation of the sustainability performance of peri-urban settlements in Tianjin

In this section, an evaluation on the sustainability of current development practice of the three chosen study cases in Tianjin, i.e. Huaming New Town (HNT); City Sunshine (CS) and Dongli Lake Development (DLD), is carried out through the delivery of Questionnaire A (Appendix I) to the occupants of the study cases. This section describes the data collected through the questionnaire survey and presents an analysis based on both descriptive and inferential statistics methods. The analysis is structured according to the evaluation framework presented in Table 3-1.

Within each of the six themes of the evaluation framework, descriptive statistics are first presented to describe the overall evaluation scores calculated for the study cases on each parameter under the theme. The purpose of this is to compare the performance of study cases on the theme as a whole (as represented by "Total avg." in the histograms), and show the relative performance on the parameters by each study case (as represented by "PAR n.-n." in the histograms) and all study cases as a whole (as represented by "avg." in the histograms). Inferential statistics using the Kruskal-Wallis test are then performed on each parameter to identify the

differences between the evaluation results obtained for each study case. This aims to identify the relative strengths/weaknesses of a certain settlement type at the implementation of a certain sustainability feature.

5.6.1 Theme 1: Ecologically responsible development



	PAR 1-1	PAR 1-2	PAR 1-3	PAR 1-4	PAR 1-5	PAR 1-6	PAR 1-7	PAR 1-8	PAR 1-9	PAR 1-10	PAR 1-11	PAR 1-12	Total avg.
HNT	**3.85**	3.78	3.6	3.53	3.51	3.48	3.43	**3.24**	3.47	3.3	3.36	3.52	3.51
CS	3.76	**3.82**	3.32	3.34	3.44	3.3	**2.85**	2.94	3.21	3.19	3.25	3.37	3.32
DLD	3.89	**3.91**	3.74	3.69	3.51	3.36	**3.14**	3.41	3.79	3.78	3.67	3.72	3.63
avg.	**3.84**	3.82	3.58	3.53	3.5	3.41	3.25	**3.23**	3.51	3.4	3.42	3.54	3.48

PAR 1-1: Solar orientation
PAR 1-2: Natural lighting
PAR 1-3: Natural ventilation
PAR 1-4: Energy efficient building envelope
PAR 1-5: Energy-saving products
PAR 1-6: Water-saving equipment
PAR 1-7: Renewable energy systems
PAR 1-8: Provision of separate refuse collection/recycling systems
PAR 1-9: Preservation of natural green land and water body
PAR 1-10: Protection of natural species and habitat
PAR 1-11: Protection of natural topography and geology
PAR 1-12: Integration of built and natural environment

Figure 5- 16: Overall comparison of study case mean scores under Theme 1

Figure 5-16 illustrates the mean scores of the evaluation of the three studied cases (HNT, CS and DLD) on the sustainability theme "Ecologically responsible development", as calculated through the occupants' questionnaire survey. The result shows that: in total, DLD scores the highest under this theme amongst all cases (Total avg. mean score: 3.63), with HNT in second place with a Total avg. mean score of 3.51, and CS got the lowest evaluation score for this sustainability theme (Total avg. mean score: 3.32), indicating the least perceived success in its

implementation of ecologically responsible development. For each study case the best and worst evaluations (highlighted in bold figures) suggest the most and least successful result of ecologically responsible development implemented. For HNT, the best evaluated implementation lies with "PAR 1-1: Building orientation" (evaluation mean score: 3.85) and the worst lies with "PAR 1-8: Provision of separate refuse collection/recycling systems" (evaluation mean score: 3.24). The best and worst evaluations given to DLD and CS correspond. The evaluated most successfully delivered ecologically responsible design for both cases is "PAR 1-2: Natural lighting" (DLD: 3.91, CS: 3.82); and the least successfully delivered sustainability feature for both cases is "PAR 1-7: Renewable energy systems" (DLD: 3.14, CS: 2.85). Within each parameter, the comparison of evaluations made for the three study cases, each representing a certain development type, provides insights into their comparative strengths at delivering certain sustainability feature. It is noted that, on all the parameters under this theme, CS got the worst evaluations among all three study cases. DLD, on the other hand, achieved the best evaluations on nearly all the parameters except "PAR 1-6: Water-saving equipment" and "PAR 1-7: Renewable energy systems", for both of which HNT was given the highest evaluations. It implies that having more explicit sustainability design goals and international technological support, DLD has been more successful than the other two study cases in implementing ecologically responsible design, while the engagement of government authorities and policy support in HNT have allowed more successful installation of water- and energy-efficient systems in a residential community.

By putting the data collected from each study case together, an average evaluation score is obtained for each parameter and the theme as a whole (as represented by the purple bar in Figure 5-16). This is intended to present an overall result of the evaluation by respondents for all settlement types. It is noted that the highest evaluation score is achieved on the parameter "PAR 1-1: Building orientation" (avg. mean score: 3.84), and the lowest evaluation score is obtained on the parameter "PAR 1-8: Provision of separate refuse collection/recycling systems" (avg. mean score: 3.23). It implies that, in general, the respondents of the peri-urban settlements studied are most happy with the orientation of their residential

buildings, but are the least happy with the implementation of the separate refuse management.

Inferential statistical analysis is carried out using the Kruskal-Wallis test with Monte Carlo estimate of significance with 99% confidence level. With case identity as the independent variable and 0.01 as the threshold significance level, the results indicate that:

Passive building design

There was no significant difference in occupants' evaluation of the delivery of ecologically responsible design among the three study cases on most of the issues related to passive building design, such as "Building orientation" ("PAR 1-1: Building orientation", H=1.099, p>.01, Table 5-2) and "Natural lighting" ("PAR 1-2: Natural lighting", H=2.183, p>.01, Table 5-3). The descriptive analysis (histograms) shows a general high level of satisfaction with the delivery of these sustainability features. This reflects a general good practice of passive building design in the residential building industry. By studying the master plan layout and floor plans of the residential buildings in the study cases, it can be seen that building floor plan layout pays much attention to creating comfortable indoor environment and minimizing the heating and cooling loads with passive designs in all three communities. Within the residential units, the main living rooms are oriented toward an orientation within 30° south where possible to take the maximum advantage of natural sunlight in winters. West-facing rooms are kept limited to avoid overheating in summer when the afternoon sunlight brings the most unbearable heat. These simple passive design strategies have proven to be very effective at creating comfortable indoor thermal environments with less energy consumption.

Table 5- 2: PAR 1-1: Building orientation (cases excluded: 11 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	184.21	1.099	0.581
CS	68	173.28		
DLD	90	189.58		

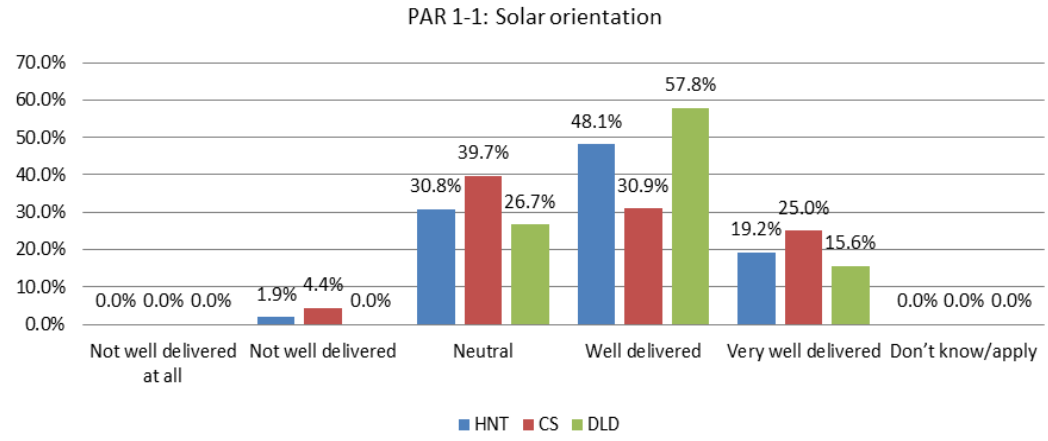
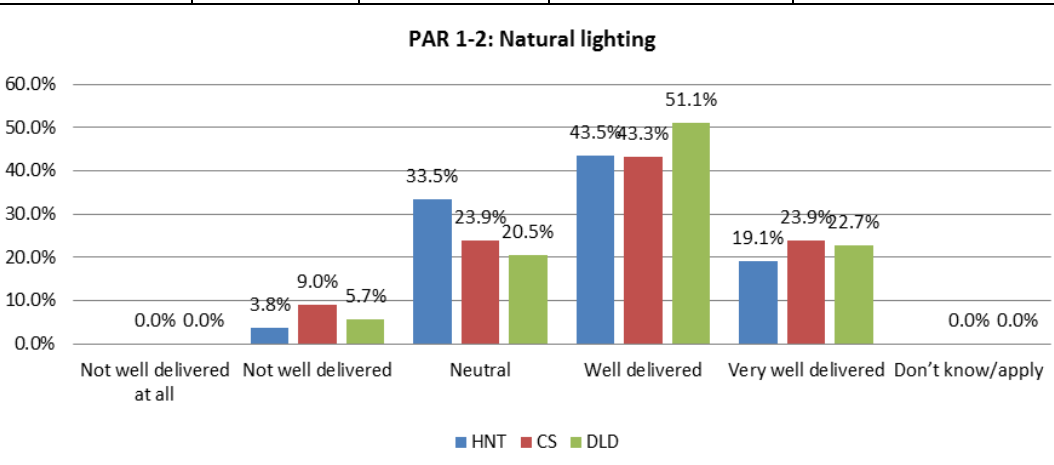


Table 5- 3: PAR 1-2: Natural lighting (cases excluded: 14 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	176.51	2.183	0.349
CS	67	185.1		
DLD	88	194.74		

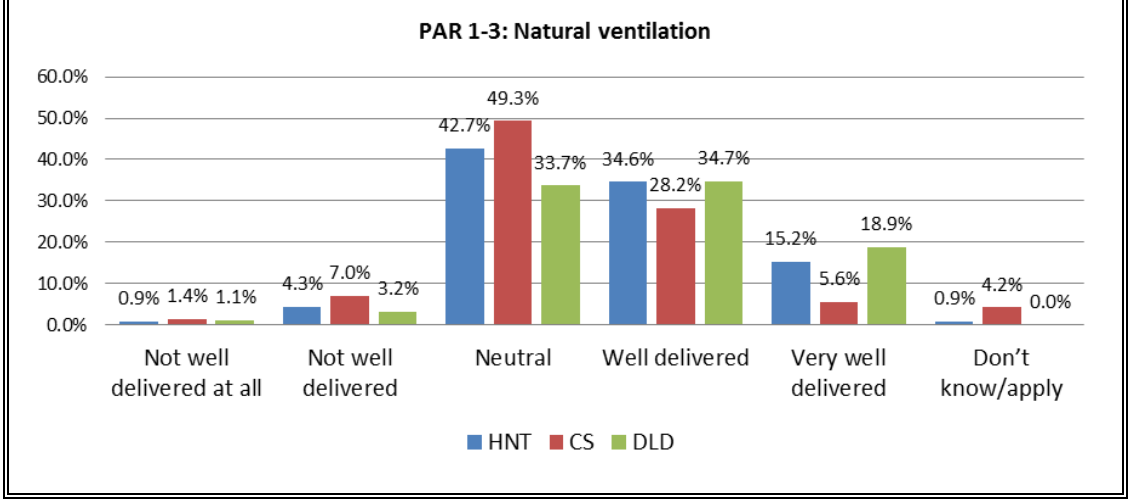


Significant difference was identified on the parameter of "Natural ventilation" ("PAR 1-3: Natural ventilation", H=9.34, p<.01, Table 5-4). On the evaluation of this parameter, DLD was given the highest mean rank (197.45) on a scale of 1 (not well delivered at all) to 5 (very well delivered). By contrast, CS had the

lowest mean rank of 149.59 and HNT (181.36) fell in the middle. Like building orientation and natural lighting, the design for natural ventilation is quite a recognized common practice in the building industry in China. The difference detected of the study cases can be explained by a close look at the plan layout of the buildings in each case. In DLD, all residential units occupy the full depth of the building in order to take advantage of the southeast prevailing wind in summer to provide the maximum cross ventilation when windows are open on both sides; In HNT, two thirds of the dwelling units are able to enjoy the benefit of cross ventilation; In CS, by contrast, as more housing units were crammed into one floor level, it becomes more difficult to arrange for cross ventilation for every unit (Figure 5-17). This is a compromise that often needs to be made when a high density is in demand. For commercial developments the decision to sacrifice comfort for a higher density come higher profit would be difficult to make because of a subsequent decreased salability of the product. In cases of affordable housing estates such as CS, however, as profit margins are set to very low percentages and eligible buyers have less freedom in their choice of the purchase, developers are therefore less obliged in producing high quality housing products and demonstrated a pursuit for the maximized profit.

Table 5- 4: PAR 1-3: Natural ventilation (cases excluded: 19 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	206	181.36	9.34	0.01*
CS	65	149.59		
DLD	87	197.45		



Note: *Significant at 0.01 level.

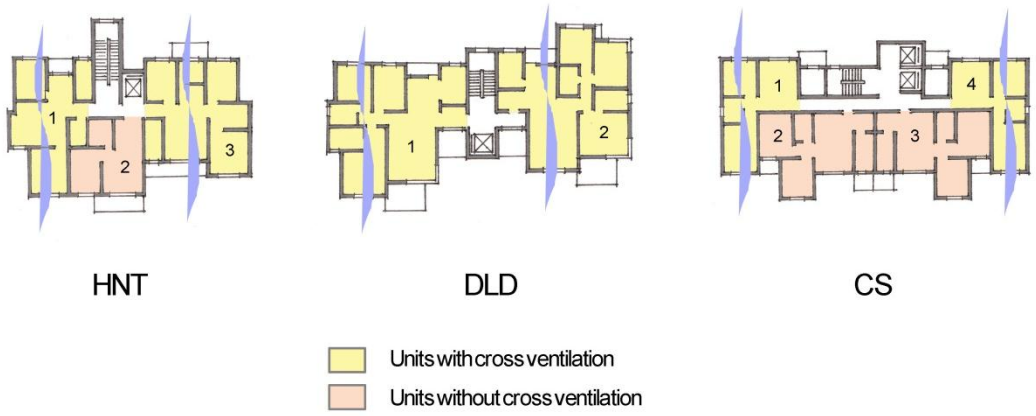
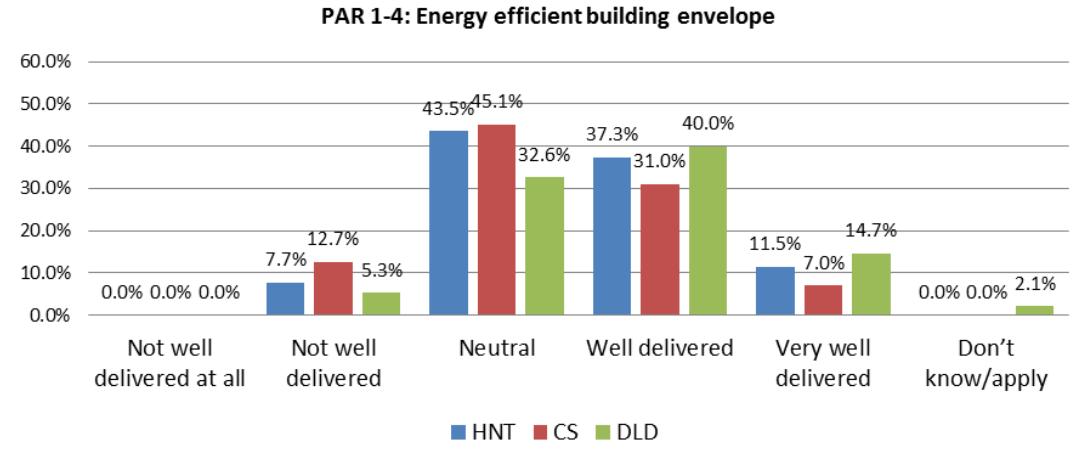


Figure 5- 17: Case comparison of typical building floor plans (Adjusted from design documents)

Table 5- 5: PAR 1-4: Energy efficient building envelope (cases excluded: 12 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	182.1	7.373	0.025
CS	68	159.95		
DLD	88	202.94		



Building energy efficiency

When the level of significance is set at 0.01, the p value obtained of the parameter "Energy-efficient building envelope" (p=0.025, Table 5-5) indicates no significant difference in occupants' evaluation on the delivery of energy-efficient building envelope in the three study cases. This result is somewhat unexpected as there was significant difference in the energy efficiency targets that have been adopted by the study cases. HNT was one of the first large-scale residential developments in Tianjin to adopt the 2004 energy-efficient design standard. In the design proposal

of NHT, much emphasis was on window detail design to prevent thermal bridging and the design of ventilated roof to reduce heat gain in summer (Huang and Fu 2009). The level of external wall and roof insulation has been significantly increased according to the new standard. As has been stipulated in the standard, no clay bricks were allowed to be used in the construction, as the production of clay bricks has been considered to have taken extensive farm land and being energy-inefficient. Therefore the designers opted for more sustainable materials such as shale bricks and slag concrete blocks (Huang and Fu 2009). Before the 2004 energy efficiency standard was made mandatory in Tianjin, Vanke, the development company of DLD, took the initiative of going ahead of the industry and adopted the LEED standard for the design of some of the residential buildings in DLD. This mainly refers to the detached villas which were aimed at the upper market. The external walls and roofs achieved a U-value of 0.4W/m^2k and 0.35 W/m^2k respectively, which are both 0.05 W/m^2k lower than the values indicated by the mandatory energy efficiency design standard 2004. A part of the apartment blocks used double-glazed windows with aluminum thermal break frames, which achieved a U-value of 2.7 W/m^2k – equaling the value indicated by the mandatory energy efficiency design standard 2004. On the other hand, CS, being developed prior to the enforcement of the 2004 standard, was built to a much lower energy-efficiency standard. Two possible explanations can be approached to explain the non-significant difference result presented by the questionnaire survey: Firstly, building energy-efficiency is a parameter better evaluated using monitoring methods than relying on subjective evaluations of residents as subjective perceptions may not be able to accurately reflect the actual effects of building energy-efficiency measures. Due to the limited resources available to this research, however, monitoring methods were not used, and residents' evaluations based on questionnaire surveys and interviews were alternative methods used to reflect the effect of different design standards on building performance as perceived by their users. As the non-significant difference result shows, the adoption of different energy-efficient design standards has made little difference on occupants' perception of building energy efficiency; A second possible explanation of the result is that: there is, in fact, little difference on the energy performance of the buildings in the three study cases albeit different design standards have been adopted. This judgement can be supported with evidence from the interviews. In

all three sites, the residents had expressed concerns over the construction quality of the buildings (personal communications with Residents A, B, D, E, F, J and K). Further evidence was obtained from the interviews of the community management representatives, who confirmed that there had been a large number of complaints over the quality of the buildings and there had been much struggle to meet the demands of repairs even within the first two years of occupancy (personal communications with Director A and Director D). There is reason to believe that the inadequacies on the quality delivered through the control of construction had played an important part on the less satisfactory implementation of higher energy-efficient design standards; or at least the distrust of its occupants on the quality of construction had led them to suspect that energy efficiency was not delivered in full accordance with the targets.

Energy- and water-saving facilities

There were no significant group differences on the evaluations of "PAR 1-5: energy-saving products" ($H=0.375$, $p>.01$, Table 5-6) and "PAR 1-6: water-saving equipment" ($H=3.854$, $p>.01$, Table 5-7). The majority of apartment residential buildings in China, including the study cases in this research, are finished without any fittings within individual units. Therefore the choices of utility products used within homes and the materials used for interior decoration are left entirely to the occupants. This may explain the small difference reflected by the statistics. It is also inferred that, the use of energy-saving light bulbs in the communal areas of HNT and DLD had made little impact on occupants' perception of community sustainability as compared to CS, where no such measure had been taken. Two reasons can be suggested to explain this. First, this proposed measure has not been implemented very well in HNT and DLD; and second, the occupants of the two communities were not fully aware of its implementation. Evidence from the residents' interviews suggests that the usage of energy-efficient bulbs within the homes is low (personal communication with Residents C, G, H, L and M), and the inference of the lack of awareness on the residents' side is reinforced: none of the interviewed residents in the three sites use energy-efficient bulbs within their homes and only one resident interviewed in DLD indicated awareness of the use of energy-efficient bulbs in the community (personal communication with Resident I).

Table 5- 6: PAR 1-5: Energy-saving products (cases excluded: 16 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	182.36	0.375	0.834
CS	66	174.37		
DLD	86	182.77		

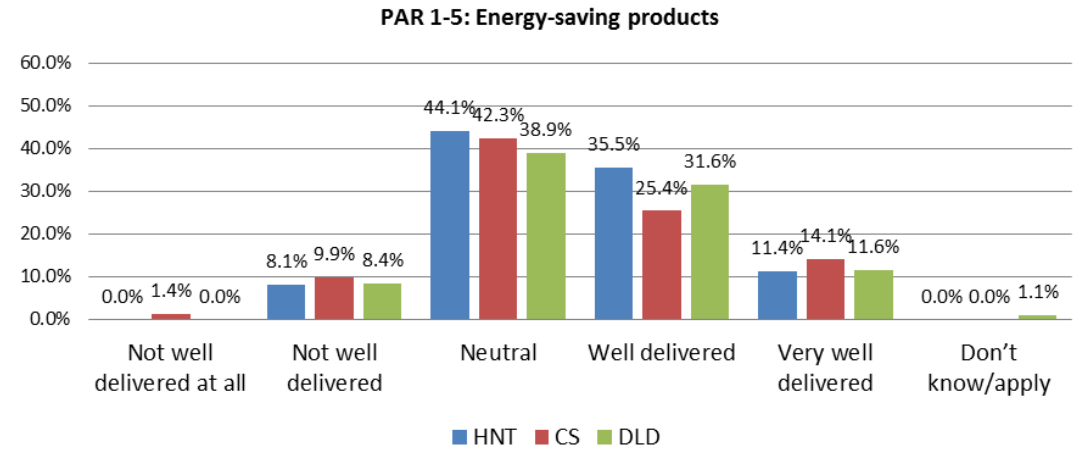
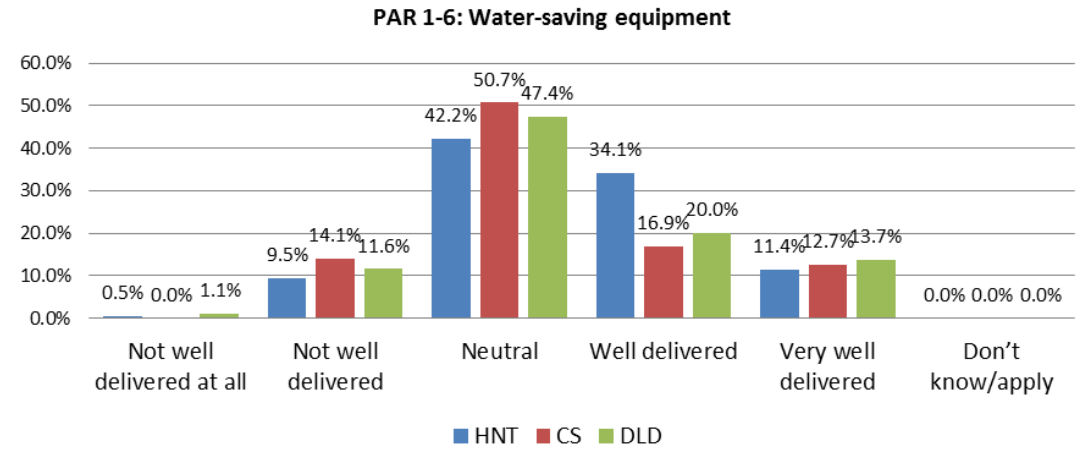


Table 5- 7: PAR 1-6: Water-saving equipment (cases excluded: 15 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	206	189.93	3.854	0.147
CS	67	165.54		
DLD	89	173.99		

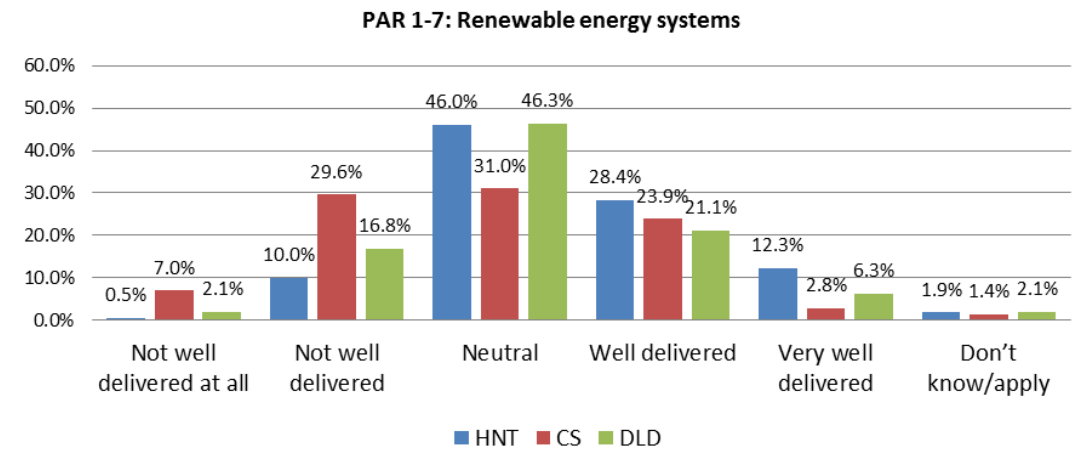


As a stipulated measure to reduce water usage, the three housing estates investigated in this study have all installed grey water recycling systems before occupation of the residents. However, until the time of the site visits, none of

them have been in effective use. The interviews with the management company/neighbourhood committee revealed that the high running and maintenance costs of the installed systems makes the use of recycled water uneconomical (personal communication with Directors B, C and D). For this reason, all three communities have completely or partly abandoned the running of the system, which explains the general low evaluation of their occupants on the delivery of this measure.

Table 5- 8: PAR 1-7: Renewable energy systems (cases excluded: 17 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	205	198.82	19.426	0.000*
CS	67	141.48		
DLD	88	167.52		



Note: *Significant at 0.001 level.

Renewable energy systems

There was significant difference (H=19.426, p<.01, Table 5-8) on the evaluations of the delivery of "renewable energy systems" among the three study cases. HNT had the highest mean rank (198.82), indicating the highest occupants' satisfaction of renewable energy system implementation. DLD had a less satisfactory response from its occupants (mean rank=167.52) and CS was rated the least successful at delivering renewable energy systems (mean rank=141. 48). As already noted, the evaluations on this parameter for both DLD and CS are the lowest within the theme "Ecologically responsible development". This indicates that renewable energy systems are the least successfully implemented ecologically responsible

development measures in the two residential development sites as perceived by their occupants. HNT, on the other hand, with enforced implementation and budgetary support from government on the installation of solar-hot water systems, has achieved considerable success. In HNT, solar hot water systems have been installed throughout the estate. Over 8000 solar collectors have been installed on the buildings' roofs to provide hot water for all housing units in the new town (Figure 5-18). Small-scale PV systems have also been installed to provide public space lighting and a bio-gas system is installed for every neighbourhood (400 families) mainly to provide fuel for cooking. According to the chief designers of the masterplan of HNT, Huang and Fu (2009), it can be estimated that an annual saving of 1347 tons of standard coal and an annual reduction of 3277 tons of CO_2 and 34 tons of SO_2 can be achieved from using renewable energy sources. Measures have also been taken in DLD to make use of available renewable energy sources. On the roofs of the terraced houses of Phase 3 development, solar collectors are installed to provide for hot water (Figure 5-19) and solar-powered spot lights for night lighting in the communal gardens are used throughout the estate.

Figure 5- 18(left): Solar-hot water system installed on roof – Huaming New Town, Source: Photo taken by author

Figure 5- 19(Right): Solar-hot water system is only installed for terrace houses – Dongli Lake, Source: Photo taken by author

It can be concluded that the measure taken at HNT to install solar hot water system for every home in the community has made a significant impact on the occupants' evaluation of sustainability delivery. By contrast, DLD had achieved some success with using renewable energy systems but had less satisfactory

response from its occupants due to the partial implementation. The fact that there was no renewable energy systems installed at CS well explains its low ranking. It needs to be noted that although CS is chosen as a representative case for affordable housing estates, its design solution for energy-efficiency and the adoption of renewable energy systems does not necessarily represent other affordable housing developments, as many later such developments have been influenced by the policy trend towards higher energy-efficiency standards and application of renewable energy systems. The New Homes projects, for instance, have installed solar-hot-water systems on all residential building blocks. As the plan for these projects show, the use of renewable energy systems has become an important feature included in the design guidance for affordable housing developments in Tianjin. It is therefore noted that the installation of renewable energy systems, such as solar-hot-water, have seen more success at the government-led development cases (HNT and New Homes) than the private-sector case (DLD). The high level of public sector involvement and financial support were essential factors that have provided the government-led developments with an advantage for trying out new technologies. However, it was also noted that although solar-hot-water systems have been successfully installed at the government-led development cases, their long-term maintenance remain questionable. As the housing type is exclusively multi-storey buildings, the ownership of the solar-hot-water systems are not as clear-cut as if they were installed on single houses, and their maintenance falls into the responsibility of the estate management company. As there is inadequate legislation and regulation in the area of estate management in China, especially related to the maintenance of renewable energy systems, this is the area where disputes between the management companies and the users of the system are likely to occur. Further, as public funding is unlikely to continuously invest in the maintenance of these systems, they may face the same fate as the grey water recycling systems.

Refuse collection/recycling systems

No significant group difference was detected on the evaluations of "PAR 1-8: separate refuse collection/recycling systems" ($H=6.588$, $p>.01$, Table 5-9). As observed by the researcher, separate refuse collection/recycling systems are not provided in any of the study cases. However, stipendiary services of refuse

separation, collection and recycling are common practice in all the communities. It is suggested here that the responses given to the evaluation of this issue can be interpreted as demonstrating the measures of refuse segregation and collection taken within the respondents' homes. In HNT, 37.9% of the respondents indicate that this practice is well delivered, 19% of the respondents indicate the contrary and 42.2% gave a neutral response; in DLD, 31.1% of the respondents are satisfied with the delivery, 16.9% think that it is not well delivered and 31.6% gave a neutral answer; in CS, 28.2% of the respondents think refuse collection and recycling is well practiced in their community, 32.4% think that it is not well practiced, and 28.2% think it is neither well nor poorly practiced. The calculated mean rank suggests that refuse segregation and collection is slightly better practiced in DLD than in the other two cases. In general, however, this sustainability measure is not very well practiced in all types of peri-urban settlements in Tianjin, and there is no significant difference in residents' satisfaction on the delivery of this measure.

Table 5- 9: PAR 1-8: Provision of separate refuse collection/recycling systems (cases excluded: 20 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	180.31	6.588	0.037
CS	63	153.1		
DLD	85	194.93		

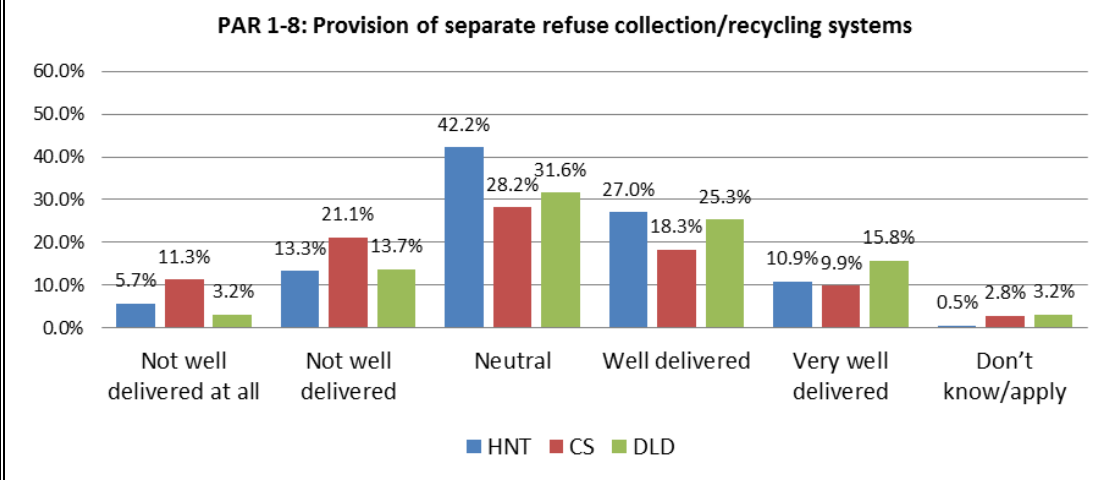
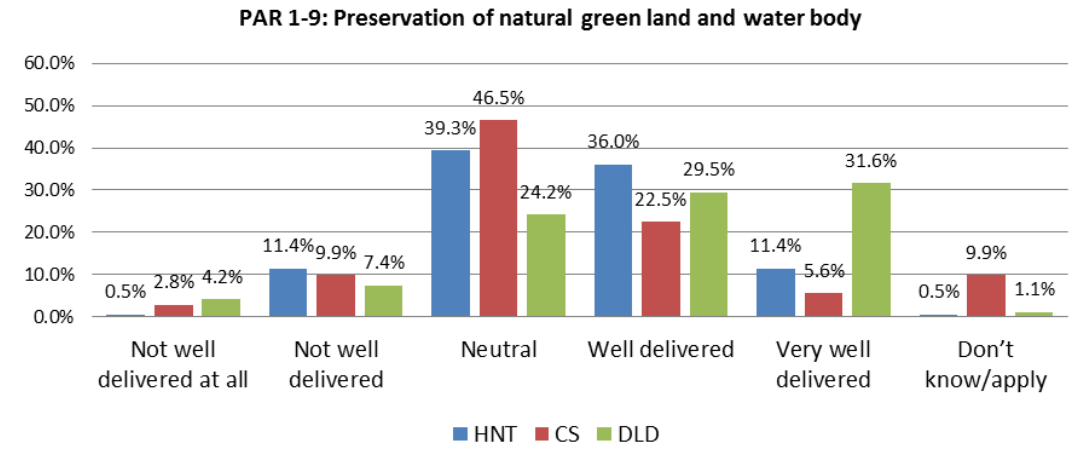


Table 5- 10: PAR 1-9: Preservation of natural green land and water body (cases excluded: 15 due to missing values)

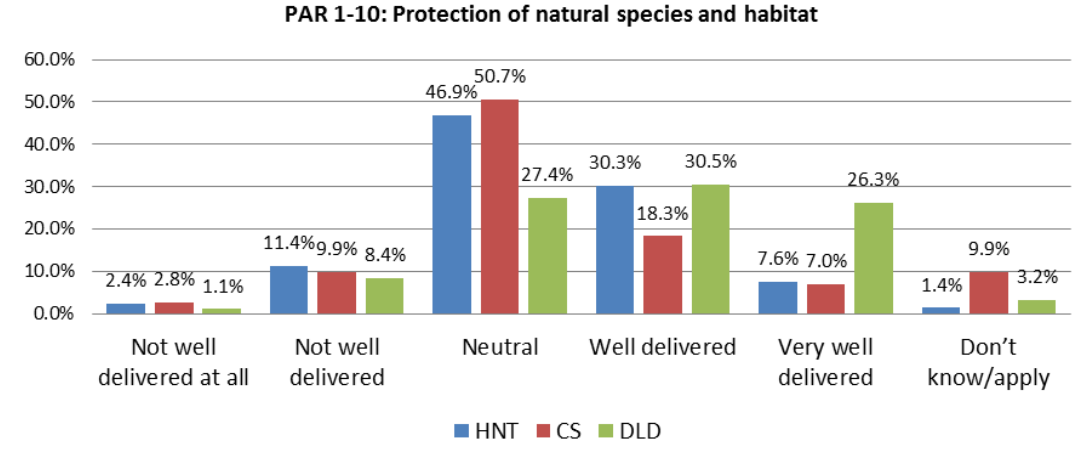
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	176.78	17.028	0.000*
CS	62	148.94		
DLD	92	214.1		



Note: *Significant at 0.001 level.

Table 5- 11: PAR 1-10: Protection of natural species and habitat (cases excluded: 17 due to missing values)

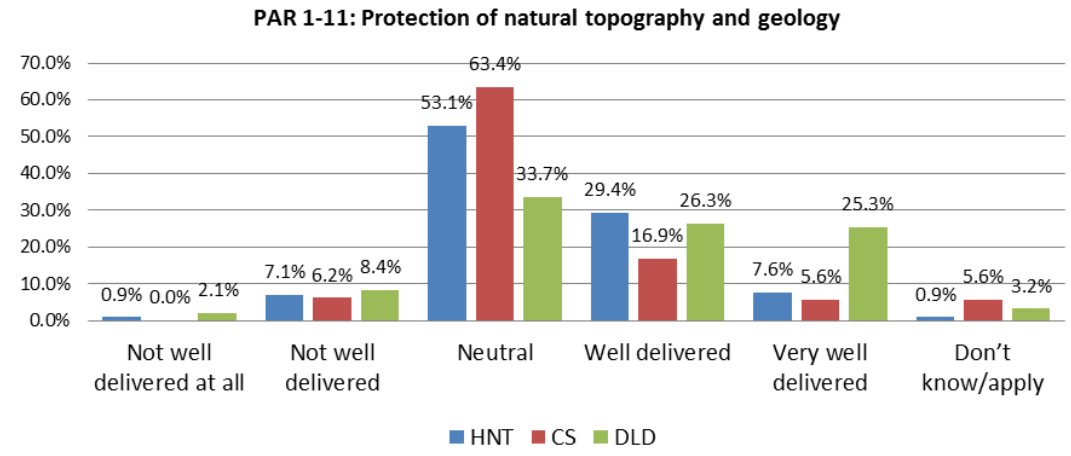
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	170.69	20.22	0.000*
CS	63	157.14		
DLD	89	219.97		



Note: *Significant at 0.001 level.

Table 5- 12: PAR 1-11: Protection of natural topography and geology (cases excluded: 14 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	207	176.77	12.135	0.002*
CS	65	159.2		
DLD	91	210.19		



Note: *Significant at 0.01 level.

Minimization of site impact

In all the evaluation of parameters indicating the minimization of site impact (i.e. "PAR 1-9: Preservation of natural green land and water body", "PAR 1-10: Protection of natural species and habitat", "PAR 1-11: Protection of natural topography and geology", and "PAR 1-12: Integration of built and natural environment", Table 5-10, Table 5-11, Table 5-12), significant group differences were detected except for PAR 1-12. For all the comparisons that indicated a significant group difference, DLD obtained the highest mean rank among all three groups. The descriptive statistics reveal that, in DLD around or over 50% respondents indicated satisfactory with the implementation of "Preservation of natural green land and water body", "Protection of natural species and habitat", and "Protection of natural topography and geology" and over one fourth of the respondents think that the sustainability features in question are "very well delivered". Being developed on natural wetland, the preservation of the water bodies and the natural habitat for the local fish, bird and plant species was proposed as high priority in DLD (Figure 5-20, 5-21). International technological support was sought to ensure an ecologically friendly development. It can be

implied from the result that the environmental protection measures taken at DLD, such as preserving the natural water body and wetland and limiting the impact of the built environment on natural habitat, had made a huge impact on the residents' perception of the development's performance in pursuing ecological responsibility. However, as an interview with the estate management company revealed, the seemingly independent ecological system created at DLD may still be a fragile one. It was admitted that the maintenance of the greenery and the wetlands requires huge amounts of investment on labour-intensive work, and that the company is "losing money" on this in exchange for a pleasing appearance to attract potential home buyers (personal communication with Director C).

Figure 5- 20 (left): Treated wetland in DLD, Source: Photo taken by author
Figure 5- 21 (right): Preserved water body in DLD, Source: Photo taken by author

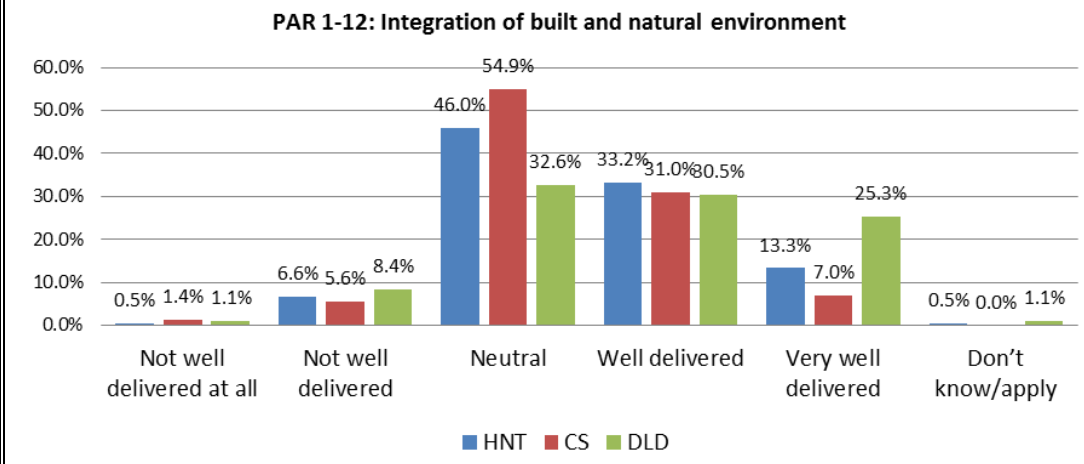
HNT has had some success in delivering this sustainability feature with over a third of the respondents indicating satisfaction. It implies that the measures by designers of HNT to preserve the farm-edge trees and water bodies have had some effect at increasing the satisfaction of the residents on the community's environmental sustainability. By contrast, only about a quarter of the respondents in CS considered this sustainability feature to be well to very well delivered.

On the issue of "Integration of built and natural environment", however, no significant difference was detected on the responses of residents in the three sites ($H=7.067$, $p>.01$, Table 5-13). The descriptive statistics show that the residents in all three sites are generally quite happy with the delivery of this sustainability feature, with 46.5% in HNT, 55.8% in DLD and 38% in CS expressing satisfaction with its implementation. The result indicates that this sustainability

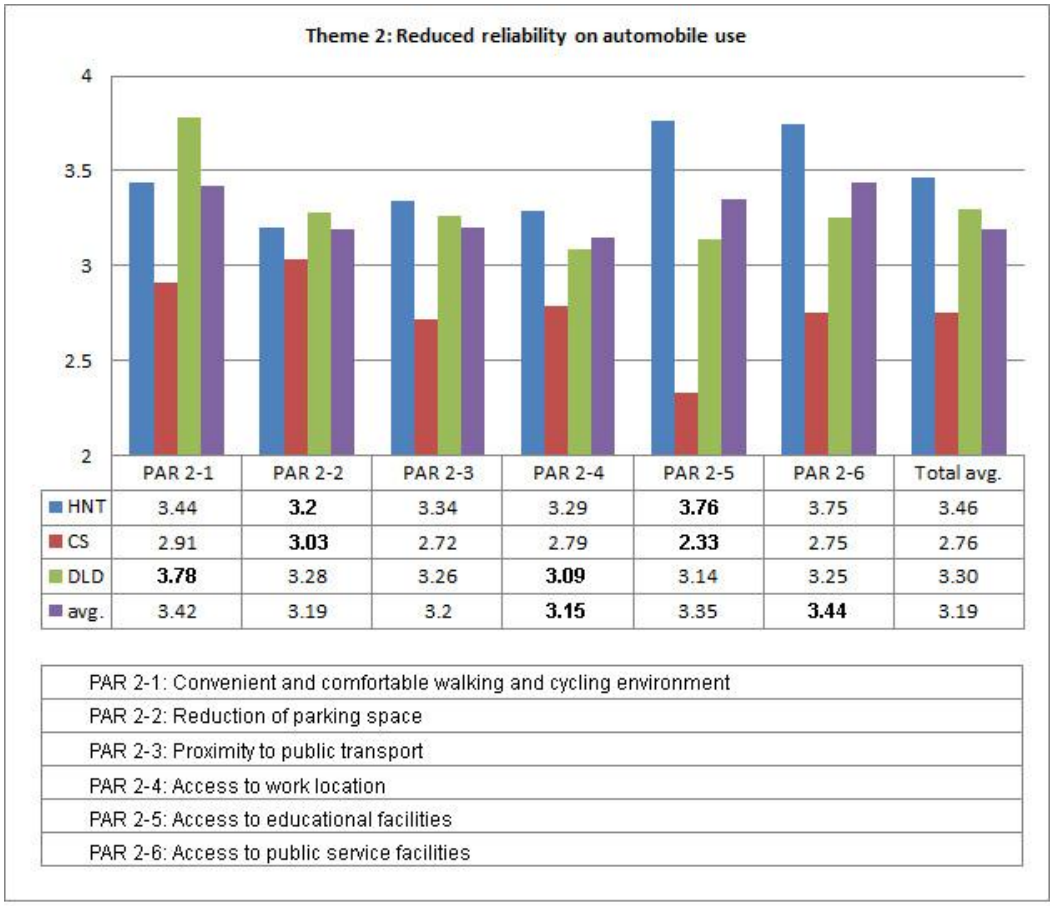
feature is generally well practiced in the peri-urban settlements studied and that there is no significant difference between the levels of success at their implementation.

Table 5- 13: PAR 1-12: Integration of built and natural environment (cases excluded: 3 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	210	185.1	7.067	0.028
CS	71	167.03		
DLD	93	208.54		



5.6.2 Theme 2: Reduced reliability on automobile use



	PAR 2-1	PAR 2-2	PAR 2-3	PAR 2-4	PAR 2-5	PAR 2-6	Total avg.
HNT	3.44	**3.2**	3.34	3.29	**3.76**	3.75	3.46
CS	2.91	**3.03**	2.72	2.79	**2.33**	2.75	2.76
DLD	**3.78**	3.28	3.26	**3.09**	3.14	3.25	3.30
avg.	3.42	3.19	3.2	**3.15**	3.35	**3.44**	3.19

Figure 5- 22: Case comparison of study case mean scores under Theme 2

Figure 5-22 illustrates the mean scores of the evaluation on the sustainability theme "Reduced reliability on automobile use" for the three studied cases. HNT had the highest total mean score under this theme (Total avg. mean score: 3.46); CS had the lowest total mean score of 2.76; while DLD came in the middle with total mean score of 3.3. For HNT, the highest evaluation score was obtained on the parameter "PAR 2-5: Access to educational facilities" (mean score: 3.76), and the lowest evaluation score was obtained on the parameter "PAR 2-2: Reduction of parking space" (mean score: 3.2); For DLD, the best evaluation was given by its occupants on the parameter "PAR 2-1: Convenient and comfortable walking and cycling environment" (mean score: 3.78), and the lowest evaluation was given to the parameter "PAR 2-4: Access to work location" (mean score: 3.09); The best evaluation obtained for CS was on the parameter "PAR 2-2: Reduction of parking space" (mean score: 3.03), and the least favourable evaluation was on

the parameter “PAR 2-5: Access to educational facilities” (mean score: 2.33). It is noted that DLD had the best evaluations among all study cases on two of the parameters under this theme: “PAR 2-1: Convenient and comfortable walking and cycling environment” and “PAR 2-2: Reduction of parking space”; while HNT achieved the best evaluations on all the rest parameters, whereas CS had the lowest evaluation scores on all of the parameters under this theme. It implies that although CS is located in the shortest distance to the city centre among all studied cases, accessibility has not been well implemented and has been perceived by its occupants as generally unsatisfactory; HNT, on the other hand, has been most successful at providing good accessibility for its occupants among all study cases. By putting together the data obtained from all three study cases, the average mean scores on each parameter can be calculated. It is noted that the highest average mean score is on “PAR 2-6: Access to public service facilities” (avg. mean score: 3.44); and the lowest average mean score is on “PAR 2-4: Access to work location” (avg. mean score: 3.15). It implies that on the issues related with transport and accessibility, accessibility to public service facilities is perceived as being best provided while accessibility to work is evaluated as the least well implemented.

Inferential statistical analysis is carried out on the theme “Reduced reliability on automobile use” using the Kruskal-Wallis test with Monte Carlo estimate of significance with 99% confidence level. With case identity as the independent variable and 0.01 as the threshold significance level, the results indicate that:

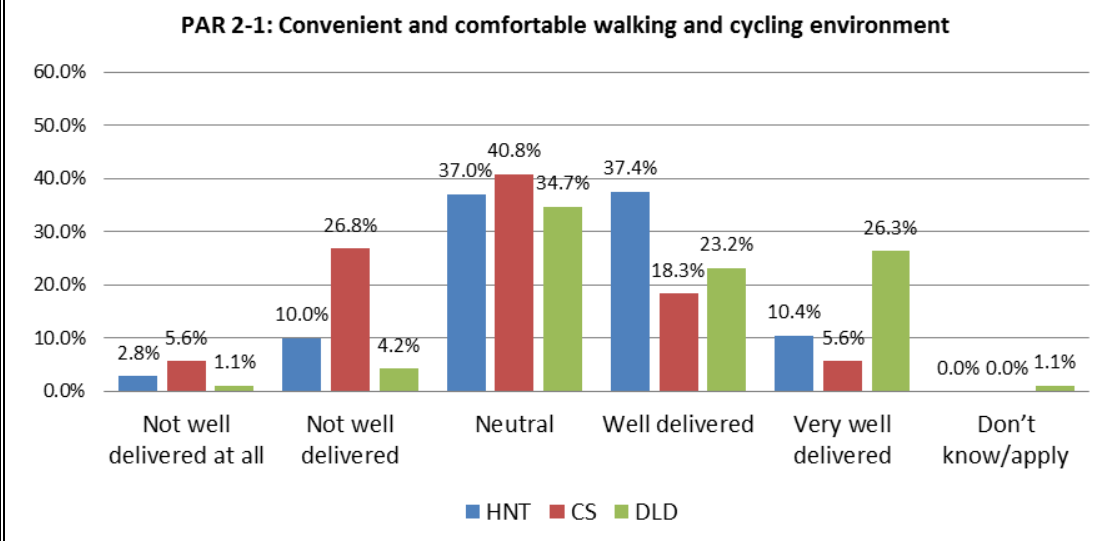
Walking and cycling environment

There was significant difference ($H=28.553$, $p<.01$) between the studied cases on the evaluation of “PAR 2-1: Convenient and comfortable walking and cycling environment” (Table 5-14). DLD had the highest mean rank (214.25) for the evaluation of this parameter, indicating the most satisfactory implementation among all studied cases, while CS had the lowest mean rank (129.31), indicating the least satisfactory implementation. It can be implied that the traffic calming and segregated pedestrian and traffic measures taken at DLD has been successful at creating a convenient and comfortable walking and cycling environment (Figure 5-23). HNT has had some success at delivering this sustainability feature with its

masterplan of segregated pedestrian and motor traffic. However, there has been no traffic calming facilities such as the speed bumps installed on the major community streets and many of these streets are as wide as 20 metres (Figure 5-24). Some of the interviewed residents reported inconvenience at crossing over the major streets and expressed worries over the security of their children when playing on street (personal communication with Residents B and D). There is reason to believe that the lack of pedestrian-oriented deigns on the major motor traffic routes within the community has comprised to some point the success achieved through segregated pedestrian and motor traffic design. CS, by contrast, adopted a mixed pedestrian and traffic design (Figure 5-25). The survey result demonstrated that this design has created a much less satisfactory community built environment than the separated pedestrian/traffic designs adopted in the other two study cases, where the residents could enjoy much more comfortable walking and cycling environment.

Table 5- 14: PAR 2-1: Convenient and comfortable walking and cycling environment (cases excluded: 17 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	206	183.72	28.553	0.000*
CS	69	129.31		
DLD	85	214.25		



Note: *Significant at 0.001 level.

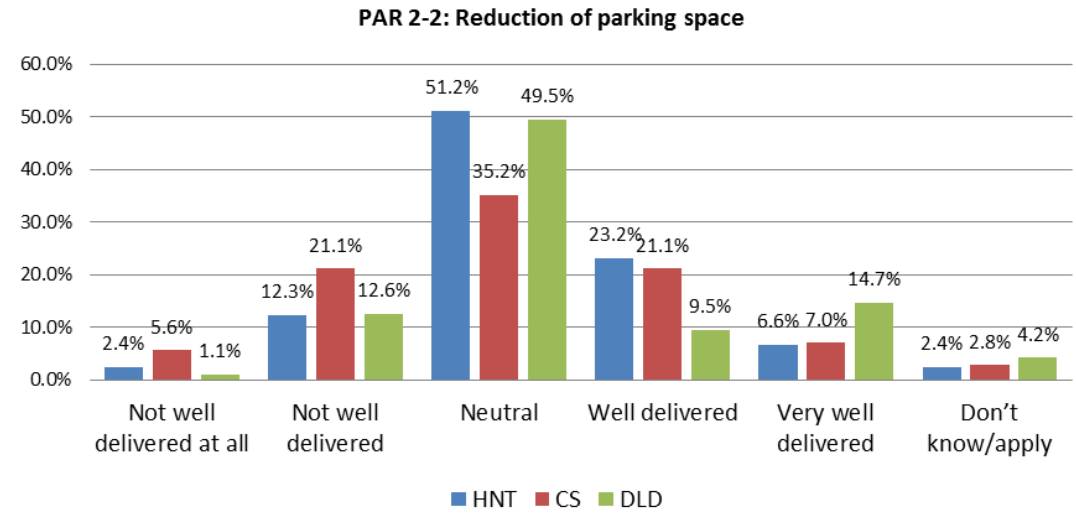
Figure 5- 23: Pedestrian-friendly environment of DLD, Source: Photo taken by author

Figure 5- 24: Wide major traffic routes in HNT, Source: Photo taken by author

Figure 5- 25: Mixed pedestrian and traffic design at CS, Source: Photo taken by author

Table 5- 15: PAR 2-2: Reduction of parking space (cases excluded: 28 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	202	177.97	1.881	0.394
CS	64	160.62		
DLD	83	178.87		



Reduction of parking space

There was no significant difference detected on the evaluation of the delivery of reduction of parking space among the studied cases ("Par 2-2: Reduction of parking space", H=1.881, p>.01, Table 5-15). However, evidence from the interview of the residents revealed that it is questionable whether the data collected for this particular question is able to provide the information that the researcher had planned to obtain. The main reason behind this doubt is that there seems to have been some "misunderstanding" among the residents of what is being asked by this specific question. Some residents claimed difficulty at understanding the reason for reducing parking spaces, and some even declared that they think one of the main problems with their community is that there is "not enough" parking spaces provided. With the fast increase of private car ownership in recent years, the problem of the lack of parking space in residential communities has become increasingly evident. It has become more and more obvious that previous plans for residential community development had underestimated the demand for parking space. Many planned residential communities face the dilemma of sacrificing community green area for more

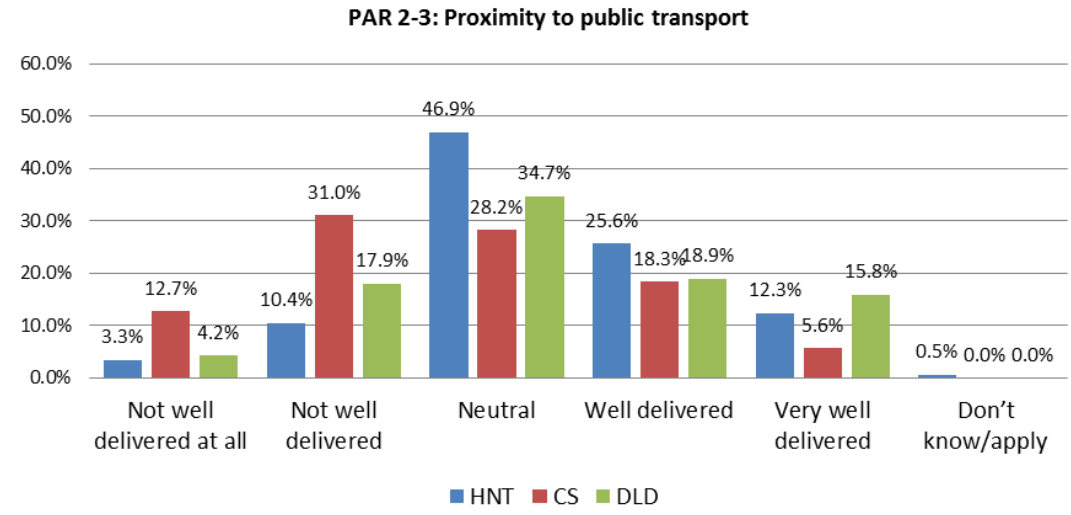
parking spaces to accommodate increasing demand (Luo 2010). The general public and even some professionals call for a higher level of parking space provision in new community developments. Given the circumstances, it does seem rather untimely to devise a community evaluation criterion that is based on the reduction of parking space, as little support would be expected to be gained from the public as well as within the building profession on its implementation. However, although the current implementation of this sustainability feature is debatable under China's circumstances, it is still considered an important evaluation criterion for urban sustainability in China, in that the reduction of automobile usage is an inevitable measure to take if China is to meet its carbon reduction targets.

Public transport provision

Significant group difference was found in the evaluation of "PAR 2-3: Proximity to public transport" ($H=17.427$, $p<.01$, Table 5-16). HNT had the highest mean rank (194.99), indicating the highest satisfaction of its occupants on the time taken to travel to public transit nodes. CS had the lowest mean rank (137.04), indicating the least well serviced by public transit among all study cases. In HNT, there are six bus transit lines running from the new town to the city centre and one runs to and from the local region and another one running between the new town and the sub urban centre – BNA. Four of these bus lines have stops at every neighbourhood in HNT, keeping the distance to travel to the nearest transit node to less than 5 minutes. Furthermore, since early 2010, electrified cars have been put into use in the new town to replace the previous fuel-powered three-wheeler-taxis (Figure 5-26). With funding from the local government, 95 new electric vehicles have been put into use and 280 more will be needed to gradually replace all previous taxis (personal communication with Official B). Electric charging posts are installed in the new town and a new EV charging station is under construction. The electrified taxis now operate within the new town and the plan to expand their service into the local region is under discussion.

Table 5- 16: PAR 2-3: Proximity to public transport (cases excluded: 14 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	194.99	17.427	0.000*
CS	68	137.04		
DLD	87	186.09		



Note: *Significant at 0.001 level.

Figure 5- 26: Electric taxis to complement public transportation within HNT, Source: Photo taken by author

By contrast, the public transit service provision in DLD is at a much lower development pace although the occupation in DLD started four years earlier than HNT. At the moment, only two bus lines operate between the development and the city centre and one operates to and from BNA. All the bus lines stop at the same station near the community centre without having stops at each

neighbourhood. It can be estimated that the time to travel to the nearest bus stop would be longer than that in HNT. There are no transit services within the community except one that is operated by the property sales department of the development company, which is used solely for carrying potential buyers to the properties for viewing. An interview with the representative of the development company revealed that the inadequate provision of public transit service is an important reason for the low occupancy rate currently found in DLD (personal communication with Developer A). There had been much concern expressed by potential buyers as well as current occupants on the inconvenience to travel to the city centre where most jobs and public services concentrate. The development company has been making effort to persuade bus companies to extend their lines to DLD, however because of its low occupancy rate it is deemed by the bus companies to be unprofitable to extend their lines here. At the moment, the majority of the occupants in DLD rely on private vehicles for daily commute and errands. The ownership of private cars has become a precondition for living here.

Of the three study cases, CS had the lowest mean rank, however, its level of public transit provision is comparable with that of HNT. There are six bus lines that connect the community with central city areas and three bus lines that run between the community and BNA. Given that CS is also the nearest to the city center of all study cases, its result of the lowest ranking under this issue was quite unexpected. A trip made to the nearest bus stop by the researcher revealed something that may provide some explanation to this. As CS is located next to a busy express way (Jinbin Road) linking the city centre to BNA, access to the bus station that have buses to the city centre direction can only be made by crossing over Jinbin Road, which is a 100 meter-wide express way with 8 car lanes on each side (there is also a 30 meter-wide green belt in the middle) with a 100 meter-long suspended footbridge linking to the other side. A trip to the nearest bus station requires walking for approximately 800 meters including climbing up and down the footbridge. It therefore can be concluded that although this community is seemingly well serviced by bus transit lines, the accessibility to the bus stops is beyond the comfortable walking distance. Furthermore, the occupants of CS belong to the lower-income classes, to whom ownership of private vehicles poses

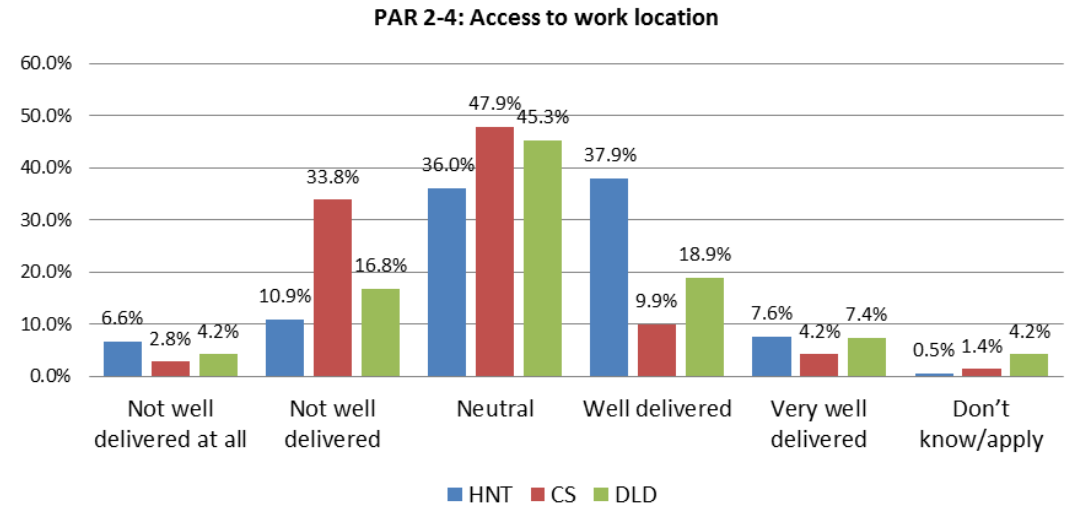
a significant financial burden to their living expenses. Therefore, public means of transportation are a necessity for their commuting.

Accessibility

Significant group differences ($p<.01$) were found on the evaluation of parameters related with community accessibility ("PAR 2-4: Access to work location", "PAR 2-5: Access to educational facilities", and "PAR 2-6: Access to public service facilities", Table 5-17, Table 5-18, Table 5-19). The results obtained from the case evaluation of all three parameters are quite comparable, with HNT getting the highest mean rank and CS the lowest mean rank throughout. HNT has the best "job-housing balance" in all three study cases. Not only the planned new town is deliberately located near established industrial parks but also there are plans to offer jobs to the residents in the residents' committee and to help them start their businesses within the new town. Although the exact figure was not available at the time of the survey, it was confirmed by a representative of the administration body of the new town in an interview that a large number of the residents in the new town are self-employed or work locally. However, as has been analysed earlier, the accessibility to work was evaluated as the least well implemented sustainability feature under Theme 2 for all study cases on average. Upon further evidence, it was found that, maintaining the job-house balance has been difficult at the urban periphery. Even with HNT's seemingly well-planned local work market, the employment prospects for many of the relocated farmers are not promising. As revealed by an unpublished survey report on farmers' satisfaction with the EZA programme, many respondents expressed dissatisfaction with their future work prospects after handing over their farmland to the collective farm factory (Wang 2008). Although Huaming New Town's town committee has been actively involved in preparing the farmers for non-farming jobs, there seems to be a mismatch between the job opportunities available and the farmers' qualifications. Most of them still favoured agriculturally-based jobs (Wang 2008).

Table 5- 17: PAR 2-4: Access to work location (cases excluded: 10 due to missing values)

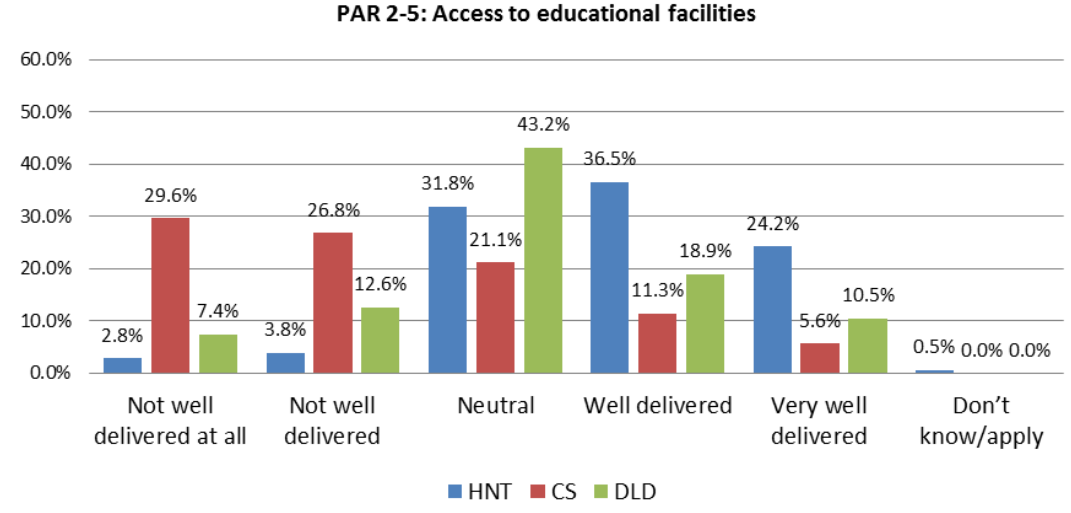
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	202.37	21.052	0.000*
CS	70	139.94		
DLD	88	175.43		



Note: *Significant at 0.001 level.

Table 5- 18: PAR 2-5: Access to educational facilities (cases excluded: 13 due to missing values)

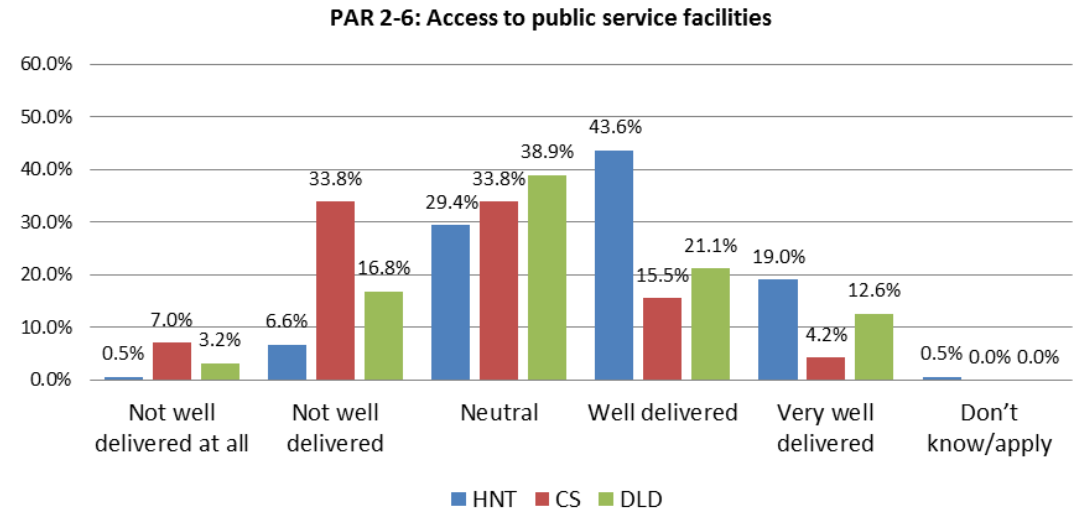
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	218.23	73.917	0.000*
CS	67	100.46		
DLD	88	160.11		



Note: *Significant at 0.001 level.

Table 5- 19: PAR 2-6: Access to public service facilities (cases excluded: 13 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	213.22	54.168	0.000*
CS	67	114.03		
DLD	88	161.68		



Note: *Significant at 0.001 level.

In DLD and CS, it is even more difficult to balance work with housing without a town government that is able to administer industries. In DLD, as confirmed by a representative of the sales department, a large part of the residents in DLD are second home buyers and speculators who work elsewhere. For those owner-occupiers who work in TAIP and BNA, daily commute to work relies heavily on private vehicles as public transit service was inadequate. There are few job opportunities available to the residents within the community with daily maintenance works undertaken by the development company and local services provided by large commercial chain providers.

In CS, the majority of the residents commute long distances to work as there are few industries and work opportunities in the local area. Quite typical of its kind, CS was located in a traditionally under-developed area on the urban fringe, where there are neither mature communities nor good quality public services. Local jobs are not readily available in such areas. Further, as many of the eligible buyers of

the CS homes are previous central city residents, long daily commutes to work in central city areas become an immediate obligation for the new occupants.

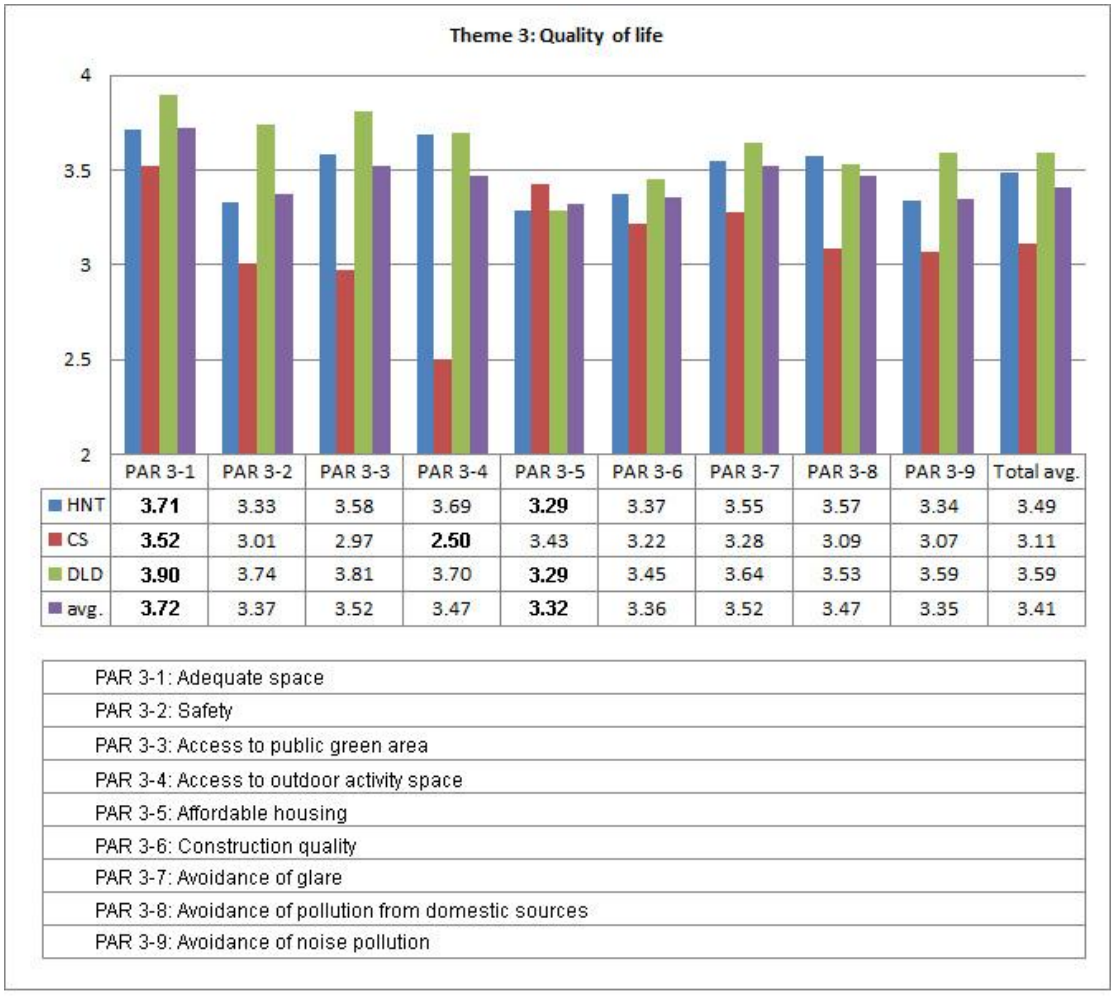
HNT was planned with one secondary school and two primary schools, all of which are located at central locations in the community allowing easy access for all residents. Public service facilities are also well provided in HNT. A booming central commercial street is offering a variety of services including restaurants, retail shops, markets, banks, a post office and a library. However, due to the large size of the community, it is estimated that the distance from the furthest point of the community to the central commercial area is over 1000 meters. Nevertheless, the electric taxis that operate within the community might be a mitigating factor albeit with inevitable costs. Other services such as community clinics, supermarkets, small convenience stores and neighbourhood centres are scattered in the neighbourhoods with pedestrian connections to each residential building allowing for easy access.

Public service facilities in DLD experienced a slow growth in terms of the level of provision. With the small number of occupants especially within the first two years of their occupancy, the development company experienced difficulty with persuading service providers to set up branches in DLD. One interviewed resident recalled that his family had to rely on the rural markets in the nearby villages for food purchase in the first two years after they had moved in (personal communication with Resident G). It was not until Phase Five of the development was completed in 2009 that the occupancy rate began to slowly pick up and so does the level of service provision. The provision of the education facilities, which was once a big selling point, experienced an even worse impact by the low occupancy rate. There had been an agreement between the development company and Shiyan Primary School (one of the best primary schools in Tianjin) to establish a branch of the school in DLD. As the teaching resources are greatly unevenly distributed with the best always going into the few good schools and with Chinese parents' general ideology of giving their children the best education possible, this agreement alone sold the properties in DLD to many buyers. However, the primary school was never opened in DLD although the school building had been finished and all necessary equipment, such as computers, had

been bought. It was the low number of enrolled students that led Shiyan Primary School to withdraw their plan to set up the branch in DLD and enrolled the children to their central city campus instead. The parents who had hoped to put their children in a local school now have to commute an hour daily to take their children to school.

Looking at the responses given by occupants in CS, it can be concluded that, accessibility presents a huge problem to their daily lives, with well over a third of the respondents expressing dissatisfaction on all three parameters related with this issue. Given the fact that CS is situated in the nearest location to the city centre in all study cases, it is implied that, when car ownership is generally at a low level, accessibility depends more on the provision of local services than the distance to service centres. When affordable/low-income housing estates such as CS are planned, minimizing land and development costs are on the top priority as very low profit margins are set for developers. Unlike commercial housing developers, the developers of affordable/low-income housing are less obliged to provide good services for their customers, on the other hand, minimizing service provision to cut cost has become common rule of thumb. For all the above reasons, the low evaluation rating obtained from the residents in CS on accessibility is hardly surprising.

5.6.3 Theme 3: Quality of life



	PAR 3-1	PAR 3-2	PAR 3-3	PAR 3-4	PAR 3-5	PAR 3-6	PAR 3-7	PAR 3-8	PAR 3-9	Total avg.
HNT	**3.71**	3.33	3.58	3.69	**3.29**	3.37	3.55	3.57	3.34	3.49
CS	**3.52**	3.01	2.97	**2.50**	3.43	3.22	3.28	3.09	3.07	3.11
DLD	**3.90**	3.74	3.81	3.70	**3.29**	3.45	3.64	3.53	3.59	3.59
avg.	**3.72**	3.37	3.52	3.47	**3.32**	3.36	3.52	3.47	3.35	3.41

PAR 3-1: Adequate space
PAR 3-2: Safety
PAR 3-3: Access to public green area
PAR 3-4: Access to outdoor activity space
PAR 3-5: Affordable housing
PAR 3-6: Construction quality
PAR 3-7: Avoidance of glare
PAR 3-8: Avoidance of pollution from domestic sources
PAR 3-9: Avoidance of noise pollution

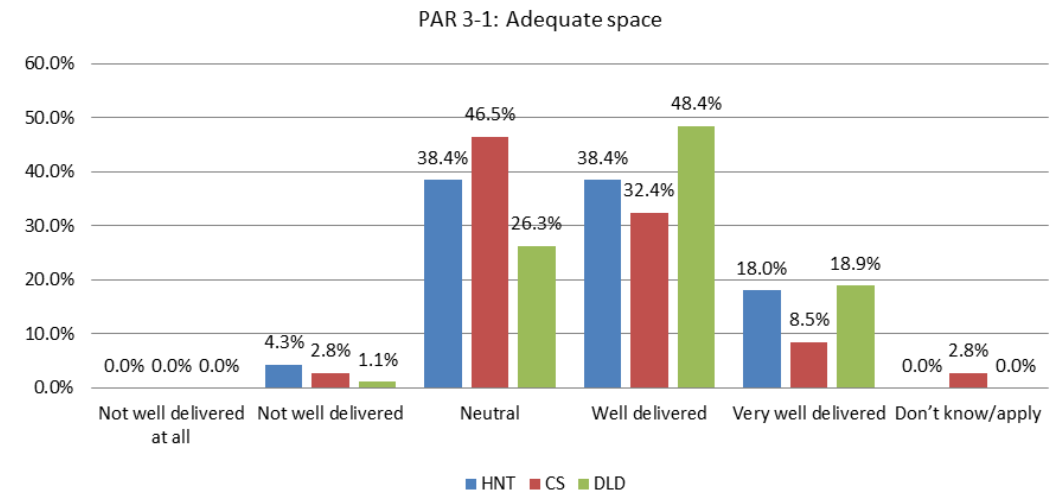
Figure 5- 27: Case comparison of mean scores under Theme 3

Figure 5-27 illustrates the mean scores of the occupants' evaluation of the three studied cases on the theme: Quality of life. DLD had the highest total mean score under this theme (Total avg. mean score: 3.59), HNT was close with a total avg. mean score of 3.49, and CS had the lowest total mean score of all study cases (Total avg. mean score: 3.11). For all three study cases, the highest mean scores was obtained on the parameter "PAR 3-1: Adequate space" (mean scores: HNT: 3.71; DLD: 3.9; CS: 3.52); the lowest mean scores was obtained on the parameter "PAR 3-5: Affordable housing" in both HNT and DLD (mean scores: HNT: 3.29; DLD: 3.29), and on "PAR 3-4: Access to outdoor activity space" in CS (mean score: 2.50). It is noted that DLD achieved the best evaluations on almost all parameters under this theme except "PAR 3-8: Avoidance of pollution from domestic source", on which HNT had the highest mean score. CS had the lowest

evaluation scores on almost all parameters except "PAR 3-5: Affordable housing", where it achieved the best evaluation among all cases. The highest average mean score of all study cases is on "PAR 3-1: Adequate space" (avg. mean score: 3.72); the lowest average mean score is on "PAR 3-5: Affordable housing" (avg. mean score: 3.32). It can be concluded that in all settlement types studied, the occupants are generally most satisfied with the size of unit living space. CS is the housing estate more affordable than the other two study cases, in both of which, occupants are the least happy with the affordability of these housing products.

Table 5- 20: PAR 3-1: Adequate space (cases excluded: 14 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	180.30	9.954	0.006*
CS	64	155.05		
DLD	90	205.12		



Note: *Significant at 0.01 level.

Inferential statistical analysis is carried out on the theme "Quality of life" using the Kruskal-Wallis test with Monte Carlo estimate of significance with 99% confidence level. With case identity as the independent variable and 0.01 as the threshold significance level, the results indicate that:

Adequate living space

Significant difference was identified in the occupants' responses to the question on the extent to which they think they enjoy adequate dwelling space ("PAR 3-1: Adequate space", $H=9.954$, $p<.01$, Table 5-20). Of the study cases, DLD achieved the highest mean rank of 205.12, HNT was rated lower with a mean rank of 180.30, and CS had the lowest mean rank of 155.05. It is noted that the calculated average per unit floor area of DLD and HNT are very close, being 108 and 107 sqm respectively, while CS had the lowest figure at 75 sqm (Table 5-21). Although the average house unit provided in DLD and HNT are of similar size, there are differences in the housing types provided. In DLD, a variety of housing types are designed to cater for a variety of family types, which range from small units for young professionals and couples to large detached houses for large families and retired people. This planned variety, which is based on thorough market research, allows commercial housing estates like DLD to be able to satisfy the different needs of their potential occupants. By contrast, in HNT, housing unit design was not based on market research but rather on the measurements of the relocated rural family's village houses. The focus was entirely on exchanging square metre for square metre a new apartment for the village dwelling, little attention has been paid to the dwelling type that different families might demand. The result is a monotonously looking housing compound with a uniformity of high-rise apartment blocks. Further, the courtyards that form part of the village dwellings was not included in the measurement for housing exchange, which means that once relocated, the rural families would lose their outdoor living space that was once essential to rural life style. For the above reasons, the difference in the evaluations given to HNT and DLD on adequate space can be explained. Being affordable housing targeted at lower-income families, the majority of housing units in CS was kept at small units, which may explain the less favourable evaluation result obtained there. The descriptive statistics demonstrate that less than 5% of the respondents in all three cases indicated dissatisfaction with this feature. Over a half of the respondents in DLD and HNT and about 40% in CS expressed satisfaction. This implies that adequate space as a sustainable settlement feature has been generally well delivered in all the cases studied, and the larger the average housing unit provided the more satisfied the occupants are with this feature.

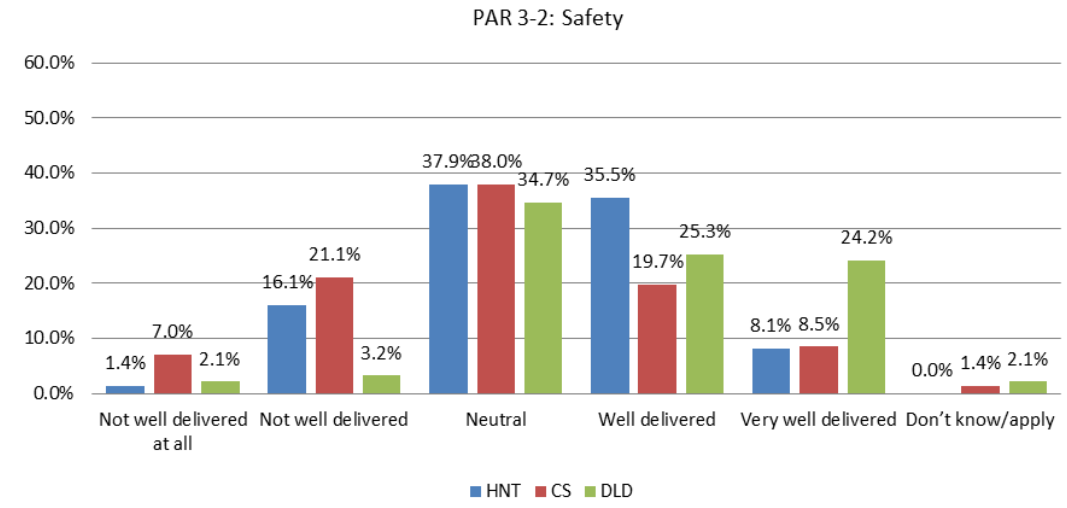
Table 5- 21: Average per unit floor area of study cases

Study Case	Average per unit floor area (sqm) *
HNT	107
DLD	108
CS	75

Note: *Calculated from master plan documents

Table 5- 22: PAR 3-2: Safety (cases excluded: 16 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	177.21	19.959	0.000*
CS	67	146.41		
DLD	85	217.58		



Note: *Significant at 0.001 level.

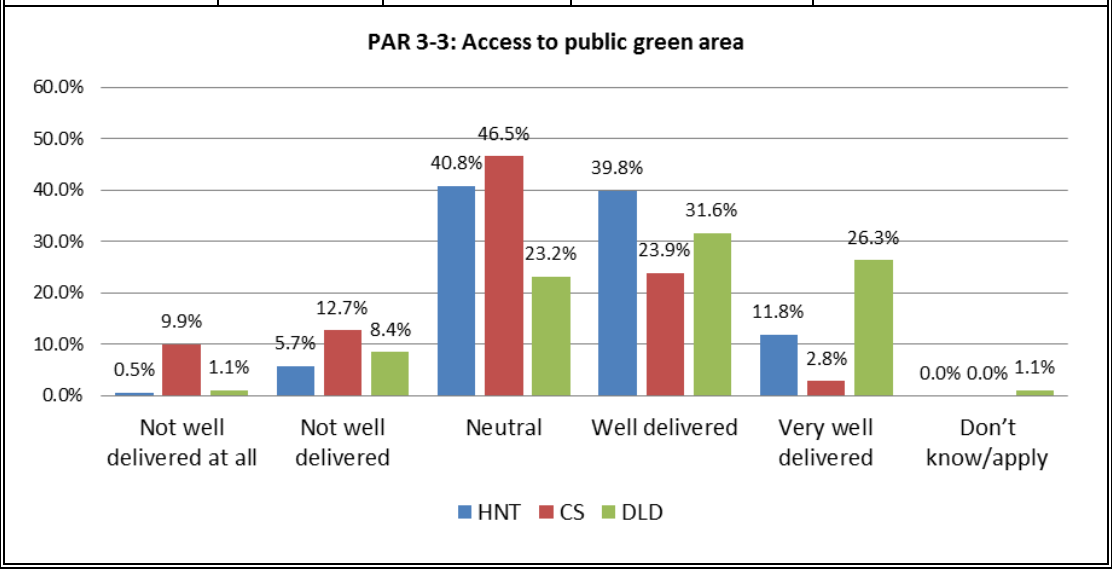
Safety and access to public space

There were significant group differences in the occupants' evaluations on "PAR 3-2: Safety" (H=19.959, p<.01, Table 5-22), "PAR 3-3: Access to public green area" (H=29.587, P<.01, Table 5-23) and "PAR 3-4: Access to outdoor activity space" (H=64.592, P<.01, Table 5-24). On "PAR 3-2: Safety", DLD achieved the highest mean rank (217.58), indicating the highest satisfaction by its occupants on its safety, and CS had the lowest mean rank (146.41), indicating the least successful at providing a safe community for its residents. All the cases studied are in the form of gated communities with clearly defined boundaries and guarded entrances. Building intercom systems and electronic alarm systems are installed in

all residential buildings to ensure authorized access and 24-hour surveillance. Judging from these facts, there is no significant difference at the provision of safety measures among the study cases. Kamphuis et al. (2010) found that neighbourhoods of low socioeconomic status and associated low level of physical activity are more likely to perceive their neighbourhood as unattractive and unsafe. As the socioeconomic status of the occupants of the study cases demonstrates significant differences, this might be an explanation of the identified difference in their perceived safety of their communities. The observation by the researcher that DLD is the community with best provided green spaces and CS being the least well provided, is supported by the evaluation results of "PAR 3-3: Access to public green area" and "PAR 3-4: Access to outdoor activity space", which both show significant group differences on public green area and outdoor activity space accessibility, with DLD achieving the highest mean ranks and CS the lowest. This can be used as evidence to imply the relative physical activity levels in the study cases and thus associated perceived community safety levels.

Table 5- 23: PAR 3-3: Access to public green area (cases excluded: 15 due to missing values)

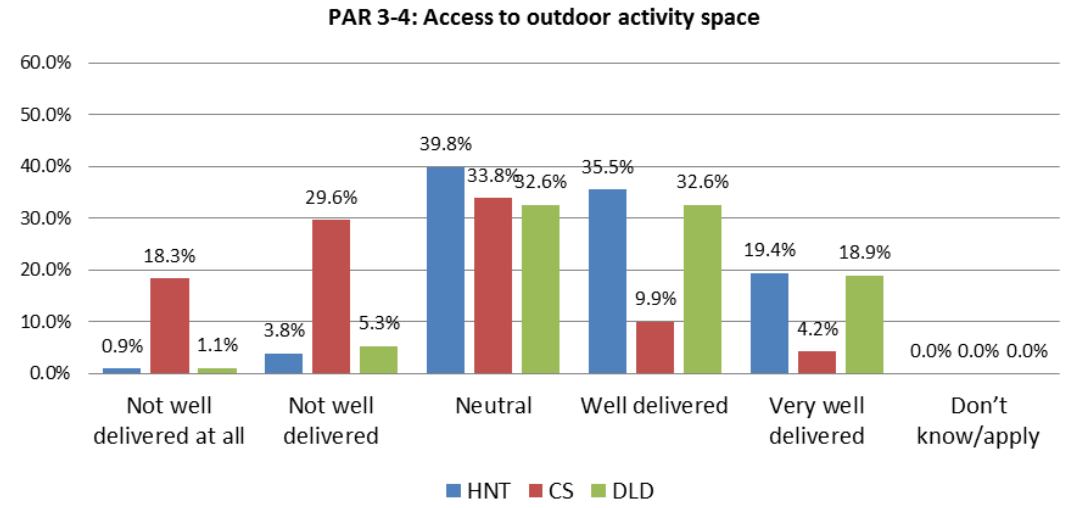
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	185.86	29.587	0.000*
CS	68	127.74		
DLD	86	213.46		



Note: *Significant at 0.001 level.

Table 5- 24: PAR 3-4: Access to outdoor activity space (cases excluded: 13 due to missing values)

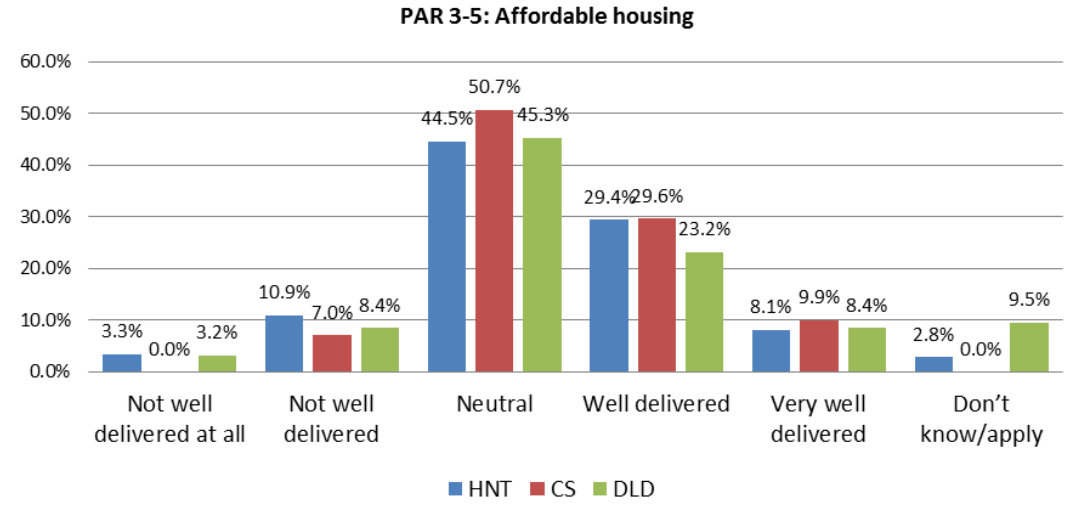
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	210	202.33	64.592	0.000*
CS	68	94.36		
DLD	86	203.78		



Note: *Significant at 0.001 level.

Table 5- 25: PAR 3-5: Affordable housing (cases excluded: 21 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	203	176.59	1.021	0.600
CS	69	188.78		
DLD	84	174.66		



Housing affordability

No significant difference was found in the occupants' evaluation on housing affordability ("PAR 3-5: Affordable housing", H=1.021, P>.01, Table 5-25). However, of all the parameters studied, this is the only one with CS achieving the highest mean rank in all study cases, although the difference is not significant enough to be identified. It can be concluded that, being designated affordable/low-income housing, CS's affordability has not achieved enough credibility among its occupants. Due to the limited public funds available for housing the low-income urban residents, families whose income levels meet the required criteria receive very little subsidies for acquiring housing. The so-called "economical and comfortable" housing is mostly the only available option for these families as subsidized rental housing is severely under-supplied. However, "economical and comfortable" housing still needs to be bought, albeit at a lower than market price. The affordability of such housing has significantly declined in recent years due to two reasons: First, because the prices of "economical and comfortable" housing are not determined upon the affordability of the eligible families, but rather, based on the profit margin necessary for developers to be willing to take on such projects, therefore, with the high-rocketing of land prices and construction costs in recent years, the prices of "economical and comfortable" housing have become less and less affordable; Second, "economical and comfortable" housing are "*maopifang*", a word used to describe such housing as being completed without any interior fittings (such as kitchen, bathrooms and lighting) or decoration. It therefore necessitates additional financial burden on the low-income families before they could make it a home. Similar situation is observed in HNT, whose mean score by occupant evaluation on affordability equals that of DLD (3.29), which provides high-end market housing. Although the EZA programme is termed "Exchange *Zhaijidi* for Apartment", the exchange comes at a price. For the families whose village houses are smaller in area than the apartment units provided in the new town, additional costs for the area difference is required, the price of which is determined by the construction costs plus profit margin of the developer. Like CS, being "*maopifang*", additional costs on interior decoration and fittings are a necessity for all HNT residents. For a typical rural family who are used to living a very basic life, the costs of urban-style living can be sometimes difficult to bear.

Construction quality

There was no significant group difference in the occupants' evaluation on construction quality ("PAR 3-6: Constriction quality", H=3.391, P>.01, Table 5-26). 16.9% of the respondents in CS expressed dissatisfaction with the construction quality of their new homes, and in HNT and DLD the percentages are 9.9% and 10.6% respectively. In HNT and CS, only about a third of all respondents indicated satisfaction with the construction quality, and in DLD, the percentage is higher at 45.3%. As has been mentioned in the analysis for "Theme 1: Ecologically responsible development", complaints on construction quality have been reported in all three sites, which implies that this is a common problem in all peri-urban settlement types. The questionnaire survey result shows that the problem is more severe in government-led public housing projects than in commercial housing projects.

Table 5- 26: PAR 3-6: Construction quality (cases excluded: 36 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	192	169.56	3.391	0.184
CS	63	156.91		
DLD	86	184.54		

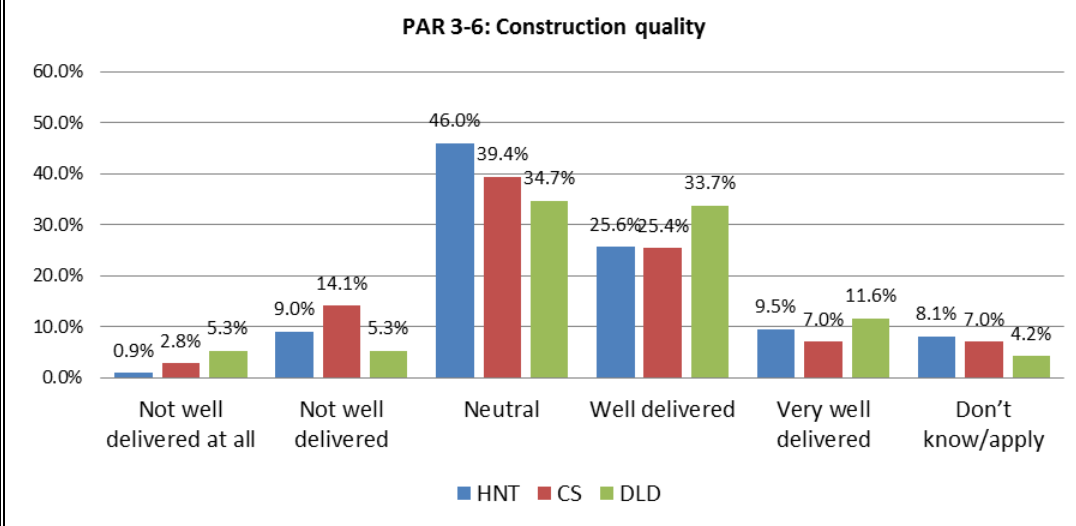
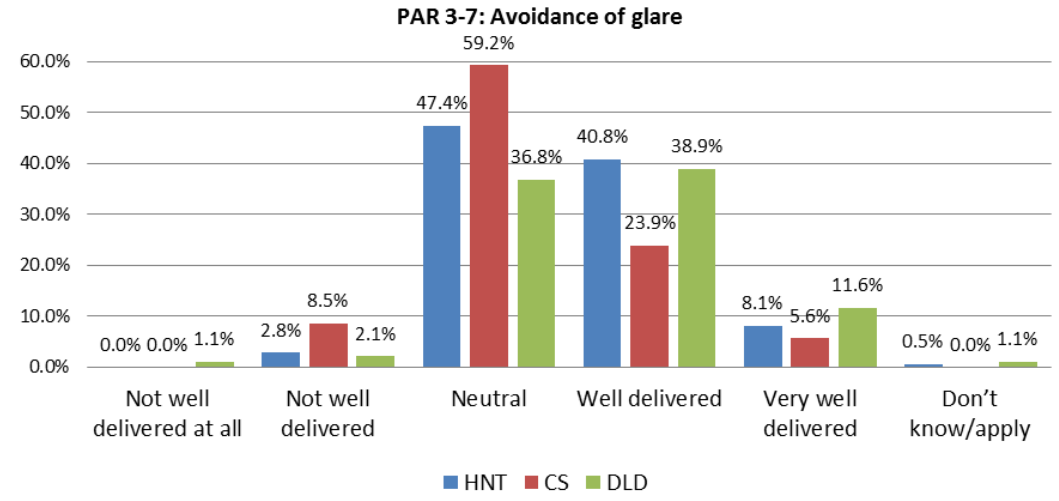


Table 5- 27: PAR 3-7: Avoidance of glare (cases excluded: 13 due to missing values)

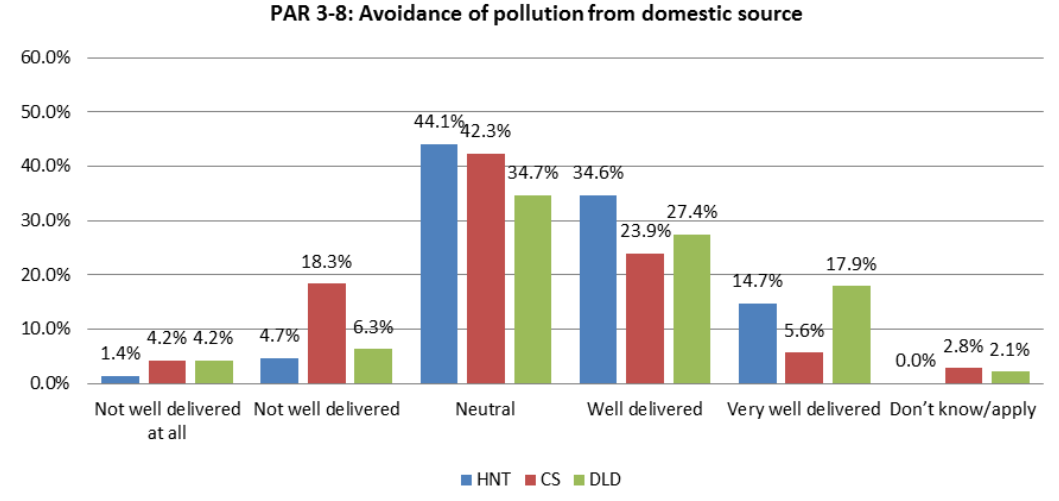
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	209	186.37	11.725	0.003*
CS	69	148.92		
DLD	86	200.05		



Note: *Significant at 0.01 level.

Table 5- 28: PAR 3-8: Avoidance of pollution from domestic source (cases excluded: 14 due to missing values)

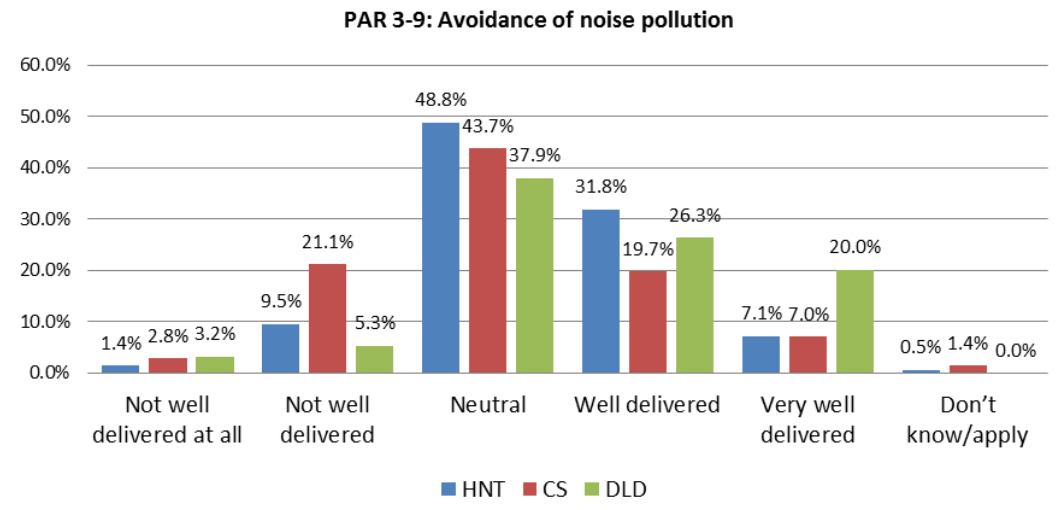
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	210	191.25	13.381	0.002*
CS	67	142.18		
DLD	86	190.44		



Note: *Significant at 0.01 level.

Table 5- 29: PAR 3-9: Avoidance of noise pollution (cases excluded: 14 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	181.18	12.985	0.002*
CS	67	150.69		
DLD	88	207.79		



Note: *Significant at 0.01 level.

Avoidance of pollution

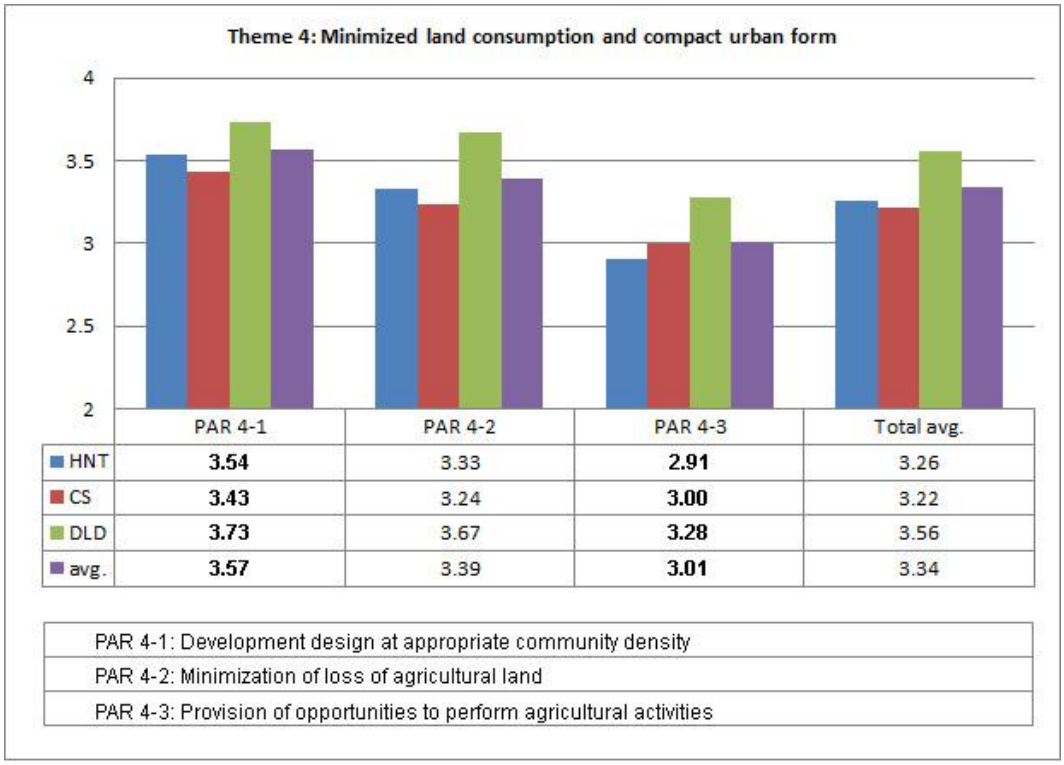
Significant group differences were identified on all parameters related with pollution within the communities ("PAR 3-7: Avoidance of glare", H=11.725, P<.01; "PAR 3-8: Avoidance of pollution from domestic source", H=13.381, P<.01; "PAR 3-9: Avoidance of noise pollution", H=12.985, P<.01, Table 5-27, Table 5-28, Table 5-29). CS has the lowest mean ranks on all three parameters, while DLD achieved the highest mean rank on "PAR 3-7: Avoidance of glare" and "PAR 3-9: Avoidance of noise pollution", and HNT achieved the highest mean rank on "PAR 3-8: Avoidance of pollution from domestic source".

The fact that CS is located next to a busy express road may have contributed to the high perceived levels of noise and glare pollution. By comparison, although both HNT and DLD are also well linked to busy intra-urban highways, they are set back a good amount of distance to avoid impacts of the traffic. Plantation between the road and the estate also plays a big part in noise and pollution prevention in both developments. Within all the studied sites, the internal

neighbourhood physical environments have been significantly improved from the rural villages that existed before them. Pollution from domestic sources has been largely reduced and sanitation well improved. Professional residential estate management companies are now in charge of daily maintenance to ensure sustained quality of living environment. However, due to the lack of legislation in the area of estate management, disputes between residents and their estate management companies and inconsistencies of residents' service charge payment have remained a huge problem. The more deprived the neighbourhood, the more severe these problems tend to be. In two of the study cases, the estate management companies are experiencing financial difficulties (personal communication with Directors C and D). With the low occupancy rate in DLD, the estate management company is struggling to make ends meet to finance daily maintenance with the collected service charge payments. However, because the development of DLD is on-going, the drive to attract future buyers has instigated extra financial support from the development company to help sustain a good quality environment. On the other hand, although the occupancy rate of CS is high, its estate management company is experiencing difficulty with the collection of service charges from the occupants. This is partly due to the many disputes between the occupants and the estate management company on the extent of the service and the rights and obligations attached with service charges (personal communication with Director D). As legislation in the area of estate management is lacking, and contracts between occupants and estate management companies vary from estate to estate, conflicts between the two parties are a quite common phenomenon. As a result, declining estate management services bring about deteriorating environmental quality (Figure 5-28).

Figure 5- 28: Signs of lack of maintenance in CS, Source: Photo taken by author

5.6.4 Theme 4: Minimized land consumption and compact urban form



	PAR 4-1	PAR 4-2	PAR 4-3	Total avg.
HNT	**3.54**	3.33	**2.91**	3.26
CS	**3.43**	3.24	**3.00**	3.22
DLD	**3.73**	3.67	**3.28**	3.56
avg.	**3.57**	3.39	**3.01**	3.34

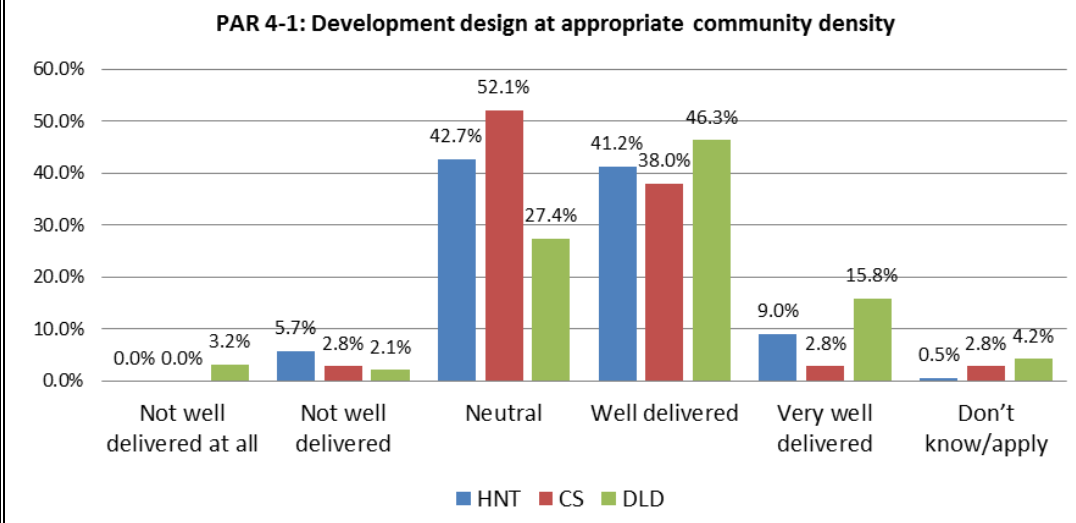
Figure 5- 29: Case comparison of mean scores under Theme 4

Figure 5-29 illustrates the mean scores of the occupants' evaluation of the three studied cases on the theme: Minimized land consumption and compact urban form. DLD achieved the highest total mean score of this theme (Total avg. mean score: 3.56); HNT and CS had very close total mean scores of 3.26 and 3.22 respectively. For all three study cases, the best evaluations were achieved on the parameter "PAR 4-1: Development design at appropriate community density" (mean scores: HNT: 3.54; DLD: 3.73; CS: 3.43); the lowest evaluation scores obtained in all

study cases are on the parameter "PAR 4-3: Provision of opportunities to perform agricultural activities" (mean scores: HNT: 2.91; DLD: 3.28; CS: 3). It implies that the respondents in all three settlements are most satisfied with the building density of their communities but would like more opportunities to be provided for them to practice agricultural activities. It is noted that DLD had the best evaluations of all study cases on all parameters under this theme; CS had the lowest evaluation scores on "PAR 4-1: Development design at appropriate community density" and "PAR 4-2: Minimization of loss of agricultural/green land"; while HNT had the least favourable evaluation on "PAR 4-3: Provision of opportunities to perform agricultural activities".

Table 5- 30: PAR 4-1: Development design at appropriate community density (cases excluded: 11 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	179.23	9.744	0.008*
CS	68	162.68		
DLD	90	209.09		



Note: *Significant at 0.01 level.

Inferential statistical analysis is carried out on the theme "Minimized land consumption and compact urban form" using the Kruskal-Wallis test with Monte Carlo estimate of significance with 99% confidence level. With case identity as the independent variable and 0.01 as the threshold significance level, the results indicate that:

Community density

Significant group difference was identified on the occupants' evaluation on community density ("PAR 4-1: Development design at appropriate community density", H=9.744, P<.01, Table 5-30). DLD achieved the highest mean rank (209.09), HNT had a lower mean rank (179.23) and CS had the lowest mean rank (162.68). The ranking order is in reverse to the order of community density level, whereas DLD has the lowest community density and CS the highest (Table 5-31). However, further study is needed to conclude that occupant satisfaction of community density is negatively correlated with the building density level.

Table 5- 31: Comparison of community building density of study cases

Study case	Average community building density (units/acre)*
HNT	42
DLD	40
CS	60

Note: *Calculated from master plan documents

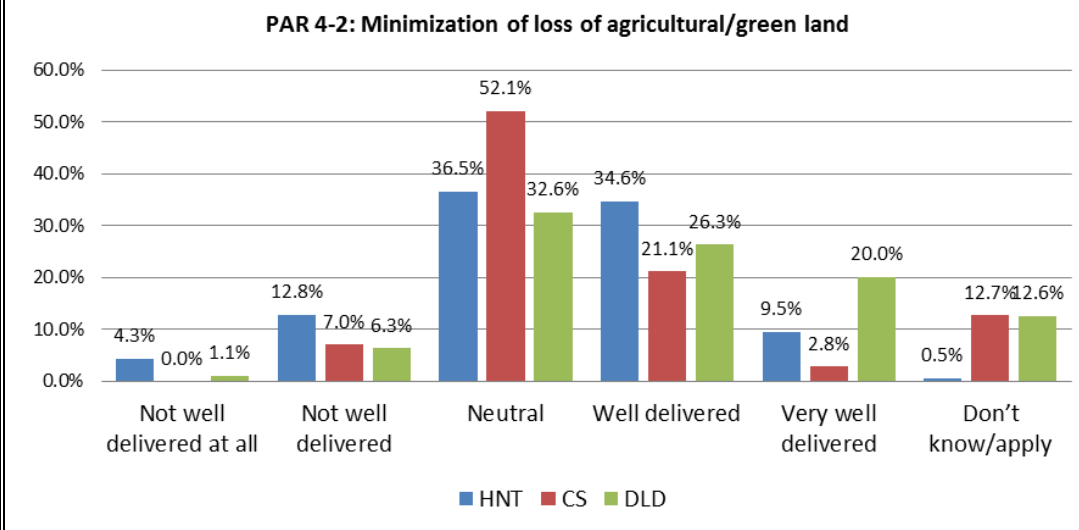
As has been mentioned in Chapter 4, compact development and efficient use of land were given the same policy significance as energy efficiency in the urban planning realm in China. It can be seen from Table 5-31 that, the densities of recently-developed peri-urban settlements in Tianjin are generally at a high level, which indicates that land efficiency has been well implemented in recent peri-urban residential developments. In DLD and HNT, the majority of the respondents think that appropriate density is well to very well delivered in their communities, and less than 6% think that this feature is not well delivered. In CS, 40.8% of the respondents gave a positive evaluation with less than 3% of negative responses, while over half of the respondents gave a neutral answer. The result indicates a general good evaluation on the delivery of appropriate development density among all studied cases. The responses collected in DLD is more scattered than the other two cases, which reflects its mixed density with both low-rise and high-rise neighbourhoods.

Agricultural/green land

There was significant group difference in the evaluation on minimization of loss of agricultural/green land ("PAR 4-2: Minimization of loss of agricultural/green land", H=9.503, P<.01, Table 5-32). DLD had the highest mean rank (199.96), CS got the lowest (153.03), and HNT fell in the middle with a mean rank of 169.67. As no measures of preservation of agricultural/green land has been proposed and implemented in CS, it is considered as a base case for comparison. The statistics result suggests that compared with CS, the wetland preservation measures taken at DLD and the extensive plantations within and surrounding the estate have made a significant impact on the perceived sustainability by its occupants. The percentage of positive evaluation obtained from HNT was a little lower than expected as the most important feature proposed for HNT is the minimization of loss of agricultural land to development. As the descriptive statistics present, 44.1% of respondents in HNT gave a positive evaluation, and 17.1% of respondents gave a negative evaluation, while 36.5% gave a neutral answer. This demonstrates the most scattered data set among all study cases with SD equaling 0.972, which implies the controversy of public opinions on this issue.

Table 5- 32: PAR 4-2: Minimization of loss of agricultural/green land (cases excluded: 30 due to missing values)

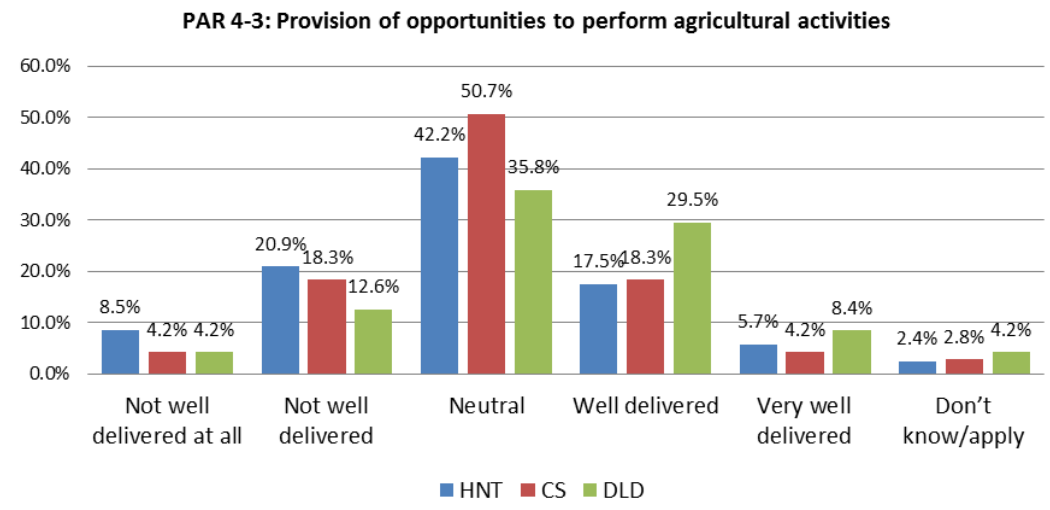
STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	206	169.67	9.503	0.009*
CS	59	153.03		
DLD	82	199.96		



Note: *Significant at 0.01 level.

Table 5- 33: PAR 4-3: Provision of opportunities to perform agricultural activities (cases excluded: 23 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	200	166.49	9.562	0.008*
CS	68	175.21		
DLD	86	204.91		



Note: *Significant at 0.01 level.

Community agriculture

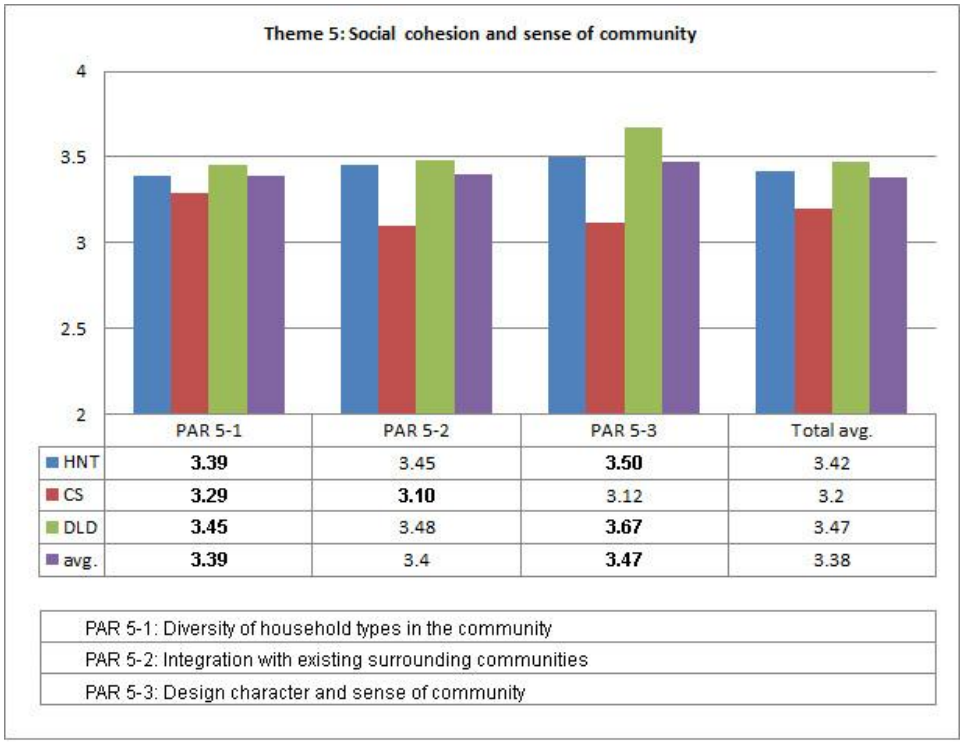
There was significant group difference on the evaluation of the provision of opportunities to perform agricultural activities in the studied communities ("PAR 4-3: Provision of opportunities to perform agricultural activities", H=9.562, P<.01, Table 5-33). As mentioned earlier, many occupants in HNT indicated preference for agriculture-based jobs. For this reason, the opportunities to perform agricultural activities, both as a job option or as a part of a self-sufficient life style, are especially important for the rural population. As the result of the occupants' evaluation shows, however, HNT was the least successful of all study cases on the implementation of this feature (mean rank: 166.49). 29.4% of all respondents in HNT gave the delivery of this sustainability feature a negative evaluation and only 23.2% indicated positive opinion. On the first site visit to HNT in 2009, the researcher had observed spontaneous agricultural activities on the edge of the estate: a dozen of the new town residents were growing vegetables on the narrow

waste land between the estate and the surrounding ring road (Figure 5-30). However, this voluntary undertaking of community food production was soon called to stop by the town committee, and in 2010, a buffer zone of trees and shrubs were planted in the area. The demand of the town residents for opportunities of agricultural activities was yet evident, despite being overlooked by the planners and the authorities. By comparison, DLD received more favourable evaluations by its occupants on this issue. 37.9% of the respondents gave positive responses with 16.8% indicating negative opinions. Unlike HNT, the developer of DLD had recognised a demand within its market for community food production both as a recreation and as part of a healthy life style. In response to this, community allotments have been planned on the edge of the planned estate and a number of peasants in the nearby villages have been employed to help with the maintenance of the gardens and give technical advices where required (Figure 5-31). By 2010, over a hundred families in the community had started growing their own food.

Figure 5- 30 (left): Spontaneous agricultural activities on the edge of the estate at HNT before 2010, Source: Photo taken by author

Figure 5- 31 (Right): Community allotments of DLD, Source: Photo taken by author

5.6.5 Theme 5: Social cohesion and sense of community



	PAR 5-1	PAR 5-2	PAR 5-3	Total avg.
HNT	**3.39**	3.45	**3.50**	3.42
CS	**3.29**	**3.10**	3.12	3.2
DLD	**3.45**	3.48	**3.67**	3.47
avg.	**3.39**	3.4	**3.47**	3.38

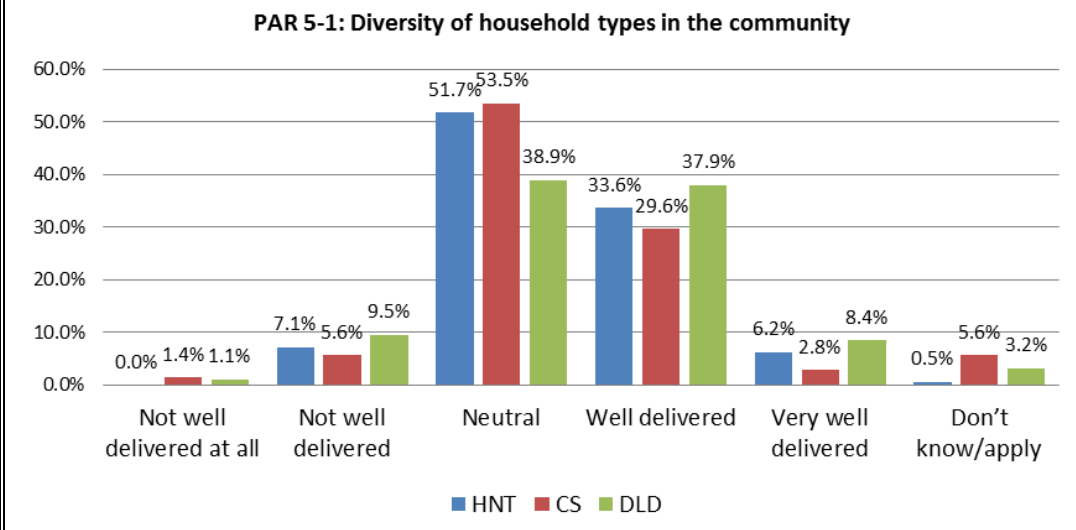
Figure 5- 32: Case comparison of mean scores under Theme 5

Figure 5-32 illustrates the mean scores of the occupants' evaluation of the three studied cases on the theme: Social cohesion and sense of community. Of all study cases, DLD achieved the highest total mean score (Total avg. mean score: 3.47); HNT had a close total mean score of 3.42; and CS had the lowest total mean score under this theme (Total avg. mean score: 3.2). For both HNT and DLD, the highest evaluation scores were achieved on the parameter "PAR 5-3: Design character and sense of community" (mean scores: HNT: 3.5; DLD: 3.67), while the lowest evaluation scores were obtained on the parameter "PAR 5-1: Diversity of household types in the community" (mean scores: HNT: 3.39; DLD: 3.45). For CS, the best evaluation was given to parameter "PAR 5-1: Diversity of household types in the community" (mean score: 3.29), and the least favourable evaluation was given to "PAR 5-2: Integration with existing surrounding communities" (mean score: 3.1). DLD had the best evaluations among all study cases on every parameter under this theme while CS had the worst evaluations. The case average scores on all three parameters under this theme are quite close with differences less than 0.1. "PAR 5-3: Design character and sense of community" was the best evaluated parameter (mean score: 3.47), and "PAR 5-1: Diversity of household

types in the community" was given the least favourable evaluation (mean score: 3.39). It can be concluded that, generally speaking, the respondents of this survey are more satisfied with the character and sense of community than with the household diversities in their communities.

Table 5- 34: PAR 5-1: Diversity of household types in the community (cases excluded: 12 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	182.57	1.992	0.366
CS	66	170.89		
DLD	91	192.75		



Inferential statistical analysis is carried out on the theme "Social cohesion and sense of community" using the Kruskal-Wallis test with Monte Carlo estimate of significance with 99% confidence level. With case identity as the independent variable and 0.01 as the threshold significance level, the results indicate that:

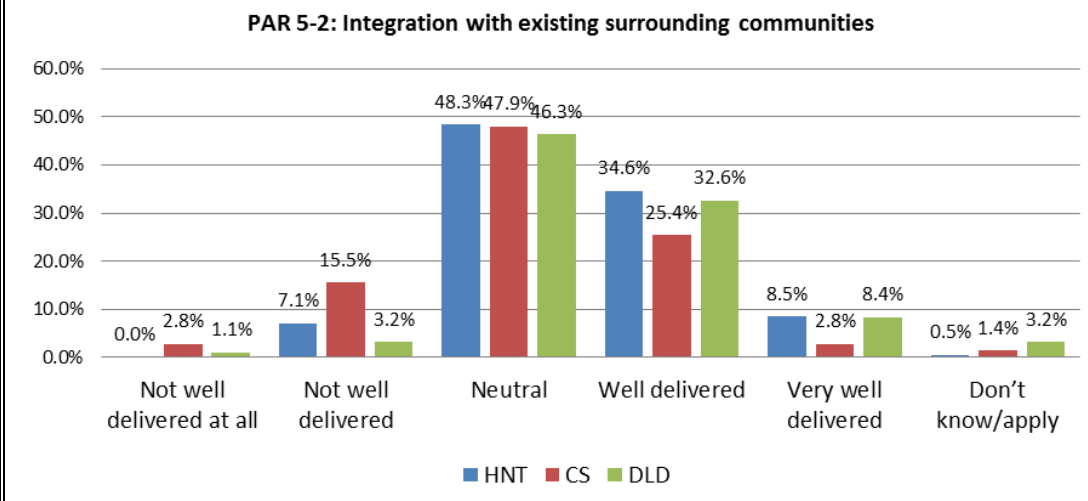
Household diversity

No significant group difference was identified on the evaluation of diversity of household types (PAR 5-1: Diversity of household types in the community, H=1.992, P>.01, Table 5-34). All the study cases demonstrate, to some extent, planned diversity of housing types to accommodate a variety of households. CS has a more homogeneous house type composition than the other two study cases

with mostly small apartment units in high-rise blocks. DLD provides much more variety of house types, from large detached villas to small apartment units. However, social mixing, on the whole, is lacking in all studied communities. Each community, although includes small and large families, shows monotony of social composition. In the plan of the study cases, their target occupant groups are clearly defined. DLD is targeted at the urban affluent and investors; HNT's residents come entirely from the rural villages that it replaces; and CS's target occupants are required to meet the low-income criteria to be eligible to live here. Thus the peri-urban social group composition is a destined patchwork, with groups of distinct socioeconomic levels each enclosed within itself.

Table 5- 35: PAR 5-2: Integration with existing surrounding communities (cases excluded: 15 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	208	187.52	9.571	0.010
CS	67	149.06		
DLD	87	192.10		



Integrated communities

No significant group difference was identified on the evaluation of integration with existing surrounding communities (PAR 5-2: Integration with existing surrounding communities, H=9.571, P>.01, Table 5-35). It has been observed that all three study cases have taken the form of gated communities with clearly defined perimeters. The integration with existing surrounding communities was

not particularly considered when designs of the communities were proposed. The communities were, in fact, designed to be self-sustained with all the necessary services and facilities. The residents, on the other hand, also do not see the necessity of travelling to neighbouring communities once the community services are more or less complete. Some of the interviewed respondents even indicated a feeling of security and privilege within their gated community (personal communication with Residents F and I). The majority of the respondents of this survey indicated either satisfaction on the implementation of this feature or did not have an opinion on the issue (HNT: 43.1% "well delivered" + "very well delivered", 48.3% "neutral"; DLD: 41.0% "well delivered" + "very well delivered", 46.3% "neutral"; CS: 28.2% "well delivered" + "very well delivered", 47.9% "neutral"). The built environment of the communities as defined by their physical appearance holds stark contrast to their neighbouring rural villages, which further prohibits the generation of integration between the new and the old. The contrast between the observed implementation outcome of this sustainability feature and that perceived by the respondents of the survey, infers that as sustainable community criteria, "integration with existing surrounding communities" is neither a considered principle in current practice in China, nor is celebrated among community residents.

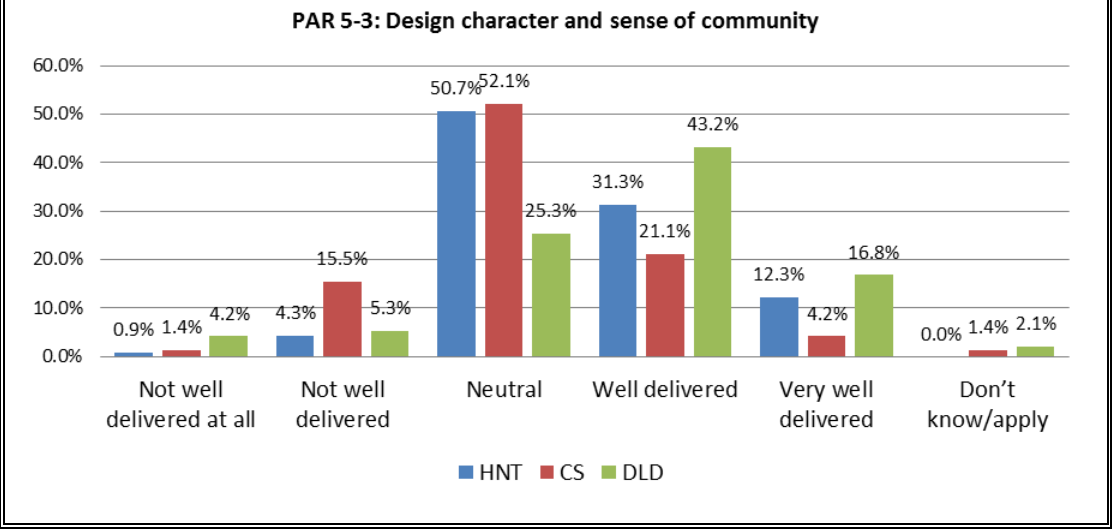
Sense of community

Significant group difference was identified on the evaluation of the design character and sense of community ("PAR 5-3: Design character and sense of community", $H=20.032$, $p<.01$, Table 5-36). DLD achieved the highest mean rank under this parameter (212.82) and CS had the lowest mean rank (141.67), with HNT felling in the middle (mean rank: 185.15). 60.0% of the respondents in DLD thought that their community had a strong design character and a good sense of community; 43.6% of the respondents in HNT thought the same about their community while over half of the respondents gave a neutral response; in CS, only 25.3% considered positively on the implementation of this feature with 16.9% feeling negative while the majority gave neutral answers. Judging from the physical outcome, DLD surely has the most strong design character compared with the other two communities. The design concept of "New Urbanism" and the building forms borrowed from Europe, together with the well-engineered wetland

environment, all gave DLD a wow-factor in appearance and its residents a strong sense of prestige and belonging. By contrast, HNT seems to lack some design character, which relates it either to its past or to its surroundings. Its built forms represent more of a typical urban gated community than its rural legacies. The endeavour of preserving entirely the original community structure has been successful and has allowed the traditional neighbourhood social network to be largely intact. For this reason, the sense of community in HNT is quite strong, albeit the sense of belonging to the new home will take time to establish. In comparison, as affordable housing community, CS entails destruction of inner-urban neighbourhoods together with their social bonds. Reconstruction of the sense of belonging and community feeling appears to be unsuccessful according to the result of this survey. Indeed, the physical built environment, as a whole, lacks character. Although neighbourhood deprivation index is not calculated for this study, CS most definitely appears to be the most deprived community of all three studied. Not only is CS located in one of the most underdeveloped areas of the city, but the internal environment of the community show signs of declination.

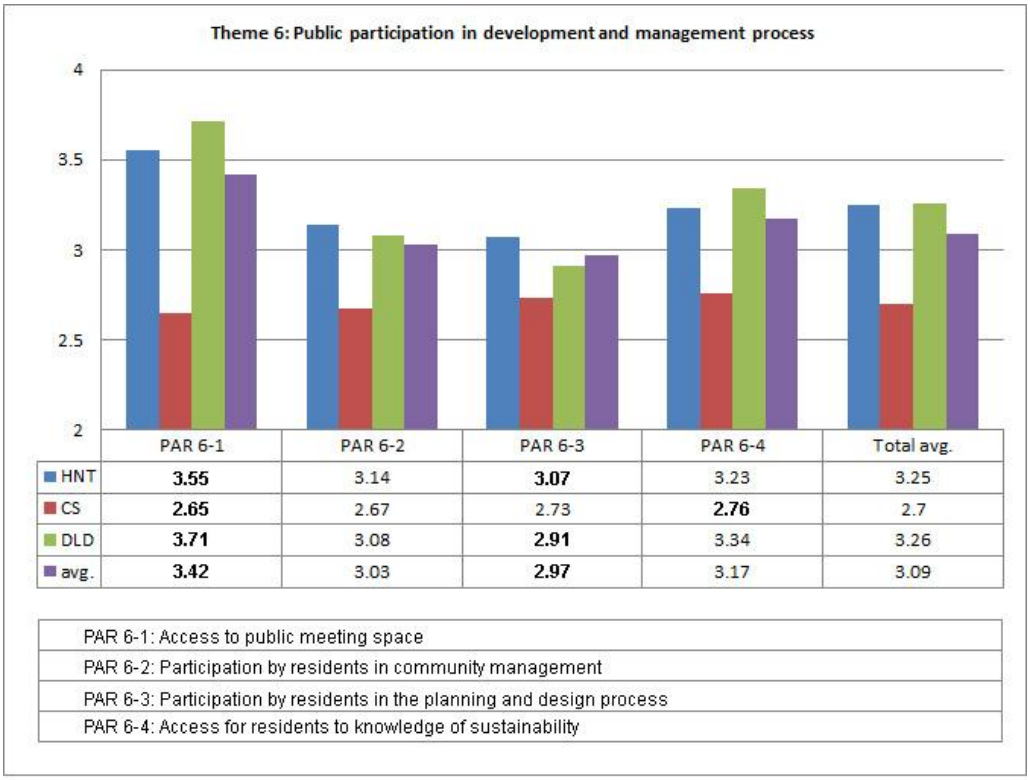
Table 5- 36: PAR 5-3: Design character and sense of community (cases excluded: 10 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	210	185.15	20.032	0.000*
CS	67	141.67		
DLD	90	212.82		



Note: *Significant at 0.001 level.

5.6.6 Theme 6: Public participation in development and management process



	PAR 6-1	PAR 6-2	PAR 6-3	PAR 6-4	Total avg.
HNT	**3.55**	3.14	**3.07**	3.23	3.25
CS	**2.65**	2.67	2.73	**2.76**	2.7
DLD	**3.71**	3.08	**2.91**	3.34	3.26
avg.	**3.42**	3.03	**2.97**	3.17	3.09

PAR 6-1: Access to public meeting space
PAR 6-2: Participation by residents in community management
PAR 6-3: Participation by residents in the planning and design process
PAR 6-4: Access for residents to knowledge of sustainability

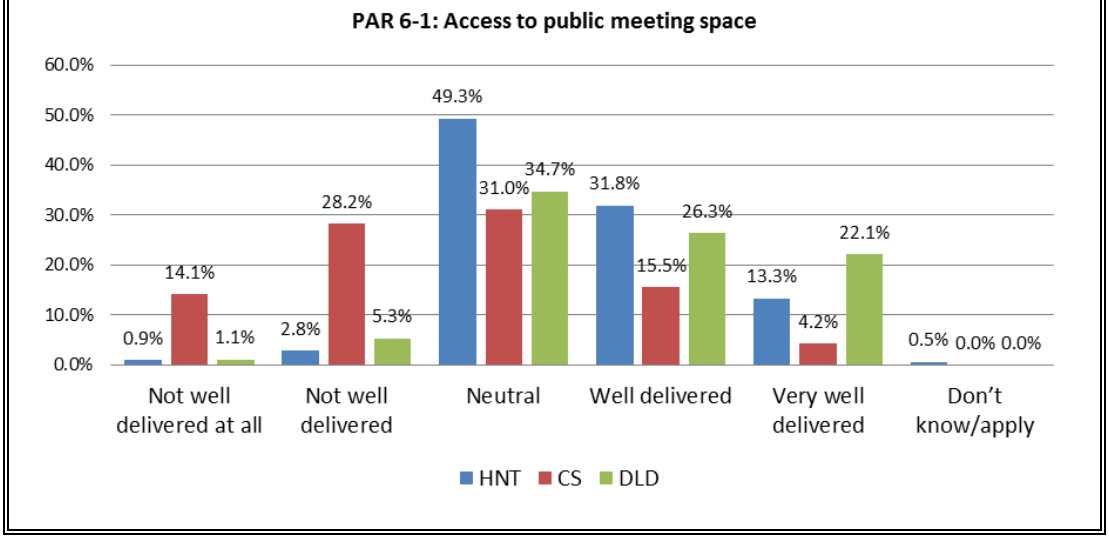
Figure 5- 33: Case comparison of mean scores under Theme 6

Figure 5-33 illustrates the mean scores of the occupants' evaluation of the three studied cases on the theme: Public participation in development and management process. DLD and HNT had very close total mean scores under this theme (DLD: 3.26, HNT: 3.25); CS had the lowest total mean score of all study cases (Total avg. mean score: 2.7). Once again, the parameters that were accorded the best and worst evaluations correspond in the study cases HNT and DLD, both of which received best evaluation on "PAR 6-1: Access to public meeting space" (mean scores: HNT: 3.55; DLD: 3.71); and worst evaluation on "PAR 6-3: Participation by residents in the planning and design process" (mean scores: HNT: 3.07; DLD: 2.91). For CS, similar evaluation scores were given to all parameters under this theme, all of which being under 3. "PAR 6-4: Access for residents to knowledge of sustainability" achieved a slightly higher score (mean score: 2.76), while "PAR 6-1: Access to public meeting space" was given the lowest score (mean score: 2.65). Of all study cases, HNT achieved the best evaluations on two of the parameters: "PAR 6-2: Participation by residents in community management" and "PAR 6-3: Participation by residents in the planning and design process"; DLD

achieved the best evaluations on all the rest parameters: "PAR 6-1: Access to public meeting space" and "PAR 6-4: Access for residents to knowledge of sustainability"; while CS had the lowest evaluation scores on all four parameters under this theme. Putting the data obtained from all three study cases together, it is noted that "PAR 6-1: Access to public meeting space" was given the most favourable evaluation (avg. mean score: 3.42); and "PAR 6-3: Participation by residents in the planning and design process" was given the least favourable evaluation (avg. mean score: 2.97). It can be implied that although places dedicated to public meeting purposes are provided, public participation, especially in the planning and design process has not been well practiced in the studied cases.

Table 5- 37: PAR 6-1: Access to public meeting space (cases excluded: 19 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	207	190.72	44.387	0.000*
CS	66	108.80		
DLD	85	207.08		



Note: *Significant at 0.001 level.

Inferential statistical analysis is carried out on the theme "Public participation in development and management process" using the Kruskal-Wallis test with Monte Carlo estimate of significance with 99% confidence level. With case identity as the independent variable and 0.01 as the threshold significance level, the results indicate that:

Public meeting space

There was significant group difference on the evaluation by the occupants on accessibility to public meeting space (PAR 6-1: Access to public meeting space, H=44.387, p<.01, Table 5-37). DLD had the highest mean rank (207.08), indicating the most successful at providing public meeting space for its occupants; HNT came close with a mean rank of 190.72, indicating that it has achieved some success at providing public meeting space; and CS had the lowest mean rank (108.80), indicating the least successful with the implementation of this sustainable community feature. Public meeting space and community activity centres have been planned and provided in both HNT and DLD. In HNT, singing, dancing, chess and card game groups have been established among community residents, who meet regularly in the activity centres that are located at the center of each neighbourhood; In DLD, both indoor and outdoor community meeting spaces are provided. The well-planted community gardens provide plenty of shaded sitting areas that cater for outdoor gathering, while community activity rooms undertake indoor meetings. In comparison, little community meeting space has been provided in CS due to its very high community density and the limited space available for public activities.

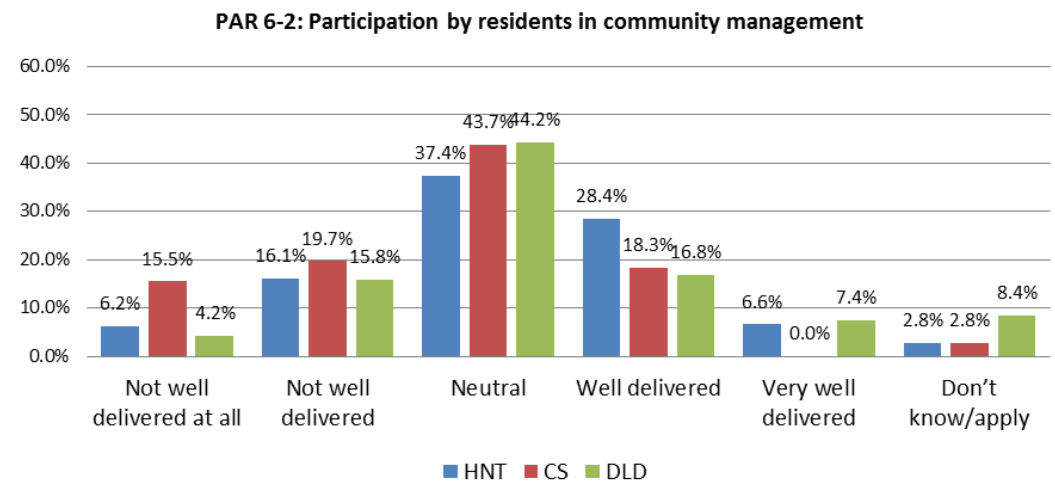
Public participation in community management

Significant difference was identified among studied cases on their occupants' evaluation on the participation by residents in community management ("PAR 6-2: Participation by residents in community management", H=10.517, p<.01, Table 5-38). HNT achieved the highest mean rank (187.72), indicating the most successful at the delivery of this feature, and CS had the lowest mean rank (144.00), indicating the least successful outcome. No respondents in CS think that participation by residents in community management has been very well implemented, and only 18.3% thinks it is fairly well implemented, while 35.2% consider it as not well delivered or not well delivered at all. Negative responses in the other two study cases are also quite high (HNT: 22.3%, DLD: 20.0%), which indicates that lack of implementation of this sustainability feature is prevalent in all study cases. Participation of residents in community management affairs is normally practiced through the residents' committee, which is formed by elected

representatives of the residents of the community. For various reasons, the establishment of the residents' committee has been completed in none of the study cases. Having preserved much of the previous town administration structures, HNT underwent the most minor neighbourhood change in all study cases, while its management hierarchy retained that of the traditional villages. However, as democracy and public involvement in community affairs was suppressed under Chinese traditional ideology, public participation in community management, although having better institutional validity than the other two cases, is still limited in the HNT. In DLD and CS, community management is dominated by decisions made by the management company, whose willingness to cater to the residents' needs decides the quality of the services provided.

Table 5- 38: PAR 6-2: Participation by residents in community management (cases excluded: 24 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	200	187.72	10.517	0.004*
CS	69	144.00		
DLD	84	178.60		



Note: *Significant at 0.01 level.

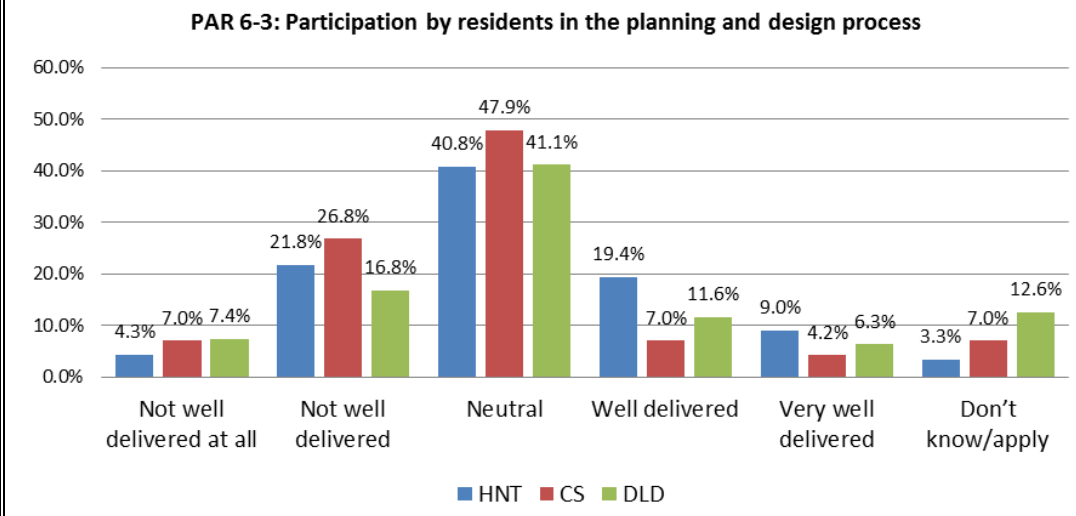
Public participation in planning and design

There was no significant group difference in the evaluation on participation by residents in the planning and design process ("PAR 6-3: Participation by residents in the planning and design process", H=6.574, p>.01, Table 5-39). High

percentages of negative responses were obtained from all study cases. In HNT, 26.1% of the respondents indicated negative opinion with 28.4% positive responses; in DLD the percentages are 24.2% and 17.9% respectively; and in CS, the percentages are 33.8% and 11.2% respectively.

Table 5- 39: PAR 6-3: Participation by residents in the planning and design process (cases excluded: 31 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	201	183.14	6.574	0.040
CS	66	149.52		
DLD	79	169.01		



The EZA programme experimented at HNT was intended as a flagship for public participation in rural urbanization. The public hearings and consultations that have been carried out have been positively embraced among the rural communities, while minimising conflicts between the local authority and the public, which were common in previous cases of farmland expropriation. However, it was observed that public participation was largely limited to the housing exchange process, with planning and design decision-making still dominated by authoritative decision and professional opinion. Moreover, although resettlement was voluntarily-based, with most of the village industries and businesses now relocated to the new town, life in the old town became more and more difficult for those villagers who were against the resettlement. Judging from the inclination of the local authority to

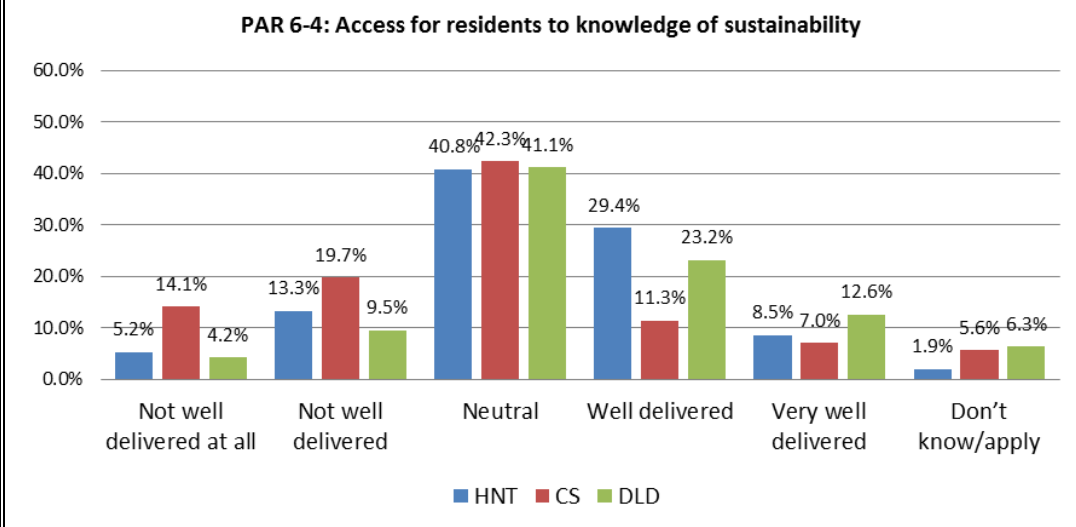
relocate all village residents, it can be predicted that it will not be long before "not moving" will become too difficult an option for the village families. CS and DLD, by contrast, showed no specific endeavour in involving local communities in decision-making, with agreements of land expropriation signed between the village/town government and the developer. Financial compensation was then distributed to farmers on the condition that they leave their land to move to resettlement housing estates or homes elsewhere.

Knowledge of sustainability

Significant group difference was identified on the evaluation on residents' access to knowledge of sustainability ("PAR 6-4: Access for residents to knowledge of sustainability", H=13.710, p<.01, Table 5-40). DLD had the highest mean rank of all study cases (194.35), indicating the best implementation of providing access to knowledge of sustainability to its residents; HNT had a lower mean rank (186.14) and CS had the lowest mean rank (140.13), indicating the least satisfactory provision of knowledge of sustainability as perceived by its occupants.

Table 5- 40: PAR 6-4: Access for residents to knowledge of sustainability (cases excluded: 19 due to missing values)

STUDY CASE	*N*	*MEAN RANK*	*KRUSKAL-WALLIS STATISTIC (H)*	*MONTE CARLO SIGNIFICANCE (P)*
HNT	205	186.14	13.710	0.001*
CS	67	140.13		
DLD	86	194.35		



Note: *Significant at 0.01 level.

The education centre built at DLD has proven to be quite successful both as a landmark of the community and as a knowledge centre for local residents and visitors alike to learn about the workings of wetland protection and other sustainable building techniques. Similar approach has been taken at HNT, which saw the construction of a community museum. The museum features the history of the town and explains the approach of the EZA programme. Although the museum is more of a part of political campaigning than a sustainability knowledge centre, it nonetheless fosters a sense of continuity for the rural residents and provides a place for them to reflect on the past and think about the present and the future. In CS, although handouts and posters containing information on energy-saving and sustainable living are occasionally posted, according to the management company, it has clearly made less effect on the residents on their perception of access to the knowledge of sustainability.

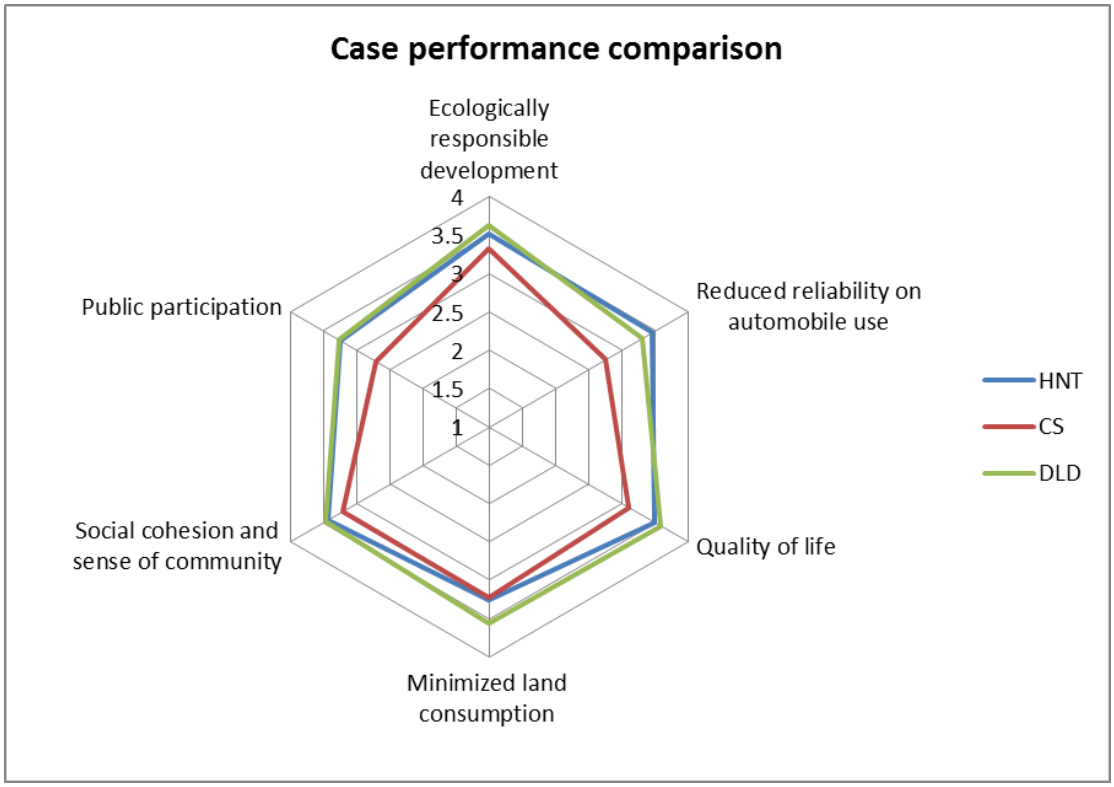


Figure 5- 34: Radar chart showing comparison of sustainability performance of studied cases

5.7 Discussion

The radar chart shown in Figure 5-34 illustrates the comparison of overall sustainability performance of the three studied cases. It can be concluded that Dongli Lake Development is the most sustainable settlement among all three cases, outperforming the other two cases in all evaluated themes except "Reduced reliability on automobile use". City Sunshine is found to be the least sustainable settlement with the lowest evaluated sustainability performance on all six themes. The sustainability performance of Huaming New Town came close with Dongli Lake Development on two research themes "Social cohesion and sense of community" and "Public participation", and outperforming the other two cases on "Reduced reliability on automobile use", while being outperformed by Dongli Lake Development on "Ecologically responsible development", "Minimized land consumption and compact development" and "Quality of life".

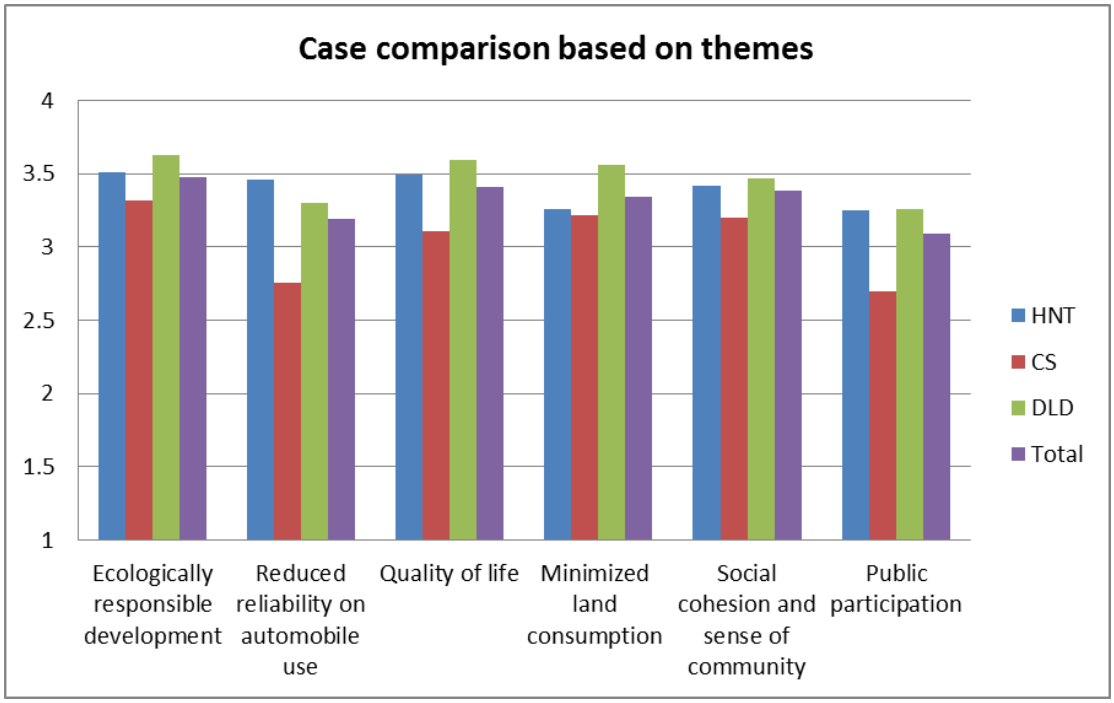


Figure 5- 35: Comparison of study cases based on themes

While the comparison of the overall performance of each case gives a general idea of the relative strengths and weaknesses of each development case, a case comparison based on themes will best illustrate how successful each specific sustainability theme is implemented in the studied cases as a whole. Figure 5-35

illustrates the comparison of study cases by plotting the total average mean scores for all six themes. It can be concluded that:

1. The best implemented sustainability themes in peri-urban settlement development in Tianjin are "Ecologically responsible development" and "Quality of life".
2. "Minimized land consumption and compact urban form" and "Social cohesion and sense of community" are themes that are less successfully implemented;
3. "Reduced reliability on automobile use" and "Public participation in development and management process" are the least well implemented sustainability themes in the studied cases.

"Ecologically responsible development" and "Quality of life"

As mentioned in Chapter 4, a transformation towards more "pro-environment" and "pro-poor" approaches has been made evident in urban development strategies and policy interventions in recent years. Through the analysis of the development cases in Tianjin, it can be found that this policy shift has made considerable impact on the current development practices, as demonstrated by the favourable evaluations on the themes "Ecologically responsible development" and "Quality of life".

It was discovered in the studied cases that, sustainable technologies such as solar-hot-water systems and higher energy-efficiency building regulations have been adopted in new peri-urban settlement developments. It has been noted that the use of renewable energy systems has been more successfully implemented in government-led cases, i.e. Huaming New Town and the New Homes projects (except City Sunshine). This is largely due to favourable policy and financial support on the use of renewable energy. By contrast, the private commercial development of Dongli Lake Development has achieved less success at implementing this sustainability feature. Passive energy-efficient building design was found to be well implemented in all study cases, demonstrating a general good practice on this issue. It was found that recent peri-urban residential development in Tianjin has been regulated by new building design regulations

requiring higher energy efficiency with improved building envelope designs. However, it is found that the actual energy-saving effect could still be compromised by the less regulated construction practice.

It was found that the usage and the awareness of using domestic energy-saving appliances were low among the residents of peri-urban settlements in Tianjin. It was also found that the use of water recycling systems was abandoned due to running and maintenance costs. There are currently no incentives on the home usage of energy- and water-saving equipment, which makes their application uneconomical.

It was found that, the protection of natural resources, especially natural wetlands, has been strengthened through strict state and county level regulation exerting significant impact on local development practice. While it is doubtful that the engineered ecology of Dongli Lake Development can be truly sustainable in environmental and economic terms, there is also the question of whether public assets such as natural wetlands should be appropriated as private development sites. Many scholars have noted the reinforcement of unequal conditions of environmental quality on different social groups as a result of private appropriation of land - freezing access to and cancelling ecological functions of natural systems and subjecting lower-income groups to environmental hazards (Allen 2003). In the case of Dongli Lake Development specifically, a more sustainable approach would have been to retain open access to the wetlands for public use and engage the municipal government in its maintenance rather than relying solely on the private sector.

The quality of life has been significantly improved in the new peri-urban settlements compared with the previous rural dwellings that existed before them. As main benefits of urbanization, peri-urban residents now enjoy adequate dwelling space, modern-style living, better environment with significantly improved sanitation, infrastructure provision, safety measures, and diminished pollution. Housing construction quality and affordability, on the other hand, remains problematic. Less than satisfactory construction quality is a commonly observed issue in all peri-urban settlement development cases studied, which

points to the ill-regulated construction process and maintenance standards. Housing affordability, albeit being especially addressed in both the affordable housing and the rural resettlement projects, has not been successfully resolved. More public funding would need to be invested into this area to mitigate the gap between the demand and the supply sides.

"Minimized land consumption and compact urban form" and "Social cohesion and sense of community"

As represented by the study cases, per-urban residential settlements have taken compact forms and have been developed at high densities in recent years. It shows that the urban land use policy of making efficient use of land, which has often been promulgated under the heading "energy/land efficient housing and public buildings", has been well implemented with current peri-urban residential development.

The EZA approach, experimented at Huaming New Town, demonstrates an innovative attempt to resolve the conflict between urban development and the preservation of cultivative land. Yet, as this study has shown, there has been controversy of opinion among the new town residents on the programme's effect of agricultural land protection. Although it is justifiable to assume that a balance can be achieved between agricultural land loss and increased agricultural land according to the proposal of the EZA programme, a question that remains unresolved is, whether the productivity and ecological quality of the replacement, former *zhaijidi* will meet the standard required. Re-cultivation and replantation of derelict land usually entails high technical and financial expenses, nevertheless they often fail to establish a natural ecosystem with steady state and easy maintenance (Jochimsen 1991). High-quality re-cultivation requires that the new landscape offers a substitute and an offset for the lost land, and provides a long-term basis as living and economic space for generations to come. The re-cultivation approach taken at Huaming New Town is indoor-based using mainly fruit and vegetable greenhouses as opposed to open-air re-cultivation based on soil remediation and replantation. It thus avoids many of the uncertainties and costs associated with soil treatment and maintenance. It is also coherent with the national strategy of agricultural transition from basic grain to high-value-added

production (Zhao 2010a). In this sense, the EZA approach has great prospects to achieve its goals. However, the impact on the ecosystem and biodiversity was neither mentioned in the initiatives nor assessed during and after the re-cultivation. This infers that the EZA approach was more from a land-use perspective than an ecological one and overlooked the issue of maintaining a balanced ecosystem. According to "NGO Sustainable Agriculture Treaty", sustainable agriculture "preserves biodiversity, maintains soil fertility and water purity, conserves and improves the chemical, physical and biological qualities of the soil, recycles natural resources and conserves energy" (Gold 1999). While there is no doubt that the EZA approach experimented in Tianjin is a big step forward from the uncoordinated acquisition of farm land for urban development, its success to offset the adverse effects of urban growth remains to be justified upon further evidence of long-term food production stability and ecological environment sustainability.

Another problem brought about by the EZA programme, which was perhaps not intended by the planners, was that of the change of the means of living inevitably associated with the change of living environment. The EZA programme was designed to make use of *zhaijidi*, and left the transfer of farm land ownership from the village families to the newly-established collective farm factory on a voluntary basis. However, maintaining the farm was not an easy option for the new town residents and barriers to this include an expensive and long daily commute from the new town to the farms, as well as the low profit available in family-based farming. Therefore most of the resettled families gave up their farms, in exchange for which, they received monetary compensation, calculated according to the yield of their farms.

Moreover, the life style change from self-sufficient rural life to consumerism-based urban life, necessitated by the EZA programme, inevitably brought about increased living costs and a change of the means of living. As has been discussed in Chapter 4, farmers without land are often vulnerable to impoverishment due to their lack of competitiveness in the urban job market. This study has found that, by way of expropriating the villages and farmland and resettling the farmers, the EZA programme has resulted in a large number of rural population being forced

out of self-sufficiency and facing difficulties of adjusting to a non-agricultural-based living. The lack of provision for performing community agriculture and the voluntary planting activities that have been taken up demonstrates the failure of response from the new town committee to such expressed needs of the residents.

It has been discovered that, a trend of homogenization of social composition within gated communities is evident among all peri-urban settlement cases studied, which when fully occupied will have population sizes equal to that of towns. Although diversity of housing unit sizes have been planned in all study cases, with the commercial housing estate (Dongli Lake Development) having a much better variety than the two government-led cases (Huaming New Town and City Sunshine). It is, however, noted that homogeneity of social composition is innate in the development proposals for peri-urban settlements. With social stratification being strengthened by the on-going economic growth, the planned peri-urban settlements each targets specifically at a certain type of social group, i.e. rural communities, urban lower-income classes, or urban professionals and upper classes. Social mixing has not been well addressed in these new settlements, and, according to this study, neither is it welcomed by the settlement residents. A common feature observed of all peri-urban settlements studied is that, they all take the form of self-contained gated enclaves that are separated from the surrounding landscape and communities by controlled entrances and perimeter barriers. They represent a multitude of isolated, disconnected decisions of individual developers that lacks coherence and cooperation. The situation is exacerbated by the fact that peri-urban land is often sold in large plots to single developers, who lack incentives to create mixed housing types and generate the sense of community both within and surrounding their estate. There also lacks integrated master planning in the peri-urban areas that help foster integration of separate developments. In terms of design character, there also seems to be a common lack of attention to the coherence and integration with the surrounding environment, which makes these new settlements appear to be “spaceships” being landed on greenfield lands.

“Reduced reliability on automobile use” and “Public participation in development and management process”

“Reduced reliability on automobile use” and “Public participation in development and management process” are the two sustainability themes that have received the lowest evaluation scores in the survey. It therefore can be concluded that they are considered as the most problematic issues with current peri-urban settlement development in Tianjin.

All the cases described in this study suffer, to varying extents, from inconvenient access to public services and work due to their peripheral locations. Poor service infrastructure provision and lack of accessibility to work have led to the reliability on private automobile use, the cost of which has made both the concept and the reality of living on the peri-urban less attractive than it was once proposed. For this very reason, the ambitious New Homes projects have tasted bitter with future developments halted. City Sunshine, as an earlier version of the New Homes projects, suffers from the same problems albeit being in better vicinity to the urban centre. Where the ownership of private vehicles is less of an issue, such as in Dongli Lake Development, it is still found to be difficult to maintain high-quality public and community services at such remote locations, as higher quality social services are predominately concentrated at the urban core. Being a much more mature and self-sustained community, Huaming New Town’s residents enjoy much better accessibility to services. However, high-quality social services are still a luxury compared with more centrally-located urban communities. As has been observed in the studied cases, poor accessibility to services plagues all types of peri-urban settlement. Compared with physical production, urban consumer services have been accorded less priority among Chinese urban decision-makers. Furthermore, planned peri-urban settlement developments have favoured self-enclosed compounds in greenfield sites, that are difficult to integrate with existing communities and infrastructure. Being located in remote locations away from the urban centre, where jobs concentrate, the peri-urban settlements are finding difficulties with maintaining a good job-housing balance. As these cases present, the provision of good public transit links, quality educational facilities, local work opportunities, consumer and social services is critical for the sustainability and prosperity of peri-urban communities.

It has been observed in the study cases that, public participation in community

management and in the planning and design process has been either limited or non-existent. Decision-making is still dominated by authoritative and professional opinions, whereas public involvement is being carefully experimented and strictly controlled within a limited boundary, such as that proposed by the EZA programme experimented at Huaming New Town. The public hearings and consultations that have been carried out have been positively embraced among the rural communities, while minimizing conflicts between the local authority and the public, which were common in previous cases of farmland expropriation. However, it was observed that public participation was largely limited to the housing exchange process, with planning and design decision-making still dominated by authoritative decisions and professional opinions.

It is found that all types of settlement cases studied have taken a "top-down" approach of packaged "town-making" and enforced expropriation of greenfield land. Such approach favours efficiency over equity and quality. The failure of the "New Homes" projects may reflect some of the problems in current decision-making processes, which may have been avoided if a public participation process had been carried out to understand the actual demands of the targeted groups. The "top-down" decision-making approach also fails to identify individual needs. In Huaming New Town, it has become more and more evident to the town committee that, jobs aren't as easily planned as physical construction in a market economy. The mismatch of the supply of former rural labours with the demand for skilled workers of the modernized industries remains a huge problem waiting to be solved. Public services provision and the construction of a sustainable local economy significantly lag behind physical construction in all peri-urban settlement types studied, which demonstrates that such centrally-led development practice has shown more success at creating eye-pleasing space than sustaining the well-being of their occupants. It might be time for the urban decision makers to reassess the "top-down" and "all-in-one-go" campaign approach and seek to assist in more spontaneous and "bottom-up" actions leading to peri-urbanization that are based on the genuine need of self-improvement.

5.8 Conclusion

This chapter has focused on answering the third research question: "To what extent has the current outcome of peri-urban settlement development practice in China addressed holistic sustainability issues?"

This chapter has documented the recent progress of peri-urban settlement development in Tianjin. Building on the previous chapter, the sustainability strategies are discussed within the context of the study cases in Tianjin. Using empirically-based research methods, the effect they have achieved in approaching sustainable development are examined. Based on the evaluation framework set out in Chapter 3, three study cases in Tianjin, each representative of one peri-urban residential development type, have been quantitatively evaluated against 37 sustainability parameters organised within 6 research themes. Their relative strengths and weaknesses at delivering each of the sustainability features are compared and analysed. It is found that, Dongli Lake Development has achieved the best overall sustainability performance compared with Huaming New Town and City Sunshine. Huaming New Town has an advantage of having the best accessibility among all three studied cases, outperforming Dongli Lake Development and City Sunshine on the theme of "Reduced reliability on automobile use", while City Sunshine has the least satisfactory performance on all six sustainability themes. In the discussion, the overall sustainability performance of the study cases on each of the six research theme are analysed, and it is found that, the best delivered sustainability themes by all studied settlements are: "Ecologically responsible development" and "Quality of life"; and the least well delivered sustainability themes are: "Reduced reliability on automobile use" and "Public participation in development and management process".

Upon the findings on the outcome of peri-urban settlement development, further study needs to be carried out to find out the reasons behind the sustainability/unsustainability of these settlements. It has been argued that people's perceptions and values affect their actions. The next chapter of this thesis is focused on the understanding of the perceptions of the stakeholders of urban

development on issues of sustainability. It is intended that by studying the stakeholders' perceptions on sustainability issues and analysing the dynamics of urban development decision-making, it is able to reveal the causes to the sustainability/unsustainability of peri-urban settlements in Chinese cities.

Chapter 6_ Decision-making and stakeholders' perceptions of sustainable peri-urban settlements in China

6.1 Introduction

This chapter is focused on answering the fourth research question: "What are the stakeholders' perceptions on the sustainability issues and how has the dynamics of decision-making affected the sustainability of the outcome of peri-urban settlement development in China?"

There are many stakeholders involved in the urban planning and development process. Planning and development decision-making is a joint action of different stakeholders and actors. In planning for sustainability, the integration and cooperation of a variety of interest groups in the decision-making process is vital for successful implementation. On the one hand, the concepts of "sustainability" and "sustainable development" are subject to contention, and may arouse different perceptions among different people. On the other hand, consensus building is essential in delivering complicated goals such as that of sustainable development. As Porter and de Roo (2007) argued, "consensus can be seen as a means to cope with uncertainty in planning processes, in particular when numerous actors with widespread and diverse interests are involved".

In this chapter, using evidence obtained from the case studies in Tianjin, the stakeholders involved in the decision-making of the three types of peri-urban settlement development analyzed in the previous chapter are identified, and the process of their decision-making described. The actions of the actors in urban planning are determined by their beliefs and capabilities, but are also subject to the institutional setting in which they act. Upon recognizing the institutional setting for urban development in China and the relative power of decision-making of the different actors, two groups of key stakeholders are identified for further analysis, i.e. the *professional* and the *household*. The chapter then goes on to address the differences in their understanding and perceptions of sustainable peri-

urban settlements. The understanding of their perception of sustainability is seen as critical in understanding the current outcome of development decision-making and their potential contribution to delivering sustainability in peri-urban developments.

6.2 The stakeholders of peri-urban settlement development in Tianjin

In this section, the decision-making process that led to the development practice of the settlement cases studied in the previous chapter is described. The stakeholders involved in the decision-making process and their contributions are identified.

6.2.1 Huaming New Town

In October 2005, the 5th Session of the 16th Central Party Committee Congress was held in Beijing. The congress made suggestions on the goals of national economic and social development for the next five-year plan. The goals include the adjustment of current economic development mode to a "scientific outlook of development" and the target of a balanced rural and urban development. In March 2006, the "National Economic and Social Development Eleventh Five-Year Plan (2006-2010)" was enacted by the National People's Congress. The plan called for a healthier and more sustainable urbanization process and emphasized on the "construction of new socialist rural areas". The "construction of new socialist rural areas" thus became the key words for the subsequent five-year plans at the province, county and city government levels.

At the local government levels, strategic plans have been drawn up to interpret the "construction of new socialist rural areas" and routes have been designed for its implementation. In October 2005, the Tianjin Municipal Commission of Development and Reform, a governmental body responsible for the formulation and administration of municipal strategic plans, proposed the plan for the "Exchange *Zhaijidi* for Apartment" (EZA) programme and devised guidelines for its implementation. The EZA programme was proposed as an innovative scheme

to solve the current problems with rural-urbanization and respond to the national strategy of "construction of new socialist rural areas". Three townships in the suburban districts of Dongli, Jinnan and Wuqing were subsequently identified as demonstration towns for the EZA programme. The township of Huaming in Dongli district was chosen as the first to implement the EZA programme. The programme was put directly under the leadership of the Deputy Mayor of Tianjin and its implementation was administered by Dongli District Government. A development company, Tianjin Binli Small Town Construction Development and Investment Ltd. (TBSTCDI), was established under the direction of the Construction Committee of Dongli District to carry out the appropriation of land and the supervision of the development. Tianjin Urban Planning and Design Institute (TUPDI) was commissioned by Dongli District Government to prepare the master plan for Huaming New Town. The proposed master plan was approved by Tianjin Municipal Urban Planning Bureau in November 2005 and the constructions began in April 2006. The local government of Huaming township and the village committees were made responsible for the organization and assistance of the house exchange and the resident relocation process. Public meetings were held between 2006 and 2007 to explain to the town residents about the EZA programme and obtain their support. A contract was then signed between each rural household and TBSTCDI as an agreement on the particulars of the house exchange process. In September 2007, the first residents were relocated from the old township and settled in the new town.

6.2.2 The New Homes and City Sunshine

Affordable housing, or so-called "economical and comfortable housing" in China, was first introduced to Chinese cities in 1994, when "the Guidance on Urban Economical and Comfortable Housing Construction and Management" was jointly published by the National Ministry of Construction, the State Council and the National Ministry of Finance. It aimed at regulating the provision of affordable housing to the middle- to low-income urban families. Square metre targets were set each year by local governments to achieve the delivery of affordable housing construction within their jurisdictions. After the land and housing reforms in the late 1990s, the real estate industry increasingly became the

pillar industry for all provincial and municipal governments and provided a large share of their revenue. For this reason, the local governments have become more and more reluctant in the construction of affordable housing where little profit can be obtained. By 2005, it has become evident that the amount of affordable housing provided was significantly lagging behind the actual demand.

In March 2005, the General Office of the State Council issued the "Notice on the Effective Stabilization of Housing Prices", calling for immediate measures to be taken to suppress of the rocketing of property prices in major Chinese cities. The "Notice" saw the development and provision of price-controlled affordable housing by local governments as a potential effective measure for stabilizing housing prices. In respond to the issue of the "Notice", Tianjin Municipal Government issued the "Notice of the Encouragement and Support on the Development of Economical and Comfortable Housing" in July 2005, which called upon the support of all government departments and all local government levels for increased development of economical and comfortable housing in Tianjin.

Developed in 2005, City Sunshine was among the first of the three large scale and high density economical and comfortable housing estates completed in Tianjin after the issue of the "Notice". In 2007, ten more economical and comfortable housing estates were planned to be development in the suburban areas within 5-10 kilometers to the outer ring road. These projects were named the "New Homes" projects. Tianjin Anju Project Development Company (TAPDC) is responsible for administering and financing the development of affordable housing in Tianjin and the provision of necessary infrastructure. TAPDC is a quasi-public enterprise, whose appointed director is at the same time the head of the Anju Project Office under Tianjin Urban and Rural Construction Committee (TURCC), a governmental office responsible for administering the development of affordable housing in Tianjin. The establishment of quasi-public enterprises has been a common practice in Chinese city governments. It allows the local government to be unofficially involved in developments and generate revenue without violating the state rule that bans formal involvement of government in business for the sake of anti-corruption (Zhang 2002). This type of practice is often adopted when there

are limited public funds. In 2007, the "Guidance on the Development and Management of Tianjin New Homes Housing Estates" was developed by TURCC, and approved and issued by Tianjin Municipal Government in the same year. The "Guidance" outlined the liabilities of all parties involved in the development of the New Homes projects and the qualities the development should achieve. TAPDC is responsible for ensuring that the "Guidance" is observed in all developments. TAPDC appointed five development companies, including both state-owned and private enterprises, to undertake the New Homes developments. Tianjin Real Estate Development Co. Ltd. (TRED) was one of them, which undertook the development of Huaming New Homes, the first of the New Homes projects. TRED is a state-owned enterprise whose real estate development projects are exclusively government-invested projects. It has been actively involved in the development of affordable housing and inner-city regeneration projects in Tianjin since the 1990s, and has over 30 affordable housing development projects on its portfolio, including City Sunshine. Tianjin Fangbiao Architectural Design Co. Ltd. was appointed by TRED to undertake the building and landscape design on the 13.5-hectare land TRED had acquired. In both City Sunshine and the New Homes projects, their occupants were more or less determined even before the development started. These are identified neighbourhoods in various locations in the central city area, which have been designated for regeneration programmes. These programmes are often under pressure to be delivered within a tight time scale, where the identified neighbourhoods are notified of the development plans by their street offices (the lowest administration level of urban government) and required to evacuate against a deadline. Each family receives financial compensation, with which a new home in a designated settlement, such as City Sunshine and New Homes, can be purchased at discounted prices.

6.2.3 Dongli Lake Development

In 2000, China Vanke Co. Ltd. (Vanke) as the principle investor obtained the land use right of 273 hectares on the north bank of Dongli Lake from Dongli district government through bidding. With support from Dongli district government, including residential relocation and prior development policy, Vanke took charge

of the main development process from investment and design to construction and management. Having acquired the land for development in 2000, Vanke postponed the development until the end of 2003. With Tianjin's real estate market still at its embryo at the time and acknowledging the inadequacy of infrastructure provision and market demand in the area, Vanke was cautious with its investments. By late 2003, when the intention of Tianjin government of the east-ward urban expansion and the increased investments into the BNA was made evident by the commission of the new urban master plan, Vanke saw the potential of the Dongli Lake area and kicked start the development process. Based on careful market research, Vanke targeted its market at the new urban elites, and aimed to construct an "exotic, low density and luxurious housing development, incorporating residential, education, tourism and leisure facilities" (http://www.tjdonglihu.com.cn/index1.html). Vanke commissioned SWECO, a Swedish architectural design consulting firm, to undertake the landscape and architectural design. Collaboration with international expertise has allowed Vanke to become, over the years, one of the leading forces in China's embryonic real estate development market. The design for the first development phase showed strong characteristics of Scandinavian style, which appealed to the urban affluents' strive for exotic luxury and fresh taste. At this stage, the main focus was to create an appealing image of the area so as to attract more market attention.

In 2005, when the first phase was completed, "Tianjin Urban Master Plan 2005-2020" was approved and the Dongli Lake wetlands were listed as "Natural Wetlands Conservation Area (County-level)" (TMUPB 2005). The focus of the development was adjusted accordingly and emphasis was put on the preservation and appropriate use of the wetlands within the development site. ATA Lawrence Group, an American Landscape design firm, was added to the design team. Two other international teams, Intuition & Logic Inc., specializing in hydraulic engineering; and ecologic design and Wass Gerke + Associates Inc., specializing in wetland engineering, were invited to provide professional support on wetland design and engineering. In 2006, when the "90/70" policy (refer to Section 4.2.4) was issued by the Ministry of Housing and Urban-Rural Development (MOHURD), yet another adjustment to the master plan of Dongli Lake Development was made necessary. Although the Dongli district government

adjusted the 70% threshold to a lower 65%, serious changes to the initial plans had to be made (personal communication with Developer A, Tianjin Vanke Urban Development Group). The private sector does not have significant influence on the local development decision-making process and thus has to obey the government, who own both particular authority and land resources in the Chinese context. During the development of later phases, Vanke collaborated with various architectural and landscape design companies based both in China and in foreign countries. Vanke's own design department is responsible for the organization of the collaborative design approach and decision-making in the main design features and specifications. Thus Vanke was able to control the characteristics that fit its need and ensure the quality of the design meets the standard that it requires. Unlike Huaming New Town and the New Homes projects including City Sunshine, Dongli Lake Development's potential residents are not predefined. They need to be won over by the quality of the product it presents. Attracting and catering for a specific group of customers is a fundamental driving force behind decision-making for commercial housing estates such as Dongli Lake Development.

6.3 The decision-making power of stakeholders

From the above analysis, four stakeholder groups of peri-urban settlement development can be identified, these are: State and local governments, real estate developers, planning and design professions, and residents. Based on the analysis of the roles of the stakeholders and their contributions in the development of the studied settlement cases, it is possible to identify some common patterns of the decision-making process for peri-urban settlement development in Chinese cities.

6.3.1"Top-down" decision-making

It is noted that a strong "top-down" approach dominates decision-making in the peri-urban settlement development in Tianjin. The decisions and principles to be adopted in development followed a hierarchical pattern that starts with state-level intentions and policies, further articulated by local government implementation

strategies, carried into practice by developers and finally put into reality by urban planners and architects. This pattern of urban development decision-making has been in existence ever since urban planning became a profession in China. It has been argued by Tang (2000) that urban planning as a profession, operates within a political context in China. Tang (2000) has pointed out that, "Chinese planners work within the state apparatus", and that "ideological priorities often prevailed over all other considerations… urban planners are circumscribed by their position in the administration structure and by state policies". In the process of urban development decision-making, professional opinions based on technological rationality are often overridden by economic considerations and even personal preferences of the city cadres in charge, as creating demonstrative development projects to win promotion for political elites is an important motivation for local government under the particular Chinese political promotion system (Zhang 2002). Since the 1980s, centralized control on local urban development has been gradually weakened, granting more decision-making power to the local governments on local development affairs. The profession of urban planners and architects has also gained more resilience to political intervention by means of the reestablishment of the nationwide China Academy of Urban Planning and Design in 1982 (Leaf 1998). However, under the current structure of governance in China, urban planning is regarded more as a mechanism to gain control over the development of the built environment as part of the package in the state control of the economy and the society, rather than a distinctive profession with a specific body of knowledge and expertise (Tang 2000).

This pattern of decision-making is nowhere more evident than that in the case of Huaming New Town. In this case, promulgated state policy played the fundamental drive in the initiation of the project and provided the regulatory principles. Local government became the active implementer of the project in response to the state policy and with strong intentions of fulfilling political achievement for the government leaders. In this sense, the local governments of Tianjin and Dongli district were the true planners and architects of the project, who had made detailed plans and implementation procedures for the development project, whereas the urban planning and architect professions were employed to mainly take charge of the technical and aesthetics sides of the plan and design.

6.3.2 “Pro-growth coalition” between private sector and local government

Since housing commoditization and marketization, and with the demands of rapid urbanization and capital accumulation, private developers extensively participated in the process of peri-urban development and played an increasingly significant role. After administrative decentralization in 1990, financial autonomy and land-use authority have been devolved to local government, whose role in delivering policies and strategies, even in formulating rules and regulations, is significantly enhanced. Because a large percentage of the local revenue comes from land-leasing, local governments have formed a “pro-growth coalition” with the private sector, especially real estate developers, based on common development interests (Zhang 2002). In terms of decision-making regarding development issues, the private sector is playing an increasingly significant role, as it is more sensitive to the market demand. Like any other business, a real estate development company is most interested in making profit. A developer would investigate the market carefully and ensure that the property products they provide meet the needs of the targeted customers. In this sense, the demand and preferences of the potential residents exert a significant level of impact on the decision-making of development by means of the market force. The regulatory power of the local government also exerts strong impact on the decision-making process of the developer. Because of the particular public ownership of urban land in Chinese cities, local government monopolizes land resources and retains strong decision-making powers in the urban development process. The local government directly controls the primary land market, delivers the policy of the central state, and makes specific rules and decisions for local development. Therefore, despite the increasing importance of the private sector, local government remains an important player in urban and peri-urban development. The development decision-making process is essentially a reciprocal cooperation between local government and private enterprise.

This pattern of decision-making is shown typically by the Dongli Lake Development case. The real estate developer followed carefully the strategic urban development direction decided by the municipal government and formed a

"pro-growth coalition" with the district government through the acquisition of the land. During the different development phases, it was evident that the developer observed carefully the changing circumstances of the area as guided by the local government and followed closely a shifting market trend. International and domestic expertise was employed to ensure the quality of the specifically commissioned end product. State and local government policy direction and regulation changes significantly impacted on the development decision-making, which can be demonstrated in two instances: the designation of Dongli lake wetlands as a natural conservation area; and the stipulation of the "90/70" land use policy. Both regulation modifications have resulted in major adjustments in the developing decision-making in Dongli Lake Development.

6.3.3 The decision-making of affordable housing projects

The decision-making pattern of the New Homes projects and City Sunshine is somewhere between that of Huaming New Town and Dongli Lake Development, in that, City Sunshine and the New Homes projects are government-led, and strongly associated with public policy indications, but received little public investment and was implemented by a quasi-public development company in close cooperation with the private sector. In other words, although these projects are initiated by the local government in response to the policy call of the state government, their implementation is put under market forces, and their success or failure will be eventually decided upon the rules of the market. The decision-making in these affordable housing projects was, therefore, neither dictated by government objectives nor completely based on market research. It had to satisfy both. On the one hand, the New Homes and City Sunshine need to observe the rules and regulations set for the development of the "Economical and Comfortable Housing" by the state government and fulfill the projected development scale decided by Tianjin municipal government; on the other hand, these are essentially real estate development projects that need to make a decent profit for all the developers and industries involved.

6.3.4 Residents: the excluded actor

It is noted that in the process of peri-urban settlement development, the affected residents, as an important stakeholder, are largely excluded from decision-making. This is most evident in the two government-led cases studied in this research, i.e. Huaming New Town and City Sunshine (New Homes), which involved large scale residential displacement and relocation. One of the main objectives of these projects was to improve the living conditions of residents in the rural settlements and the dilapidated urban neighbourhoods. However, as has been discussed in Chapter 5, according to the survey, although most residents expressed general satisfaction with their new living conditions, there has been much dissatisfaction on issues like accessibility, employment opportunities, community building and the relocation process. These concerns were in existence since the very beginning of the development projects, however, as the affected residents were unaware of the development plans until they have been decided and announced by the government and developers, there was literally no input from the residents' side, which might have, to a certain extent, prevented these problems. In the New Homes projects, specifically, the lack of communication between the government body administering the projects and the targeted displaced residents had led to serious delays, if not complete failure, of the first New Homes projects (refer to Chapter 5).

6.4 Sustainability and decision-making in peri-urban settlement development

From the above analysis, it is evident that in all patterns of decision-making in peri-urban settlement development, state-level policy directions have had strong impacts on local urban development practices. The administration structure in China allows centrally-formulated policies and strategies to be observed and implemented at local levels with exceptional efficiency and effectiveness. Meanwhile, local government is able to interpret the state-level policy and implement it with innovative strategies that fit with the specific local circumstances. Faced with limited public funds and encouraged by the national

pro-growth strategy, local governments often form a close "pro-growth coalition" with the private sector based on common development interests and actively take part in the local development projects. On the other hand, by forming the coalition with local government, private developers are gaining more power in decision-making regarding urban development issues. The planning and design professions, which play a key role in urban development decision-making in most developed countries, obtain a much minor position in the decision-making hierarchy under the current system in China. Their role is often regarded simply as providing technical support and aesthetic skills in the implementation of development plans that have been already decided at the upper levels of decision-making.

In promoting sustainable development concepts in the urban development realm, the same decision-making pattern persists. With sustainable development regarded as a national strategy, calls for a transformation of development mode to be based more on scientific rationality and the adoption of sustainability concepts in the urban development process have continuously been announced by state policies, which then trickle down to influence local development plans. With the sustainability agenda gaining more priority within urban development decision-making, the importance of the planning and design professions, who possess the necessary knowledge and expertise, starts to show. It is visible in some cases, especially privately-funded development projects, that the planning and design professions are gaining more power in decision-making. However, in government-led development projects, the planning and design professions still play a less significant role. Therefore, the decision-making pattern in urban/peri-urban development in Chinese cities sees a coalition of the first three stakeholder groups, i.e. state and local governments, real estate developers and the planning and design professions, with the fourth stakeholder group - the residents - completed left out.

To better understand sustainability in the development outcomes of current peri-urban settlements, it is important to have a better knowledge of what is perceived as the most important aspects of sustainable peri-urban settlement by the stakeholders. In the next section, a quantitative analysis is made on the data collected through Questionnaire B (Appendix II). Respondents were asked to rate

the importance of a list of 37 parameters that indicate sustainability of peri-urban settlement on a scale of one to five. As has been discussed in Chapter 3, the questionnaire was delivered to four groups of stakeholders involved in peri-urban settlement development in Tianjin, i.e. government officials, real estate developers, urban planners and architects, and residents. The first three stakeholder groups, as the analysis above reveals, forms a strong coalition in the decision-making process. Although each stakeholder group exerts different powers in the decision-making process, their perceptions and opinions AS A WHOLE decide the final development outcome. For this reason, and also due to the limited scope of this research, the comparison between the responses of the first three stakeholder groups will not be made. A comparison, however, is made between the residents group (hereafter referred to as the ***household*** group) and the first three stakeholder groups compiled as one, which hereafter is referred to as the ***professional*** group. By making this comparison, it is able to reveal the similarities and differences between the conceptions that lead to the outcome of development product and that held by the users of the development product.

6.5 Stakeholder perceptions on peri-urban sustainability

In this section, descriptive and inferential statistics methods are adopted for the quantitative analysis on stakeholders' perceptions of the importance of the list of sustainability parameters given in Table 3-1. The descriptive statistics analysis is based on the mean scores calculated of the responses given to questions contained in Questionnaire B, the purpose of which is to show the average importance levels of each parameter as perceived by the stakeholder groups, i.e. the *Professional* and the *Household* groups. The inferential statistics analysis uses the Mann-Whitney U test with significance of p=0.01, to test any significant differences between the responses given by the studied stakeholder groups, the result of which is used to indicate either consensus or contention of the stakeholder groups' opinions on a specific sustainability issue. Qualitative analysis based on evidence obtained through interviews is also used to complement the findings made based on quantitative analysis.

Table 6- 1: Inferential statistics of parameters of Theme 1

Parameter	*N*	*Perceived importance (Mean)*	*Perceived importance (SD)*	*Mean rank - Professional*	*Mean rank - Household*	*Mann-Whitney U*	*Monte Carlo Sig. (2-tailed)*
PAR 1-1	519	4.31	0.722	244.59	266.38	25550.0	0.096
PAR 1-2	435	4.42	0.679	199.00	221.77	11700.0	0.124
PAR 1-3	516	4.39	0.734	247.51	263.22	26274.5	0.229
PAR 1-4	515	4.35	0.701	262.12	256.24	27162.0	0.651
PAR 1-5	516	4.18	0.728	241.55	265.78	25350.5	0.064
PAR 1-6	516	4.24	0.712	263.54	256.36	27098.0	0.575
PAR 1-7	518	4.14	0.776	263.12	257.94	27672.0	0.697
PAR 1-8	518	4.25	0.724	252.58	262.45	27060.5	0.448
PAR 1-9	525	4.37	0.774	287.09	252.81	25023.5	0.009*
PAR 1-10	524	4.25	0.793	291.25	250.31	24219.5	0.003*
PAR 1-11	524	4.01	0.788	253.21	266.44	27254.5	0.327
PAR 1-12	529	4.03	0.789	216.39	285.33	21511.0	0.000**

Note: *Significant at 0.01 level, **Significant at 0.001 level.

6.5.1 Theme 1: Ecologically responsible development

Under the theme "Ecologically responsible development", it is noted that the two groups of respondents, i.e. the *Household* and the *Professional*, have attached similar levels of importance on most of the parameters ($p>.01$, Table 6-1). As illustrated in Figure 6-1, the most important issue (parameter) rated by the *Household* group is PAR 1-2: Natural lighting (mean score: 4.44), with the least important being PAR 1-11: Protection of natural topography and geology (mean score: 4.03); while the most and the least important issues rated by the *Professional* group are PAR 1-9: Preservation of natural green land and water body (mean score: 4.51) and PAR 1-12: Integration of built and natural environment (mean score: 3.76). On three of the parameters examined under this theme, significant differences were detected on the responses given by the two respondent groups ($p<.01$, Table 6-1), they are: PAR 1-9: Preservation of natural green land and water body, PAR 1-10: Protection of natural species and habitat, and PAR 1-12: Integration of built and natural environment. The *Professional* group has rated significantly higher importance levels on PAR 1-9 and PAR 1-10 compared to the *Household* group, whereas on PAR 1-12, the *Household* group obviously considers it as more important than does the *Professional* group.

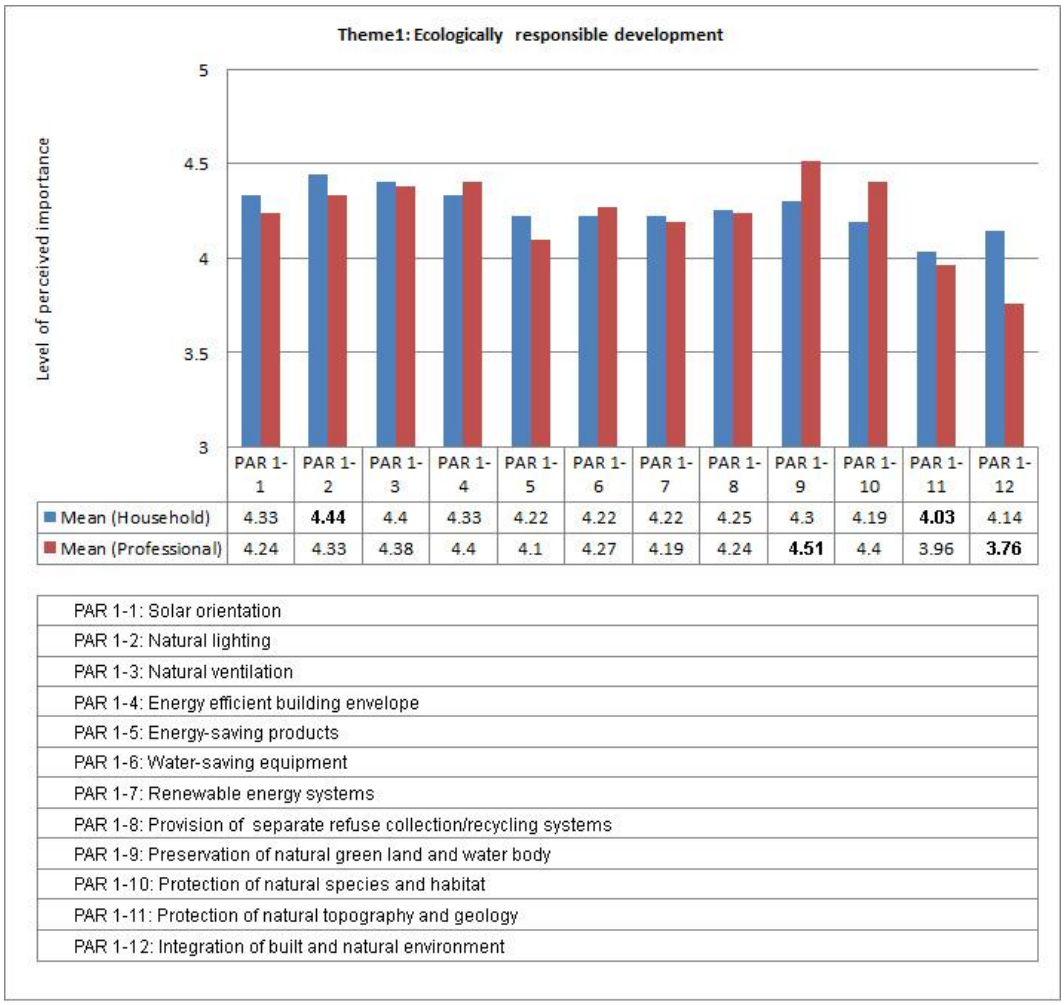


Figure 6- 1: Stakeholder group comparison of the perceived importance on the parameters of Theme 1

The statistical result implies that much consensus has been obtained on the two groups of stakeholders' opinions on issues related with passive and active energy-efficient designs in buildings, whereas different opinions were expressed on issues related with the protection of natural resources and the integration of the built and natural environments.

It has been shown from both the survey and follow-up interviews a consensus on the importance of energy efficiency as a main criterion to assess sustainability in the development of peri-urban settlements. However, many admit that much has yet to be done if an energy efficient future is to be achieved.

Some of the interviewed planners and architects admitted that they have limited knowledge of energy-efficient. Although some of the passive energy-efficient

design measures have been generally practiced, such as building orientation, natural lighting and ventilation, these were applied mostly according to rule of thumb rather than evidence-based design intervention. Many felt that the methods of sustainable design are ill-provided in the current design guidance. Current building design codes indicate the amount of energy savings required without providing detailed guidance on design solutions.

"There has been increasing interests in sustainable design in the real estate market. However, few practitioners truly understand sustainability concepts. Most of them take it as simply greening the environment and putting solar collectors on the roofs." (Urban planner A, Tianjin Urban Planning and Design Institute)

Further, energy-efficient building design has not been given emphasis in the early design stages.

"During the design process, little thought is given to building energy efficiency. Function and aesthetics are often the main concerns. Building energy performance is just a calculation that needs to be done at the end of the design process in order to get through the regulation."(Architect A, Tianjin Architecture Design and Research Institute)

"Energy efficiency of the buildings is often overlooked in the urban planning stage of an urban development." (Urban planner B, Tianjin Urban Planning and Design Institute)

Others consider energy efficient building design as *"a job for the service engineers"* (Architect C, Tianjin Architecture Design and Research Institute). In the architectural design profession a clear division is drawn between architects and engineers, with architects leading the role and engineers seen as supporting. Engineers are rarely involved in the design process until at a later stage when most of the design details are decided. Engineers are seldom seen as able to contribute to revising design solutions but rather ought to treat them as a given boundary within which to work. This dichotomy in the design profession has resulted in diminished opportunities to produce passive design solutions that are important for energy efficient building.

In terms of renewable energy systems, the general opinion of the professional interviewees is that it is a very important sustainability design measure, however, the additional cost associated with the installation and maintenance of renewable

energy systems often prevent developers from using them. Current good practices are often where specific requirements are stipulated (by local authority for instance) on renewable energy usage.

Several interviewees have described the current building industry as in a *"rough"* style, meaning generally lacking attention to detail in all professions involved. This can be largely attributed to the speed under which constructions are being carried out in China. The rapidly increasing urban population and subsequent housing shortage have propelled the building industry into a fast moving streamline whose main job is to turn out housing products to meet a required amount. Quality has often had to be compromised as a consequence.

"To me the problem [of low building energy efficiency] *isn't with the design but lies in the construction stage. While design is regulated with standards there is no standard to control construction quality."* (Urban planner A, Tianjin Urban Planning and Design Institute)

Like most other labour-intense industries that China depends on for its prosperity, the building industry provides a large proportion of job opportunities for the vast unskilled labour force.

"The main workforce employed for building construction is mainly constituted of rural migrant workers, who generally lack professional training. Their poor working conditions and low pay do not contribute to high quality job either." (Official A, Tianjin Municipal Construction Committee)

However, many still felt that the main problem lies with the government. The weakness of evaluation instrument and regulation enforcement allows profit-seeking developers to get away with low quality building.

"The majority of new-built residential blocks are sold even before construction starts, plus there is no post-construction evaluation process that ensures quality. Developers and construction companies lack the will to deliver high quality housing." (Official A, Tianjin Municipal Construction Committee)

This is echoed by the findings of Glicksman et al. (2001b), in which it was stated that two institutional barriers are hindering the implementation of energy efficiency in the building industry: one is the disparity between the behaviors of central and local governments leading to the discontinuity of the enforcement of

national energy-conservation standards; another is the propensity of local authorities to weigh economic development over environmental regulation.

However, although the interviewed residents consider energy efficiency to be an important indicator of sustainable design, there is little consumers' interest in investment into energy efficient construction. This is partly due to China's current system of heating provision, which calculates energy bills based on housing floor area rather than the actual energy used. Energy and water prices are kept at a low level and play little role in giving incentives for making savings. Statistical evidence from the other studies supports the observation of this general attitude. A small-scale survey of prospective homebuyers in Beijing showed that willingness to pay more for a "green, sustainable, or energy efficient" home was limited to less than 10% of the base house price (Glicksman et al. 2001b).

On the issues of Preservation of natural green land and water body and Protection of natural species and habitat, more importance have been accorded by the respondents from the *Professional* group than the *Household* group. The *Professional* group had given the highest importance ratings in this theme to these two parameters, indicating the opinion that these are the most important issues related with ecologically responsible design. The importance ratings to these two parameters given by the *Household* group were lower than those given to the ones related with passive and active energy-efficient design, which indicates that the *Household* group considered these issues as being less important than energy efficiency issues.

Both planner/architects and government officials have expressed concerns over the speed at which natural environmental assets, the species and their habitat are being lost due to the rapid process of peri-urbanization.

"It is a pity to see how fast these natural wetlands have disappeared over the last few decades… Tianjin has lost largely its kidney to urban development." (Urban planner C, Tianjin Urban Planning and Design Institute)

"The government is very much concerned with protecting the wetlands and other natural green fields. New regulations have been passed accordingly. New developments should observe these regulations when being planned." (Planning official A, Tianjin City Planning Bureau)

It is noted that a very low importance level has been given to the issue of integrating the built with the natural environment (PAR 1-12) by the *Professional* group, with the general opinion that this issue is either irrelevant in the peri-urban context or that it is difficult to assess.

"We provide what the market requires. The market requires modern and urban. If we give them rural, we fail." (Developer A, Tianjin Vanke Urban Development Group)

"There is a huge contrast between the required urban environment for these planned communities and the rural environment in the surroundings. It is very difficult to create the conversation between them." (Urban planner D, Tianjin Urban Planning and Design Institute)

"We try to preserve any valuable exiting buildings, trees and water bodies as much as we can. I think this is as much as we can do about integrating the built and the natural environment." (Architect D, Tianjin Architectural Design and Research Institute)

The residents interviewed showed less concern on the issue of natural environment protection. The majority attitude is that although the protection of natural environmental asset and species is an important issue, it is of little impact to their daily lives. It is generally expected that these issues would have been taken care of during planning.

6.5.2 Theme 2: Reduced reliability on automobile use

Under the theme "Reduced reliability on automobile use", it is found that very different perceived importance levels are given to all parameters by the two stakeholder groups, which indicates that they hold very different opinions on all the issues related with transportation and accessibility in peri-urban settlement development. The parameter rated the most important under this theme by the *Household* group is PAR 2-5: Access to educational facilities (mean score: 4.43), and the rated least important parameter is PAR 2-2: Reduction of parking space (mean score: 3.91); the *Professional* group gave the highest mean score to PAR 2-

6: Access to public service facilities (mean score: 4.21), and the lowest mean score to PAR 2-2: Reduction of parking space (mean score: 3.57) (Figure 6-2). It indicates that both stakeholder groups consider the issue of reduction of parking space as less important than the other parameters, while different opinions on priorities are held: with the *Professional* group identifying the overriding importance of public facilities provision and the *Household* group emphasizing more on educational facilities.

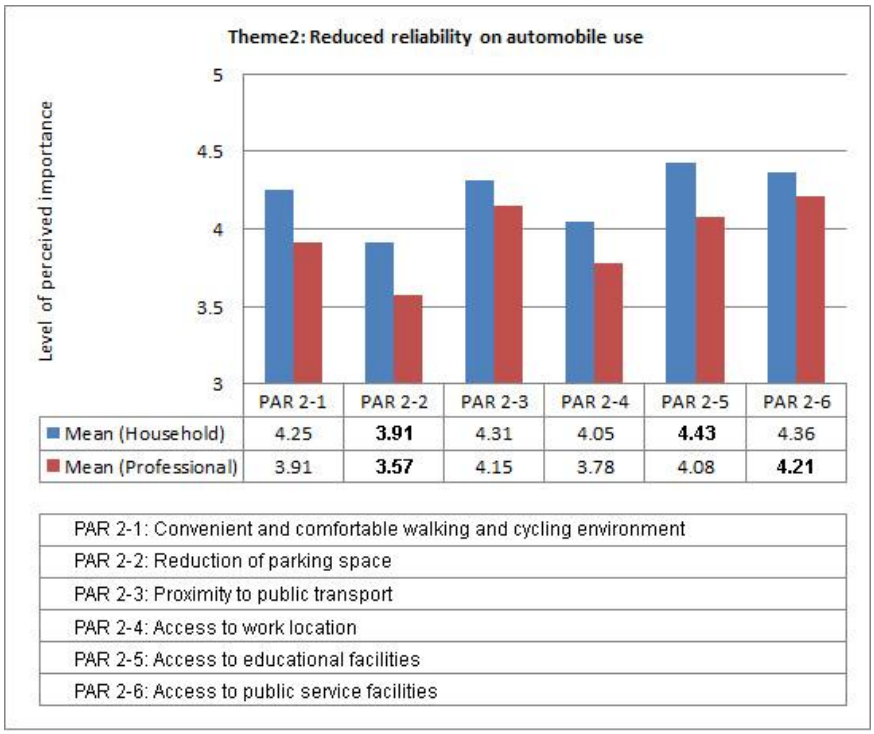


Figure 6- 2: Stakeholder group comparison of the perceived importance on the parameters of Theme 2

Table 6- 2: Inferential statistics of parameters of Theme 2

Parameter	*N*	*Perceived importance (Mean)*	*Perceived importance (SD)*	*Mean rank - Professional*	*Mean rank - Household*	*Mann-Whitney U*	*Monte Carlo Sig. (2-tailed)*
PAR 2-1	517	4.15	0.760	214.57	278.20	21227.5	0.000**
PAR 2-2	514	3.81	0.922	218.75	274.23	21815.5	0.000**
PAR 2-3	515	4.27	0.763	231.83	269.37	23919.5	0.004*
PAR 2-4	526	3.97	0.873	230.01	277.62	23635.0	0.001*
PAR 2-5	518	4.33	0.733	211.00	280.21	20615.0	0.000**
PAR 2-6	518	4.32	0.693	234.51	270.27	24337.0	0.006*

Note: *Significant at 0.01 level, **Significant at 0.001 level.

Significant group differences were identified on all parameters examined under this theme (p<.01, Table 6-2), with the *Household* group giving significantly

higher scores than the *Professional* group on all parameters. The result implies that in terms of transportation and accessibility, the professionals involved in the development and planning of the peri-urban settlements have attached significantly less importance than the actual users.

The follow-up interviews revealed that, to many of the professionals, peri-urban settlement developments will inevitably bring about increased reliability of automobile use, and some even take the increased car ownership as a premise for more peri-urban developments.

"The national strategy is encouraging people to buy private cars. The car ownership is increasing very fast in recent years, and the trend is very likely to go on. When we planned these (peri-urban) *settlements, we had a vision of future increased private car ownership."* (Planning official C, Tianjin City Planning Bureau)

Some felt that the improvement of public transportation is essential and needs the cooperation of other government departments. Planning alone cannot solve the problem.

"We plan these (peri-urban) *developments near or next to public transit links and plan all the necessary facilities to service them. But they* (the construction of public transit routes and public service facilities) *take a lot of time and investment to materialize. And it is not something that we* (the planning institutes*) can control."* (Urban planner E, Tianjin Real Estate Development Co. Ltd.)

When asked about the lack of services and associated low occupancy rate observed in current peri-urban settlements, the majority interviewed professionals did not consider it as a huge problem and are generally optimistic about future prospects.

"The current problems with the services and transit provision are only temporary and are quite common with early development phases. When the occupancy rate picks up, these problems will be eliminated." (Developer C, Tianjin Real Estate Development Co. Ltd.)

"There might have been some degree of over estimation about the market when these developments were planned…But in the long term, the demand for peri-urban developments is still high as the urbanization rate is still very low." (Official A, Anju Project Office, Tianjin Municipal Construction Committee)

The residents of the studied settlements, on the other hand, based on the feeling that inadequate service provision and the increased cost on commuting have caused the most inconveniences on their daily living, consider the improvement of public transportation and accessibility to be essential for the sustainability of peri-urban residential settlements.

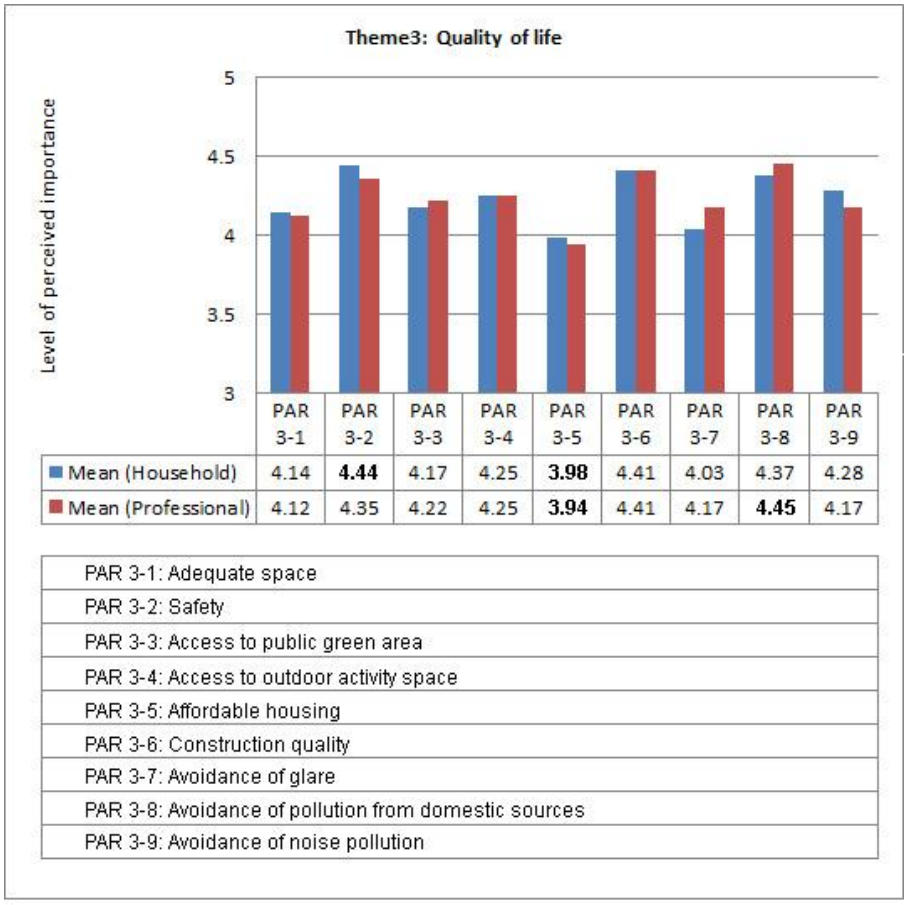


Figure 6- 3: Stakeholder group comparison of the perceived importance on the parameters of Theme 3

6.5.3 Theme 3: Quality of life

As is shown in Figure 6-3, the parameter rated the most important under the

theme "Quality of life", by the *Household* group is PAR 3-2: Safety (mean score: 4.44), and the rated least important parameter is PAR 3-5: Affordable housing (mean score: 3.98); the *Professional* group gave the highest mean score to PAR 3-8: Avoidance of pollution from domestic sources (mean score: 4.45), and the lowest mean score to PAR 3-5: Affordable housing (mean score: 3.94). It indicates that both stakeholder groups consider the issue of housing affordability is less important than the other parameters under this theme, while different opinions on priorities are held: with the *Professional* group identifying the overriding importance of avoidance of pollution within residential communities and the *Household* group attaching more importance on the safety of their living environment.

No significant group differences are identified on the levels of importance given to all parameters under this theme (Table 6-3). It implies that a consensus between the studied stakeholder groups has been obtained to a large degree on the perceived levels of importance of all the parameters examined.

Table 6- 3: Inferential statistics of parameters of Theme 3

Parameter	*N*	*Perceived importance (Mean)*	*Perceived importance (SD)*	*Mean rank - Professional*	*Mean rank - Household*	*Mann-Whitney U*	*Monte Carlo Sig. (2-tailed)*
PAR 3-1	517	4.14	0.705	254.17	261.07	27306.5	0.595
PAR 3-2	433	4.43	0.704	197.58	220.81	11472.5	0.113
PAR 3-3	518	4.18	0.754	264.85	257.20	27402.0	0.563
PAR 3-4	501	4.26	0.710	244.93	253.74	25963.5	0.495
PAR 3-5	526	3.97	0.855	258.49	265.61	28078.5	0.598
PAR 3-6	512	4.41	0.748	249.69	259.46	26612.5	0.440
PAR 3-7	522	4.07	0.724	278.02	254.52	25882.0	0.073
PAR 3-8	521	4.39	0.674	267.40	258.26	27471.5	0.486
PAR 3-9	519	4.25	0.699	238.89	268.56	25093.0	0.030

It is generally felt by the interviewed stakeholders, both the professionals and the residents, that the standard of living has dramatically improved in the new-built communities and that the improvement of quality of life should be held as an important evaluation criterion for sustainable peri-urban settlements.

"We ensure that all buildings are constructed to high standards and a minimum of 30sqm/person is achieved on flat size… Facilities such as water supply, central heating, drainage system, solar powered hot water system, lighting system are all provided with high standards." (Official A, Anju Project Office, Tianjin

Municipal Construction Committee)

"We appointed an estate management company to take care of daily maintenance of the residential estate… We consider the maintenance of a high quality living environment a very important goal to achieve with the (EZA) *programme."* (Official B, Huaming New Town Administrative Office)

"The presentation of quality dwelling environment is essential for our developments, as our market seeks high quality living at affordable prices. We have invested a lot into the maintenance of the estate's environment and will continue to do so." (Developer A, Tianjin Vanke Urban Development Group)

The residents interviewed also agree that the quality of living is generally good in their communities. However, some concerns have been voiced regarding safety issues and the deteriorating status of the buildings and community facilities and the lack of maintenance, which, they consider, should be stressed more in future community developments.

6.5.4 Theme 4: Minimized land consumption and compact urban form

Under the theme "Minimized land consumption and compact urban form", the responses of the two stakeholder groups conform on two of the parameters but disagree on one parameter (Table 6-4). Both groups consider "PAR 4-3: Provision of opportunities to perform agricultural activities" to be less important than the other two parameters under this theme (mean score: Household: 3.74; Professional: 3.19). The *Household* group prioritizes the importance of minimization of loss of agricultural land (mean score: 4.22); while the *Professional* group considers appropriate community density to have the overriding importance (mean score: 4.21) (Figure 6-4).

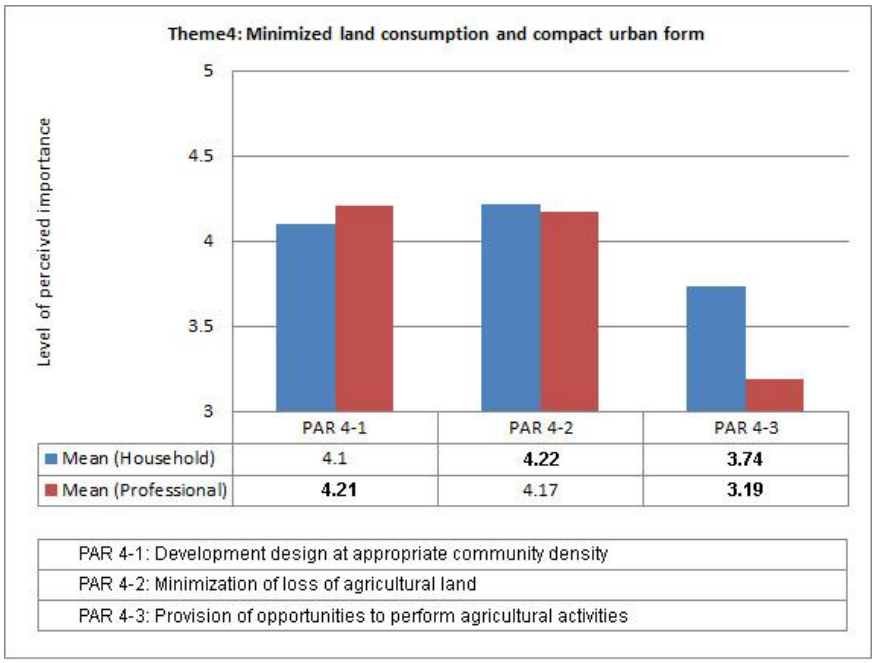


Figure 6- 4: Stakeholder group comparison of the perceived importance on the parameters of Theme 4

Table 6- 4: Inferential statistics of parameters of Theme 4

Parameter	*N*	*Perceived importance (Mean)*	*Perceived importance (SD)*	*Mean rank - Professional*	*Mean rank - Household*	*Mann-Whitney U*	*Monte Carlo Sig. (2-tailed)*
PAR 4-1	528	4.13	0.774	275.38	259.94	27318.0	0.254
PAR 4-2	518	4.20	0.832	255.45	261.20	27302.5	0.661
PAR 4-3	509	3.58	0.994	196.47	279.92	18235.5	0.000*

Note: *Significant at 0.001 level.

Between the studied stakeholder groups, no significant differences have been identified on their perceived importance levels of the parameters PAR 4-1: Development design at appropriate community density (U=27318.0, p>.01) and PAR 4-2: Minimization of loss of agricultural land (U=27302.5, p>.01), which indicates that consensus can be implied on the stakeholder groups' opinions on these issues.

Although a consensus is held on the importance of the preservation of precious agricultural land, many agree that conflicting land use priorities are still at play with the persisting drive for growth.

"National strategy has put preservation of farmland very high on the priority list in recent years. It has become much more difficult to exploit on agriculture land

now." (Planning official B, Tianjin City Planning Bureau)

"The pressure of urbanization and peri-urban development is still quite strong. The conflict between the protection of farmland and urban development will continue to exist." (Urban planner D, Tianjin Urban Planning and Design Institute)

Significant difference is identified on the stakeholder groups' responses on PAR 4-3: Provision of opportunities to perform agricultural activities ($U=18235.5$, $p<.01$). It implies that the *Household* group and the *Professional* group disagree significantly on the importance of provision of opportunities to perform agricultural activities as a sustainable peri-urban settlement criterion, with the *Household* group attaching significantly more importance to it than the *Professional* group.

The interviewed professional stakeholders hold the opinion that the demand for opportunities to perform community agriculture does not exist with the current peri-urban residents, and that the maintenance and management of allotments would complicate with the estate management and incur additional costs.

"The majority of the residents in the new peri-urban communities are urban residents. They seldom have the skills for planting and farming. So providing community allotments will be meaningless." (Urban planner C, Tianjin Urban Planning and Design Institute)

"There is no current legislation and planning guidance in the area of community agriculture… Few real estate developing companies and estate management companies would take on such projects as it might make their jobs more complicated and involve more investment." (Planning official C, Tianjin City Planning Bureau)

The residents of the studied peri-urban settlements, on the other hand, demonstrated a high level of interest in the prospect of community agriculture, which is already evident in the spontaneous farming activities that have been taken up in these communities (refer to Section 5.6.4). Although many consider that this is not a required necessity for a community to be sustainable, it would certainly bring the community life closer to nature and help enhance a healthier

life style for its residents.

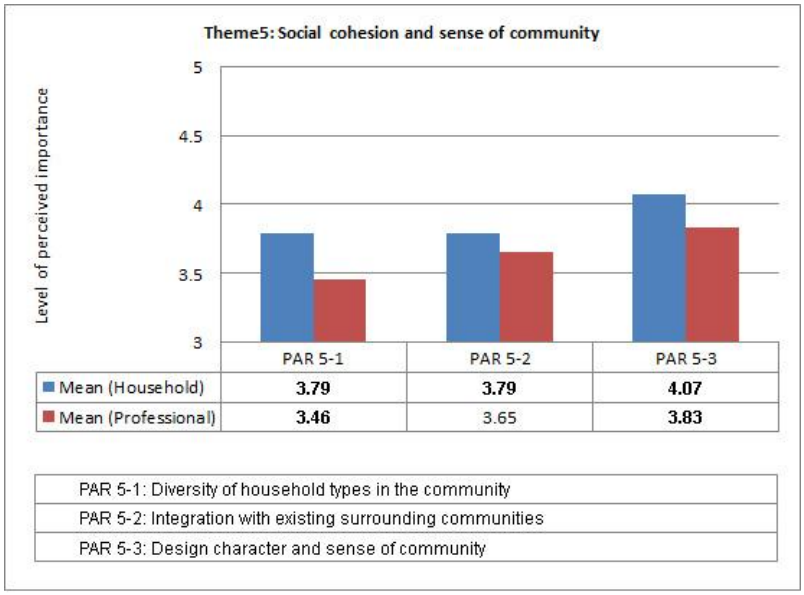


Figure 6- 5: Stakeholder group comparison of the perceived importance on the parameters of Theme 5

6.5.5 Theme 5: Social cohesion and sense of community

Figure 6-5 illustrates the perceived level of importance given by the two stakeholder groups on the theme "Social cohesion and sense of community". It is found that the majority of ratings given by both respondent groups to parameters under this theme are lower than 4, indicating a general lower opinion of this theme's relevance to sustainability compared with other themes. It is found that on all three parameters studied, i.e. PAR 5-1: Diversity of household types in the community; PAR 5-2: Integration with existing surrounding communities; PAR 5-3: Design character and sense of community, the mean scores given by the *Household* group are comparatively higher than that given by the *Professional* group. For both groups, the parameter rated as having the highest importance under this theme is PAR 5-3 (mean score: Household: 4.07; Professional: 3.83). The *Household* group gave the same mean score for PAR 5-1 and PAR 5-2, indicating that on average the *Household* group considers housing diversity and integration with surrounding communities to have equal importance (mean score: 3.79). The *Professional* group gave the lowest mean score to PAR 5-1, indicating an average opinion that housing diversity being the least important issue under

Theme 5 (mean score: 3.46).

Table 6- 5: Inferential statistics of parameters of Theme 5

Parameter	*N*	*Perceived importance (Mean)*	*Perceived importance (SD)*	*Mean rank - Professional*	*Mean rank - Household*	*Mann-Whitney U*	*Monte Carlo Sig. (2-tailed)*
PAR 5-1	523	3.69	0.907	223.56	278.34	22629.5	0.000*
PAR 5-2	527	3.75	0.937	246.85	271.15	26172.0	0.079
PAR 5-3	441	4.03	0.844	191.57	226.74	11165.0	0.024

Note: *Significant at 0.001 level.

Inferential statistics using the Mann-Whitney U test show that, highly significant group difference is identified on the groups' perceived importance level of PAR 5-1($U=22629.5$, $p<.001$); while no significant differences are identified on the responses to the importance of the other two parameters ($p>.01$) (Table 6-5). The result indicates that the *Household* and the *Professional* groups hold significantly different opinions on the level of importance of "Diversity of household types in the community" as a sustainable community criterion; while no significant evidence is found on their disagreement on the level of importance of "Integration with existing surrounding communities" and "Design character and sense of community".

In the follow-up interviews with the *Professional* group, it revealed that many have conserved opinions on planning diversity of household types in the community, or at least do not consider it as a desirable characteristic for community design.

"Social mixing in communities is not desirable in China. People want to live near those of similar social status… The gated communities ensure that people of similar socio-economic status live near each other… and there is also a safety consideration as well." (Urban planner D, Tianjin Urban Planning and Design Institute)

Some also question the practicality of mixing household of different socio-economic status.

"If you put poorer households in the same community with the richer households, the poorer households would not be able to afford the same level of management

cost as the richer households. It makes it difficult to charge the management fees." (Architect D, Tianjin Architectural Design and Research Institute)

The residents of the studied communities are also wary about the concept of mixed communities, with the general reaction being that it may cause confrontation of the already exacerbating hostility between the upper- and lower-classes.

As regards the design character and the creation of the sense of community, the interviewed professionals agree that appropriate design interventions are essential for creating the identity of a community and enhance a sense of belonging for the community residents. The residents' opinion also emphasizes the importance of design on the identity of their communities. They feel that both design character and sense of community are lacking with their communities, and hope these issues would be stressed in future community planning and design.

6.5.6 Theme 6: Public participation in development and management process

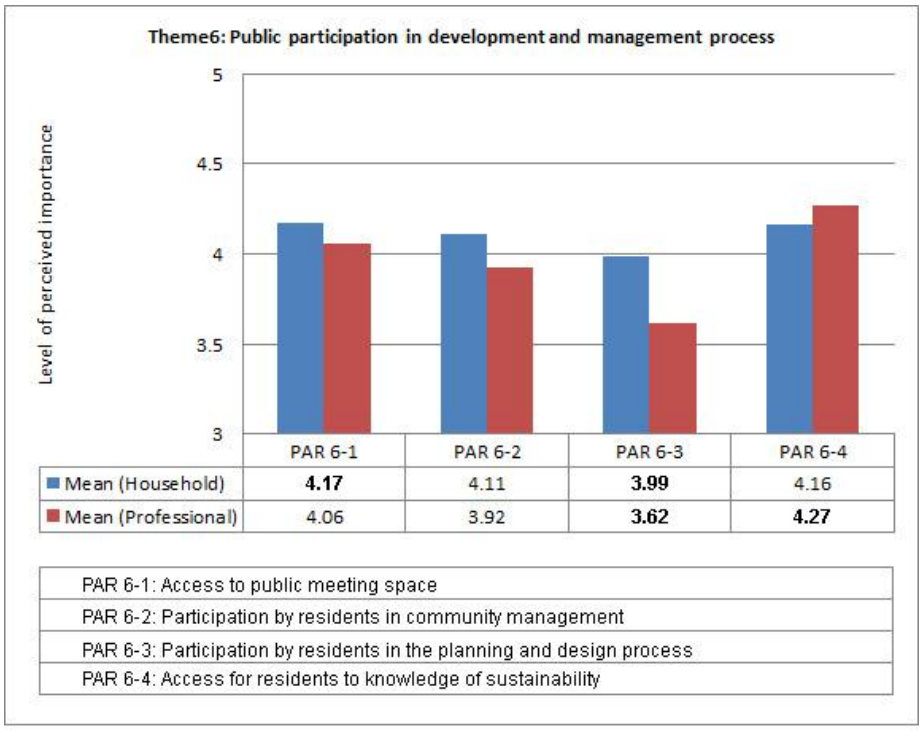


Figure 6- 6: Stakeholder group comparison of the perceived importance on the parameters of Theme 6

Figure 6-6 illustrates the perceived level of importance given by the two stakeholder groups on the theme "Public participation in development and management process". It is found that on the four parameters studied, i.e. PAR 6-1: Access to public meeting space; PAR 6-2: Participation by residents in community management; PAR 6-3: Participation by residents in the planning and design process; and PAR 6-4: Access for residents to knowledge of sustainability, the mean scores given by the *Household* group are comparatively higher than those given by the *Professional* group on the first three parameters. On PAR 6-4, the *Professional* group gave a higher mean score than the *Household* group. The *Household* group gave their highest mean score to PAR 6-1 (4.17) and the lowest mean score to PAR 6-3 (3.99), indicating that, to the *Household* group, the most important feature that leads to the improvement of public participation in community development and management is the provision of public meeting space, and the least important is the public participation in the planning and design process. The *Professional* group gave their highest mean score to PAR 6-4 (4.27) and the lowest mean score to PAR 6-3 (3.62), which indicates that they join with the *Household* group in thinking that involving the public in the planning and design process is the least important of all four parameters that leads to community public participation while stressing more importance on the distribution of the knowledge of sustainability.

Table 6- 6: Inferential statistics of parameters of Theme 6

Parameter	*N*	*Perceived importance (Mean)*	*Perceived importance (SD)*	*Mean rank - Professional*	*Mean rank - Household*	*Mann-Whitney U*	*Monte Carlo Sig. (2-tailed)*
PAR 6-1	514	4.14	0.740	241.70	264.38	25459.5	0.082
PAR 6-2	520	4.06	0.762	238.58	269.89	24972.5	0.020
PAR 6-3	516	3.88	0.877	219.03	275.60	21922.5	0.000*
PAR 6-4	525	4.19	0.748	277.43	256.85	26623.0	0.126

Note: *Significant at 0.001 level.

Inferential statistics show that, highly significant group difference is identified on the groups' perceived importance level of PAR 6-3 ($U=21922.5$, $p<.001$); while no significant differences are identified on the responses to the importance of the other three parameters ($p>.01$) (Table 6-6). The result indicates that the *Professional* group attaches a significantly lower importance level to public

participation in the community planning process than does the *Household* group; while the two groups of stakeholders largely agree on the importance levels of the issues of "access to public meeting space", "participation by residents in community management" and "access for residents to knowledge of sustainability".

Public empowerment and participation in decision-making are held as a controversial topic by the interviewed professionals. Although most of them understand the rationale and recognize the benefits of public involvement in decision-making, they are more concerned with the complications it may bring to the decision-making process and the inevitable lengthening of the timeframe required for such process. Moreover, the lack of knowledge and education on the public's side is considered to potentially prevent them from effective involvement in decision-making. However, above all, the institutional barriers that prevent publication of information and democratic decision-making are considered to be the main obstacles holding back the development of public participation in China.

"The current mode of urban development prioritizes speed. Public participation usually takes a lot of extra effort and time. The timeframe we are set against seldom allows us to be able to organize public meetings and hearings." (Developer C, Tianjin Real Estate Development Co. Ltd.)

"*We make announcements and publication of the development plans on our website prior to development. The public is welcome to express their opinions… We consider these as adequate means* (of public participation)." (Official A, Anju Project Office, Tianjin Municipal Construction Committee)

"The current organizational structure in planning practice does not allow for extensive public participation… The willingness to participate in public affairs is also rather low among the mass public". (Urban planner C, Tianjin Urban Planning and Design Institute)

The general opinion collected from the resident interviews shows that they have a strong will of participating in urban development affairs, nonetheless were unaware of the ways to do so. They also felt that the publicity of information

related with urban development projects are very limited and hard to obtain, which prohibits them from participation. They also questioned the sincerity of the city authorities and the planners to take their opinions on board even when they are expressed.

6.6 Discussion

Using both quantitative and qualitative research methods, this chapter has presented a study on the perceptions of two stakeholder groups (*Professional* and *Household*) on 37 sustainability parameters. Categorizing the parameters into themes, it was found that:

1. The studied stakeholder groups held similar opinions on the importance of the sustainability parameters under Theme 1 (Ecologically responsible development) and Theme 3 (Quality of life). Consensus was obtained on the perceived importance level of the majority of the parameters of these two themes.
2. Neither overall consensus nor contention was found with the stakeholders' perceptions on the themes 4 (Minimized land consumption and compact urban form), 5 (Social cohesion and sense of community) and 6 (Public participation in development and management process). The studied stakeholder groups agreed on the importance level of some of the parameters under these themes while disagreed on others.
3. The studied stakeholder groups disagreed completely on the importance levels of the parameters under Theme 2 (Reduced reliability on automobile use). Significantly different stakeholder opinions were obtained on all the parameters under this theme.

"Ecologically responsible development" and "Quality of life"

It was found that energy-efficient design and the use of renewable energy and water resources were considered by both *professional* and *household* stakeholders to be important sustainable features for peri-urban settlement. It was also found that passive design strategies are traditionally emphasized in the planning and

building design professions but lack sophisticated guidance for their systematic implementation. The practice of energy-efficient building design and renewable energy systems rely more on the regulatory power of the current design codes for effective implementation, and may sometimes be compromised due to other design requirements such as function, aesthetics and cost. Albeit the consensus on the importance of building energy-efficiency among all stakeholders, the lack of knowledge with energy-efficient design solutions among building design professionals and the indifference among building occupants about the energy performance of their homes may inhibit the further improvement of energy performance in residential buildings. Within the building industry, the lack of provision for early stage energy-efficient design in the current building design process, the lack of post-construction assessment of building energy performance and the general shortage of skilled workforce are considered the main obstacles for delivering quality building construction, which is essential for ensured energy performance of buildings.

Some difference in opinion was found with issues related with the protection of natural ecological assets, with the *Professional* respondents attaching more importance than the *Household* respondents. It was found that the professionals were concerned about the implications of urban development in terms of natural environment protection and maintained that the protection of natural environment and animal species should be more emphasized in the process of peri-urban development, while the residents were less aware of the impacts of urban development on the environment, species and their habitat. On the other hand, the residents considered the integration of built environment with its natural surroundings as an important feature for a peri-urban settlement to be ecologically responsible, while the professionals held the opinion that this is not an important issue and is difficult to achieve with planned development.

It was found that the opinions held by the *Professional* and the *Household* groups on issues related with Quality of life were highly compatible, with all parameters under this theme receiving similar importance ratings by both respondent groups. Both groups held the opinion that the built residential environment has an important role to play in providing good life quality. The issues of community

safety and maintenance to minimize pollution were considered the most important quality of life features while the affordability of homes was considered less important.

"Minimized land consumption and compact urban form", "Social cohesion and sense of community", and "Public participation in development and management process"

It was found that the studied stakeholder groups agreed on the importance of minimizing agricultural land lost to peri-urban development and building at appropriate densities. However, given the unresolved economic growth and land use priorities, many agreed that the controversy between continued urban spatial expansion and agricultural land preservation may persist. A difference in opinion on community agriculture was found with the studied stakeholder groups, with the *Household* group stressing more importance on the issue's relevance to sustainability than the *Professional* group. It implies that the professionals, when making plans for the peri-urban area, may have underestimated the need by local residents for opportunities to perform agricultural activities.

The theme of "Social cohesion and sense of community" was found to have received lower importance ratings than the other themes. A difference of opinion was found with the issue of diversity of households in community, with the *Household* group stressing more importance on community diversity. However, it was also found that both stakeholder groups have reservations in regard to social-mixing in community planning, either in terms of its practicality or its social implications. Consensus was obtained on stakeholder perceptions of issues of sense of community and integration with neighbouring communities.

Contention of opinions was found with the issue of public participation in community planning and design. Although both stakeholder groups were aware of the institutional barriers to effective public involvement in urban planning decision-making in China, the *Household* group considered the opportunities of participating in planning and design decision-making as being far more important than did the *Professional* group. On the other hand, consensus was largely obtained on issues of public involvement in community management and on the

premises of enhanced public participation such as the provision of meeting spaces and knowledge dissemination.

"Reduced reliability on automobile use"

It was found that "Reduced reliability on automobile use" was the most contended sustainability theme between the studied stakeholder groups. The *Professional* group had understated the importance of all parameters related with transport and accessibility according to their *Household* group counterpart. Holding the increased ownership of private vehicles as a premise for planning settlements on the urban edge, the professional decision-makers did not consider the necessity of self-sustainability in the peri-urban settlements they planned. On the other hand, the actual low ownership of private vehicles of the current peri-urban residents had put them in the position of relying on service facilities provided within or in vicinity to their communities. It can be concluded that, while recognizing the role of planning on providing good transportation and accessibility, the concept of reduced reliability on automobile use had not been held as a desired feature for peri-urban settlement by the professional decision-makers. By contrast, the peri-urban residents expected more emphasis to be stressed on the accessibility and self-sustainability of planned settlements in order to improve the convenience of living in the peri-urban without the necessity of owning private cars. For the same reason, accommodation for walking and cycling was not particularly considered an important feature for settlement sustainability by the professionals while receiving high importance rating by the residents. Difference in opinion was also found with the priority of provided service types, with the professionals prioritizing public services such as commercial facilities while the residents emphasizing on the vicinity of educational facilities such as kindergartens and schools.

6.7 Conclusion

This chapter has focused on answering the fourth research question: "What are the stakeholders' perceptions on the sustainability issues and how has the dynamics of decision-making affected the sustainability of the outcome of peri-urban

settlement development in China?"

The chapter has analysed the structure of the decision-making and the relative roles of the stakeholders in the decision-making process of peri-urban settlement development in Tianjin. It was argued that the understanding of stakeholders' perceptions on sustainable development issues is important for a better interpretation of the current outcome of peri-urban settlement development.

By analysing the dynamics of the decision-making process that have led to the outcome of the studied settlement cases in Tianjin, it was found that the decision-making of the studied settlement cases follow a similar pattern, with a "top-down" hierarchy dominated by state-level policy directions at the top and lower levels of local governments following suit, while forming a "pro-growth coalition" with the private sector. In this process, the urban planning and architecture professions are often side-tracked to take supporting roles of providing technical and aesthetic skills, and the residents, who are the receivers of the development outcome, are almost completely excluded from decision-making.

Based on the evaluation framework set out in Chapter 3, the importance of each of the 37 sustainability parameters were evaluated by two stakeholder groups, i.e. the Professional and the Household groups. It was found that, largely consensus of stakeholder perceptions were obtained on the themes: "Ecologically responsible development" and "Quality of life"; and contention of stakeholder perceptions were obtained on the theme: "Reduced reliability on automobile use".

To fully understand the development outcome of peri-urban settlements in China, it is important to examine how the stakeholder perceptions on sustainability have affected the outcome of developed settlements. The next chapter will be focusing on establishing the relationship between stakeholders' perceptions of sustainability and the evaluated outcome performance of studied settlements and make implications for future development practice to achieve better sustainability.

Chapter 7 _ Discussion: The perceptions and performance of sustainability in peri-urban settlement development in China

7.1 Introduction

This chapter builds on the previous chapters and presents a discussion that is focused on finding the relation between the stakeholder perceptions of sustainability and the sustainability performance of peri-urban settlements. It has been argued that people's perceptions are of interest because they influence actions, and in turn the result of actions. By making a correlation between the perceptions and performance of sustainability, it is aimed to reveal the way in which perceptions of sustainability has affected development practice in its ability to deliver sustainability as an end product, and find solutions to improve sustainability of future development.

7.2 Comparison of stakeholder perceptions of sustainability with development performance

In this section, a comparison is made between the stakeholders' perceptions of sustainability, as represented by the perceived importance levels of the sustainability parameters listed in Table 3-1, and the evaluated performance of the studied settlements, as represented by the level of delivery against the corresponding parameters.

Table 7-1: Spearman's rho correlation of stakeholder perceptions and evaluated settlement performance

Stakeholder group	*N*	*Spearman's rho correlation coefficient*	*Significance (1-tailed)*
Household	37	0.309	0.031
Professional	37	0.394	0.008*

Note: *Significant at 0.01 level.

Table 7-1 illustrates the Spearman's rho correlation between the mean importance calculated of the 37 peri-urban sustainable settlement parameters perceived by the *Household* and *Professional* groups and their perceived level of delivery in the studied settlement cases. With the threshold significance set at p=0.01, the result demonstrates a significantly positive relation between the perceived importance level of sustainable parameters and their level of delivery for the *Professional* group ($r=0.394$, $p<0.01$). This indicates that the perceptions on sustainable peri-urban settlements by the professionals involved in their development explain, to a large extent, the performance of those settlements against sustainability criteria. To put it in simple terms, if one sustainability feature is held as more important than another by the professionals, it is more likely than not that the feature will be better delivered than the other that is held as less important. The perceived importance of sustainability peri-urban settlement features by the *Household* group, on the other hand, shows a non-significant correlation with their corresponding performance in the studied settlements ($r=0.309$, $p>0.01$). This indicates that the level of importance perceived by a resident of a certain sustainability feature does not have a significant effect on its subsequent delivery in settlement development. That is to say, the opinions of the residents, when it comes to peri-urban settlement development, are less influential than those of the professionals on the actual outcome.

The findings from the correlation analysis corresponds with the previous discussion in Chapter 6 on China's planning system being dependent on a "top-down" authoritarian approach with very limited civil society involvement. It reconfirms the dominating influence of the parties involved in the decision-making process on the outcome of settlement development practice.

Referring back to Section 5.6, it was concluded upon survey results that: "Theme 1: Ecologically responsible development" and "Theme 3: Quality of life" are, on the whole, the best implemented sustainability features; whereas "Theme 2: Reduced reliability on automobile use" and "Theme 6: Public participation in development and management process" are the least well implemented sustainability features in the studied peri-urban settlement cases; with "Theme 4: Minimized land consumption and compact urban form" and "Theme 5: Social

cohesion and sense of community" falling in between. Referring back to Section 6.6, it was concluded that, "Theme 1: Ecologically responsible development" and "Theme 3: Quality of life" are the themes with compatible stakeholder perceptions; whereas "Theme 2: Reduced reliability on automobile use" was the theme with the largest discrepancy of stakeholder perceptions; with "Theme 4: Minimized land consumption and compact urban form", "Theme 5: Social cohesion and sense of community" and "Theme 6: Public participation in development and management process" falling in between, which received neither overall consensus nor contention on stakeholder perceptions. By comparing these conclusions from the previous chapters, some relationship can be identified between the conformity of stakeholder perceptions on sustainability and the sustainability outcome of developed settlements: good settlement sustainability performance coincide with conformity of stakeholder perceptions with the only exception being the theme of public participation, which was poorly practiced although some level of conformity was found with the stakeholder opinions. It therefore can be concluded that, lower levels of sustainability performance in the settlement development outcome coincided, to a large extent, with lower levels of consensus on the conceptions of sustainability between the decision-makers of the development and the residents of the communities developed.

7.3 The "three bias" of delivering sustainability

To make the linkage between the perceptions and performance of sustainable peri-urban development, an argument is based on the comparison between the institutional and conceptual basis of development decision-making and the outcome of the development practice. The point of departure of the argument is the identification of the gap between the perceptions of sustainability between the decision-makers and the actual users of the settlements and its relation with the development outcome. As has been discussed in the last section, the gaps between conceptions coincide to a large extent with lower levels of outcome evaluation. Therefore, it is concluded that the problems that exist with peri-urban settlement development can be attributed, to a large extent, to the gaps between the sustainability conceptions of the decision-makers and the residents of the

developments. This then raises the questions of *"What caused the gaps?"* and *"Can they be mediated?"* These questions are considered to be critical in bring about more sustainable practice in future developments. The following discussion thus focuses on answering these questions.

In answer to the questions raised above, three types of "bias" are identified here as the causes to the gaps, which are explained under the subheadings *"institutional bias"*, *"economic bias"* and *"professional bias"*. By analyzing their cause and nature, it is hoped to illustrate how they have affected development practice and what can be done to remedy.

Institutional bias

In China, the mode of planning and managing urban development has remained highly centralized. As Chu (2004) claimed, decision-making has been operated entirely by the government as a "closed circle", without hardly any community involvement, even though research showed that high percentages of residents expressed willingness to participate in affairs that affect their communities.

This research has shown that this centralized manner of decision-making and policy implementation has been effective at ensuring the implementation of centrally-devised strategies to be implemented at local levels with optimized speed. Under the goal of delivering the three Es of sustainability (Environment, Economy and Equity), this kind of institutional setting certainly has its advantages, especially with the implementation of environmental protection laws and policies. However, the research has also shown that social values, such as the preservation of traditional neighbourhoods and rural life, have been compromised, and individual needs of different people of different conditions have been largely overlooked. This raises the question of "who are the masters of the city?" In other words, who should be making the decisions about the future of urban development and be able to enjoy all kinds of social welfare offered by the urban system? Public participation in urban development decision-making has been widely promoted and practiced in many developed countries. In China, however, due to the disproportionate powers between the governments and the generally affected stakeholders at the grassroots, public participation in China is still

difficult to achieve true meaning. Public participation in urban planning of Chinese cities has been limited for several reasons: Firstly, the autocracy of the socialist regime and top-down planning structure impinges on public participation in the process of planning decision-making for fear of empowerment of local communities to challenge their fundamental authority (Enserink and Koppenjan 2007); Secondly, the crave for efficiency of development has meant that public consultation and participation have been suppressed; and thirdly, trust and equity, as cornerstones of participatory decision-making, have not been well established in China.

The concentration of power and the diversity of people and conditions have prevented the authorities from understanding the interests at the micro-level, especially that of disadvantaged groups such as the rural class and the urban poor. Therefore, bottom-up initiatives ought to be encouraged to foster public participation in urban development decision-making. The current institutional setting, political culture and incentive structure that demonstrate traits from the centrally-controlled planned economy still inhibit wide adoption of true and meaningful public participation. On the other hand, participation itself is a learned skill that takes time to grasp, both for government and the public. The enforcement of institutional conditions catering for public involvement in urban development could be one way to ensure checks and balances for decision making and give voice to affected parties and individuals.

Economic bias

Of the threes Es of sustainability, Economy has often dominated the other two (Environment and Equity) and has profoundly shaped the institutions and value structure of the culture. This has been claimed to be the case with the liberal-democratic countries as well as Socialist countries (Wheeler 2004). Wheeler (2004) argued that: "What seems to be needed is a democratic system in which social and environmental values really do balance economic ones, and in which the public sector can play a more substantial role in asserting these values".

In China specifically, a transition from Socialist planned economy to market economy has been taking place since the embarking of the economic reforms in

the 1980s. While decision-making power has been decentralized to local authorities, the private sector is gaining more influence through active involvement in economic activities. The involvement of the private sector is seen as able to affect the efficiency, social equity, and effectiveness of urban programs (Shabbir Cheema 1991). The market rationale, which is the corner stone in a free market economy, is increasingly becoming a fundamental component in the evolution of cities. However, being a less free market economy, the private sector in China has had to form a coalition with the local government in the pursuit for economic growth.

In the settlement cases studied here, it can be seen that a strong and even dominating factor has been contributed by economic considerations rather than the environmental and social goals that were claimed to be central to decision-making. City Sunshine and the New Homes projects, for instance, had an overriding social goal of benefiting the urban low-income class and providing homes for displaced inner-urban residents at affordable prices. However, the decision-making, as it turned out, was more concerned with reducing the cost to require a minimum amount of public investment while ensuring reasonable profits for the public- and private-sector development companies involved. The result is dull-looking high-density residential compounds located in a remote site with inadequate infrastructure provision and poor accessibility to services. Given this, the failure of such projects was almost inevitable, as the basic needs, let alone quality of living, were not satisfied. At Dongli Lake Development, although environmental goals were given high priority, they were more from a market-oriented perspective rather than out of professional responsibility. In her description of the workshop between the Tianjin designers and the Western technical team on wetland design of the Dongli Lake Development in August 2006, McPhillips (2006) wrote: “At Dongli Lake, the concept of setting aside space designed specifically for animals was greeted with intense skepticism and a bit of disdain.” She also noted that to the Tianjin design team, the wetland was primarily “an aesthetic feature to help sell houses with a dose of water quality treatment thrown in” (McPhillips 2006). The conflict between sustainability and profitability was evident.

Professional bias

Professions such as urban planning and architecture play a crucial role in the process of sustainable development, in that they directly address the physical conditions of the built environment. As argued by Tang et al. (2008), there seems to be an "expert-cult" phenomenon in Chinese development planning, which largely depends on extensive professional and technical knowledge rather than the views of the general public. This is completely different from the Western assumption that individuals best understand their own needs, and that the involvement of local people can significantly contribute to better development planning if there is adequate opportunity to do so (Tang et al. 2008).

As this research has shown, on the one hand, the planning and architecture professions are currently sidetracked into doing business or have been disempowered institutionally; on the other hand, their knowledge and beliefs, based on which the plan and design decisions are made, are often not reliable. As Chambers (1998) argued, development experience has been full of "errors and myths", which are deeply-entrenched misbeliefs of the development professionals on the reality. Other researchers refer this phenomenon to "wooden-headedness", which means "the persistent following of strategies that are obviously counter-productive even when clear evidence exists that these are not working" (Wheeler 2004). In the studied settlement case of Huaming New Town, the design of the EZA programme was a result of the collaboration between the Tianjin authority and the planning profession. From a theoretical point of view, the plan seemed ingenious. However, when it comes to implementation, problems emerged, one of which being the adjustability of the rural residents to urban living. As the research shows, being deprived of their land and rural life, many relocated farmers seemed at lost in the brand new modern homes created for them, and others are worried about the future for themselves and their children. The problems that have emerged upon completion of the programme shows that in the plan decision-making, the professionals have underestimated the reliability of the rural population on agricultural land for cultural need, social stability and economic well-being. And above all, the whole-village resettlement plan overlooked the individual interests and needs of different people. Responding to these problems, it is perhaps time for the professionals to rethink the question of "Who are we

working for?" If it is still inevitable for planning decision-making to be dominated by professional opinions, whose interests should be prioritized? In his article, Chambers (1998) called for a new professionalism that is based on the primacy of the personal, which means the recognition of "the power of personal choice, the prevalence of error, and the potential for doing better". A paradigm shift, therefore, is needed in the planning profession of China to turn towards less emphasis on planning prescription and control in favour of seeing planners' input as one of the many inputs required in the development process, valuing other forms of non-technical knowledge and seeking the involvement of community members in the definition of a common vision. In short, planning should be an iterative, participatory and flexible process.

7.4 Conclusion

This chapter has focused on answering the last research question: "What is the relation between the stakeholders' perceptions of peri-urban sustainability and the sustainability performance of developed peri-urban settlements, and what implications does it have on planning and design?"

By making a statistical correlation between the evaluated performance of peri-urban settlements and the stakeholders' perceptions of sustainability, it was revealed that the perceptions of sustainability by the professionals involved in the development of peri-urban settlements have a significant influence on the sustainability of the developed outcome; whereas the perceptions of the users of the developed communities, i.e. the residents, have little influence on the sustainability of the developed outcome.

By bringing together the conclusions from the previous chapters, it was revealed that, lower levels of sustainability performance in the settlement development outcome coincided, to a large extent, with lower levels of consensus on the conceptions of sustainability between the decision-makers of the development and the residents of the communities developed. Based on this finding, it was concluded that the problems that exist with peri-urban settlement development can

be attributed, to a large extent, to the gaps between the sustainability conceptions of the decision-makers and the residents of the developments.

A discussion was then made to explain the implications for urban planning and design, which point to the lack of institutional conditions for public participation in decision-making; the domination of the pursuit for economic benefits over other sustainability goals in the current value structure; and the need for a paradigm shift in the urban planning and architecture professions towards involving more input from the grassroots.

Chapter 8 _ Conclusions and Recommendations

8.1 Introduction

This chapter concludes all the findings in this research and answers the research questions raised. It then makes recommendations for future peri-urban settlement development in terms of design and policy interventions. Finally, the limitations of this study are explained with suggestions for further research themes.

8.2 Conclusions

This section concludes the findings in this research and addresses the research questions asked and objectives outlined in Chapter One. In Chapter One of this thesis, the major aim of this research was developed: "to evaluate the perceptions and performance of sustainability in current peri-urban settlement development in China". To address this aim, five objectives were outlined, which are:

1. To identify the sustainability issues related with peri-urban settlement development and establish an evaluation framework for the assessment of development practice in China;
2. To examine the socio-economic and environmental impacts of peri-urban settlement development in China, and assess current progression on policy interventions in the area of sustainable urban/rural development;
3. To evaluate the sustainability of the outcome of current peri-urban settlement development practice in Chinese cities and identify the current problems;
4. To understand the dynamics of decision-making in the planning and design of peri-urban settlements in China and assess stakeholders' perspectives on issues of peri-urban sustainability.
5. To establish the relation between the sustainability performance of peri-urban settlements and the stakeholder perceptions on peri-urban sustainability, and identify the implications for the planning and design of

peri-urban settlements.

In this section, summaries are made on the findings with regard to each objective.

8.2.1 Sustainability issues in peri-urban settlement development and the evaluation framework

It was argued in this research that, issues of sustainability in the peri-urban interface were dealt with different focuses between the post-industrial cities in the developed world and cities in the developing countries. Through an intensive literature review, it was shown that theories and practices regarding sustainable peri-urban development in the developed countries saw an evolution of ideas and concepts that began with the Garden City movement and evolved to the sustainability and low carbon agenda proposed for the twenty-first century. In the post-industrial cities of the Anglo-American world, concerns with urban expansion and haphazard development at the urban fringe coincided with the rise of counter-urbanization facilitated by widespread car ownership and efficient public transport. Main public concerns over this trend were on the environmental consequences associated with increased vehicle ownership and the inevitable loss of large areas of high-quality agricultural and forest land to greenfield development. Key design and policy interventions included New Urbanism and Smart Growth, which called for ecologically-friendly, compact, walkable and mixed settlement forms with high level of involvement by local residents. The low carbon agenda also added an energy-oriented concern that call for more concentrated interventions at both state and local levels.

It was illustrated that the literature on sustainability of the peri-urban area of the Third-World cities was found to be focusing mainly on two areas of issue: one was dealing with socio-economic issues such as poverty, and the other was dealing with environmental issues such as pollution and resources implications. Poverty issues are caused by exacerbated segregation and social inequity brought about by urban growth and rural migration and the resultant “de-agrarianisation” due to sprawl. Environmental issues concern with the ecological impacts on the

natural environment and resources caused by urban spatial expansion. Interventions to address poverty issues and environmental degradation point to improved institutional engagement and restructured management frameworks and call for approaches that will tackle poverty alleviation and social justice alongside environmental integrity.

Housing and land reform policies since the 1980s have given rise to urban restructuring in Chinese cities, which is characterized by decentralization and peri-urbanization. With the combined driving forces of rural urbanization, inner-city regeneration and suburban residential development, the peri-urban landscape is continually being urbanized at an unprecedented rate and sees the combination of three types of development, i.e. rural resettlement projects; public affordable housing compounds; private-sector real estate development of suburban commercial housing. It is concluded that the sustainability issues in the context of peri-urban areas of Chinese cities are complex and would require a combined research framework that incorporates issues emerging out of both the First and Third World contexts.

It was argued that, combining the research focuses of peri-urban settlements in the First and Third World cities, six research themes can be identified with regard to sustainability issues, which constitutes the basis for the evaluation framework that structures the analysis the rest part of this research was to present:

- Theme1: Ecologically responsible development
- Theme2: Reduced reliability on automobile use
- Theme3: Quality of life
- Theme4: Minimized land consumption and compact urban form
- Theme5: Social cohesion and sense of community
- Theme6: Public participation in development and management process

Within each theme, key sustainability issues were identified to be translated into a total of 37 parameters for the evaluation framework.

It was argued that an integrated research approach should be adopted for this study,

one that combines an evaluation of the development outcome of peri-urban settlements using the framework proposed, and an understanding of stakeholder perceptions of sustainability issues.

Table 8- 1: Summary of policy responses to sustainable urban/rural development in China

Sustainability themes	Proposed policy responses
Ecologically responsible development	1. Implementation of "3rd Step" Mandatory Building Energy Efficiency Standard. 2. Establishment of Water Saving Offices in cities; publication of Water Saving Society Development Plan and a series of guidance and codes for water-efficiency plan. 3. Implementation of the EIA law; establishment of a system of environmental protection standards at both the national and local levels. 4. Promulgation of the National Plan for Wetland Protection Action and China Action Plan for Biodiversity Conservation.
Reduced reliability on automobile use	Promotion of "Green Transport" systems in cities to curb congestion and mitigate environmental impacts.
Quality of life	1. Improvement of living conditions and minimization of health and pollution problems through urban regeneration and improved infrastructure provision. 2. Publication of the Guidance on the Management of Affordable Housing and more regulated development and management of "economical and comfortable housing".
Minimized land consumption and compact urban form	1. Publication of the National General Land Use Planning Framework (1997-2010) and stipulation of statutory force on a 1,800 million mu "Red Line" denoting the minimum limit on the amount of preserved farm land. 2. Implementation of "Exchange *Zhaijidi* for Apartment" (EZA) programmes. 3. Publication of Guidance Note for Developing Energy/Land Efficient Housing and Public Buildings.
Social Cohesion and Sense of community	1. Call for the construction of a "Harmonious Society" in national strategic plan. 2. Increased advocation of social mixing in community development. 3. Promotion of "community building" in urban residential development.
Public participation in community development and management process	1. Promulgation of the Regulation on the Disclosure of Government Information. 2. Implementation of the Provisional Measures on Public Participation in Environmental Impact Assessment 3. Increased institutional measures catering for public participation in urban planning decision-making.

8.2.2 China's peri-urban settlement development and policy responses to sustainability in urban/rural development

It was concluded that a shift towards more sustainable development has been given high priority in national strategies in China to propose for the integration of the social, economic and environmental goals of society. New policies and regulations promulgated to address sustainability issues in the field of urban/rural

development were identified, which are summarized in Table 8-1.

It was also noted that although the Chinese government is demonstrating a strategic transition from unitarily pursuing economic growth towards being more sympathetic of the environmental and social consequences that rapid economic growth could bring, there are still many limitations of the proposed sustainability policies. It was argued that the consequences and effect of their implementation remains to be judged upon detailed evaluation of the effect of their implementation.

8.2.3 The outcome of peri-urban settlement development in China – lessons learnt from Tianjin

Three recently developed peri-urban settlement cases in the city of Tianjin, each representing a particular type of residential settlement typical of peri-urban areas in Chinese cities, were examined using the proposed evaluation framework. Table 8-2 summaries the findings from the cases studies.

Environmental sustainability

Peri-urbanization challenges the environmental sustainability of the metropolitan regions. It was found in this study that, the studied settlement cases in Tianjin have performed comparably well in terms of environmental sustainability and ecological responsibility. This study has found that energy-efficient design regulations have been generally well observed in the development of the settlement cases studied. However, it is also concluded that the actual effect of the energy-efficiency measures remains to be assessed upon further studies based on monitoring. This leads to the observation that energy performance monitoring and post-construction evaluations are presently lacking and inefficient in the Chinese building industry, which may partly account for the lack of motivation of developers and construction companies to build to high quality.

Table 8- 2: Summary of Case Studies in Tianjin

Type of Peri-urban Settlement	Name of Study Case	Approaches to Sustainability	Key Challenges
1. In situ resettlement of rural community	Huaming New Town	1. Balance urban development with farmland preservation 2. Improve quality of living for the farmers 3. Improve well-being of landless farmers 4. Building energy efficiency 5. Use of renewable energy 6. Public participation	1. Long-term rural ecological stability 2. Landless farmer re-employment 3. Increased living cost and less self-sufficiency for rural households 4. Lack of true public involvement
2. Affordable housing compound	City Sunshine and New Homes	1. Improve housing affordability 2. Improve quality of living for the poor 3. Building energy efficiency 4. Use of renewable energy	1. Failure to meet the needs of target groups 2. Imbalance between work and housing 3. Poor service infrastructure provision 4. Lack of public participation
3. Suburban commercial housing estate	Dongli Lake Development	1. Preserve natural wetlands 2. Building energy efficiency 3. Use of renewable energy 4. Mixed housing types	1. Fragile ecology and expensive maintenance 2. Cancellation of public access to environmental assets 3. Inadequate service infrastructure provision 4. Lack of public participation

The use of renewable energy sources is gaining increasing policy support in property development to combat the emerging energy crisis. This research has discovered that the government plays a significant role in the implementation of the use of renewable energy in housing developments in China. In the three investigated settlement cases, renewable energy usage such as solar hot water has been widely applied in the two government-led developments, while receiving limited application in the private-sector housing development case. This implies that policy and financial support are essential for housing developments to take renewable energy on board and balance the increased primary input and maintenance costs, which are the main obstacles hindering wide application of renewable energy systems.

It has been noted that more public attention has been directed towards the recognition of the adverse impacts by peri-urban development on the natural environment, such as wetlands, natural greenery, water bodies and biodiversity in China in recent years. In this research, it has been observed that this pro-environmental transition in the urban planning practice has made a positive impact on the recent peri-urban developments, as demonstrated by increased

design interventions to preserve the natural environmental capital in the developed areas. Nonetheless, it is also noted that there still exists a conflict between the goals to achieve sustainability and retain profitability.

An obvious side-effect of building outside the central city area is the inevitable increase on the distance to travel between the urban core and its peri-urban outgrows. It has brought about increased reliability on the use of automobile and increased traffic congestion and air pollution in many developed countries, which had undergone the process of peri-urbanization decades ago. As the case studies of this research have shown, Chinese cities may now be experiencing similar situations to their western counterparts. It was found that, all studied settlement cases demonstrated high levels of automobile reliance. In these new peri-urban developments, public transportation options are limited and good accessibility to public services remains difficult to sustain.

The most publicly recognized environmental concern related with peri-urbanization in China is probably that of the loss of agricultural land to peri-urban developments. The EZA programme has been one of such measures devised as to address the conflict between the requisition of farm land for urban development and the need to preserve agricultural land for food security and environmental integrity. This research has revealed, by means of the case study in Tianjin, that the compensation of acquired farmland by re-cultivation of former *zhaijidi* may only achieve the balance of increased and lost agricultural land in land use quantity terms, and fail to maintain the rural ecosystem and food security. As the re-cultivation took exclusively the form of fruit and vegetable green houses, the loss of prime farmland, which were fertile agricultural land that yielded basic foods necessary for the survival of the population, fail to be truly compensated. There is reason to believe that the EZA programme might be just another way of getting around the restrictions on farmland acquisition for urban development, and may even instigate further loss of prime farmland under the disguise of innovative land use strategies.

Socio-economic sustainability

Three decades of fast economic development have significantly transformed the

lives of the Chinese people. In this research, the study cases in Tianjin have demonstrated that the quality of life of the peri-urban residents, as demonstrated by adequate living space, good quality living environment, safety, improved sanitation and diminished pollution, has been hugely improved compared with the previous rural environment and has received general satisfaction among the current residents of the new settlements. This indicates highly success of the housing development authorities and industries at providing good quality of life for the rapidly increasing urban population. However, the case studies carried out in this research have also revealed that there still exist problems that affect life quality. It has been observed that construction quality remains problematic and affordability has decreased since the on-set of the property boom. More importantly, it has been identified that lack of accessibility to local services and reliance on private automobile use have caused serious problems for the peri-urban residents. With service infrastructure provision prevalently lagging behind settlement plan and construction, accessibility to services, all in all, becomes a dominating factor in sustaining peri-urban settlements.

As argued earlier in this thesis, social stratification has been brought about accompanying economic development in China. Peri-urban settlement development in its current pattern has served to strengthen social stratification by means of homogenization of social strata of their residents and differentiation by stratified standards of services and accessibility. As public services provision follow a hierarchical pattern with higher standards nearer the urban centre and lower standards towards the peripheral areas, all peri-urban settlement cases studied here suffer to certain extent inadequacy of service accessibility. Commuting between the peri-urban estate and the urban centre is consequently necessitated to overcome the inadequacy. However, when the cost of commuting or private vehicle ownership is difficult to bear, the quality of living becomes at stake. In the studied cases, it has been observed that signs of deterioration have shown in the more deprived communities although they have been developed in less than ten years, and there is a danger of them becoming future slums as the composition of the occupants is shifting towards the less well-off classes with the deterioration of the living environment. The lack of work opportunities on the urban edge is another factor driving the flight back towards central city once it

becomes affordable. These observations lead to a rethinking of the current planning of peri-urban settlements, especially with affordable housing estates. The location of affordable housing developments in the urban periphery is not an uncommon practice in China, however, few of them have been successful. It is perhaps time for urban planners to reassess the current strategy of affordable housing provision and consider other possible routes.

The issue of agricultural land covers both environmental and socio-economic aspects of sustainability, in that it not only concerns the natural ecosystem but also represents a particular culture and socio-economic setting, in which the rural lifestyle has dominated for centuries. As this research reveals, the transformation of living means and lifestyle of farmers necessitated by the EZA programme has brought about a recognition that the mismatch of the supply of former rural labour with the demand for skilled workers of the modernized industries remains a huge problem that needs more than community design to resolve. Moreover, the socio-economic transformation of the rural sector may reduce the rural productivity of the metropolitan region as most peri-urban areas in China are located on highly productive agricultural land. It suggests that when resettlement plans for the rural communities are made, more thoughts need to be given to maintaining economic well-being for the communities affected rather than forcing them out of self-subsistence and leaving them vulnerable to unemployment and poverty.

The innovative schemes adopted by the cases studied in Tianjin, despite laying claim to sustainability, are each found to be promoting only certain facets of the sustainability agenda. It is found that a holistic agenda to achieve sustainability is currently lacking within peri-urban settlement development, an agenda that takes into account current issues and integrates environmental, social, and economic aspects of sustainability.

8.2.4 Decision-making in peri-urban settlement development and stakeholder perspectives on sustainability

It has been argued that, the local authorities, real estate developers and planning

and design professionals have formed a strong coalition in decision-making in the development of peri-urban settlements in Chinese cities. As the study cases in Tianjin have revealed, the plan strategies that have been made were greatly influenced by nationally devised policies with adjustments to suit local circumstances. The decision-making power of local authority leaders is found to be strong especially with government-led development projects. Private-sector developers are gaining more power in development decision-making by forming a pro-growth coalition with local governments in seeking profits through real estate development. The planning and design professions retain subordinate roles to the government and developers by providing technical and aesthetic skills for plan implementation.

Through a study on the perceptions of the *Professional* and the *Household* stakeholder groups on the sustainability issues, it was found that the stakeholder groups' opinions differed on some sustainability issues while conforming on others. It was found that the stakeholder groups' perceptions differed most on the issues related with "reduced reliance on automobile use", with the *Household* group attaching far more importance to all related issues than the *Professional* group. The finding implies a possible underestimation on the decision-makers' side on the importance of good accessibility and self-sustainability of peri-urban communities when they were planned. This may explain the reason for the low performance evaluation by the residents on the same issues.

It was found that consensus of stakeholder opinions was largely obtained on the issues related with "ecologically responsible development" and "quality of life", which coincided with the favourable evaluations by the residents on their delivery in current settlement development. It was also found that, although the stakeholders largely agreed on the importance of these sustainability issues, there were some concerns over their implementation. The reasons for the concerns point to policy and regulatory inefficiencies, lack of sufficient knowledge and skills within the building industry, as well as the need for a changed mindset and increased public awareness.

Neither overall consensus nor contention of stakeholder perceptions was found

with issues related to “Minimized land consumption and compact urban form”, “Social cohesion and sense of community”, and “Public participation in development and management process”. It was found that, the *Professional* and *Household* stakeholders agreed on the importance of farmland protection against peri-urban development, while disagreeing on the importance of opportunities for community agriculture; agreed on the need to foster sense of community in planned settlements, while disagreeing on the importance of planning diversified housing types; agreed on the necessity of catering for public involvement in community management, while disagreeing on the importance of public participation in community planning and design.

8.2.5 The perceptions and performance of sustainability in peri-urban settlement development in China

To find solutions to Chinese cities’ emerging peri-urban problems, this research was set out to look at both the stakeholders’ perceptions of sustainability and the performance of sustainable outcome of peri-urban settlement development in China. It has identified the relationship between the two. In the discussion made in the previous section, it was concluded that: firstly, the decisions made by the professional groups, i.e. government officials, developers, planners and architects, dictate the outcomes of developed settlements, while the residents, which are the recipients of the developed outcomes, have little influence to the decisions being made that may have affected their lives; and secondly, the problems identified in the outcome of the studied settlement developments could be largely explained by the differences in the perceptions of the professional and household stakeholder groups on issues related with sustainability. In other words, the lack of consensus, on what makes sustainable community, between the decision-makers and users of these communities was considered the main reason behind their unsustainability.

8.3 Recommendations for future peri-urban settlement development in China

Sustainable communities are almost never successfully built from scratch, on the

other hand, they need time to mature. The problems found with the current development outcomes of peri-urban settlement development in Tianjin may, to a certain extent, be attributed to the fact that these settlements are recent developments. It is tempting to conclude that their problems may be resolved with time. However, it is still meaningful to make recommendations on policy and design interventions that may prevent the problems or help in solving them in the short to long term.

To improve energy efficiency in residential buildings and communities, it is necessary to introduce a system of regulatory and design measures to enable a step change in sustainable building practice in China. Integrated design standards similar to Code for Sustainable Homes and Passivhaus that specify design details rather than simply stipulating a percentage of energy saving would provide better guidance to the building industry and offer greater regulatory certainty to developers and designers. An integrated design process that involves both architects and engineers from the early stages of building design may provide better opportunities for implementing energy-efficient design. Post-construction evaluation and post-occupancy monitoring may also serve as a feed-back system, which provides opportunities for evidence-based improvements on design interventions.

A system of energy supply which makes use of all natural energy sources and minimizes the output of undesirable by-products is to be seen as an integral part of an energy efficient settlement. As this research has shown, the barrier preventing the wide taking up of renewable energy systems is mainly economic feasibility. This requires interventions at both state and local levels. Potential solutions to this may include tax leverage that discourage the use of conventional energy sources and grant tax reliefs on renewable energy usage, as well as giving lower-interest loans to developers to invest in renewable energy systems and water-saving measures. In terms of long-term usage and maintenance of the renewable energy and water-saving systems, which has been found as causing problem for the implementation of such systems, it is recommended that legislation and detailed regulations in the area of estate management be improved, outlining the ownership and responsibilities of the parties in the use and

maintaining of renewable energy/water-saving systems, and financial leverage be applied to users in order to encourage the installation and adoption of such systems. Further development also requires economical production and technology improvement to increase the reliability of the systems. However, even more serious is the information deficit which works against the implementation of energy concepts. Continuing education programmes for architects, planning experts, and construction workers, and as well as programmes to increase the awareness of consumers on energy issues would help improve the wide taking up of energy efficient designs.

The conflict between urban spatial expansion and preservation of natural environmental assets and biodiversity requires state-level legislations to be strengthened and strictly observed through planning permissions. At the moment such legislations are weak in the power of implementation and are often compromised for exchange of maximized profit. It thus requires increased awareness of the importance of the ecological agenda and enhanced professional responsibility among development decision-makers to see through an ensured implementation of the sustainability strategies.

One of the claimed inevitable impacts of increased population on the urban edge is the increased travel distance and automobile reliance. Given the rapidly increasing level of car ownership in China, the trend seems irreversible. Although the situation of urban traffic deteriorates significantly each year, China's policy makers continue to hold that the individual right to private car ownership cannot be deprived, and behind this there is still a strong reliance of national economic growth on the contributed gross domestic product (GDP) by the expanding automotive industry. Although public transportation development has become more prioritized on the urban authorities' agenda, its progress is still lagging behind peri-urban settlement constructions. The crucial point lies really with a matter of resolving competing national priorities. Despite the difficult choices that need to be made, there are still options that are left unchecked, one of which being car-sharing. Car-sharing offers individuals an alternative to private vehicle ownership. It benefits individuals by transferring the fixed costs of ownership into variable costs, allowing users to tailor their auto-use expense to their personal

needs. As Shaheen and Martin (2006) argued, car-sharing may be more readily incorporated into developing nations where motorization is still in its early stages. In their study of the market potential for car-sharing in China, they concluded that car-sharing is overall receptive among the Chinese urban population and that car-sharing would help to ease the growing demand for private vehicles and prevent some of the negative impacts of widespread motorization (Shaheen and Martin 2006).

Improved accessibility to local services and jobs is essential for reduced travel distances and automobile dependence. The prevalence of the lack of service infrastructure provision in current settlement developments suggests that this is the area that needs most urgent interventions. When making decisions on the location for settlement development, it is preferable to choose those areas with matured urban services and existing employment opportunities. With current developments, this is often compromised for the low cost of peripheral land. This therefore requires that the urban planning decision-makers to have the vision and the will to plan for the long-term interest of residents rather than focusing on immediate economic benefits. It also requires that more public investment be available for public services provision and stricter regulations to enforce developers to dedicate ample investment in service infrastructure upfront any development. Moreover, transitional measures could be considered for the early stages of development when the population size is unable to support large-scale public services. For instance, community-based businesses could be encouraged through policy support and tax incentives. Planning and design for new settlements should also cater for the opportunities of small community- or family-based businesses and seek to integrate this consideration into the master plan and neighbourhood designs.

This research has questioned the effectiveness of the EZA programme on the protection of agricultural land while accommodating urban growth. It is recommended that a detailed evaluation be carried out on the current outcome of the EZA programme in terms of the effect on agricultural land protection and rural ecosystem preservation before its wide adoption and application. On the other hand, as alternatives to greenfield development, urban infill and brownfield

developments have long been overlooked by urban planners and decision-makers in China, due to the added costs of demolishment and decontamination and lack of legislation and expertise in the areas. As Luo et al. observed, there is currently no integrated legislation and effective incentive measures to encourage contaminated land development in China (Luo, Catney and Lerner 2009). Therefore it is suggested that interventions be taken in this area to encourage infill and brownfield development through enforced regulations, policy and financial incentives and planning control mechanisms, so as to relieve the burden of peri-urban development on greenfield sites and agricultural lands.

This study has shown that, the socio-economic impacts brought about by the EZA programme on the rural households demonstrates trends of further disadvantaging the marginalized social groups by eliminating the possibility of self-sufficiency yet failing to provide opportunities for improvement of well-being. Past experience in other Asian countries such as Japan and South Korea offer some thoughts. In these countries, both industrialization and agricultural growth led the way in the urbanization process. Efforts were made to increase rural incomes through higher yields, guaranteed prices, and increased opportunities for employment in rural industries. Physical infrastructure improvement, such as rural roads, electrification, consolidation, and irrigation, also aided the transformation (McGee 1991). In China, however, agriculture is being "squeezed out" of the regions undergoing peri-urbanization, leaving the rural population as "surplus labours" requiring resettlement not only in terms of housing but also in terms of employment. Using the Japanese and South Korean experiences, it might be time to reassess current strategies of rural resettlement and seek to assist spontaneous rural-urbanization rather than enforcing it through a top-down and "all in one go"-style campaign.

Although it is not clear what strategies work in favour of the creation of a cohesive community, there have been evidence to show what definitely do not work. One of the things to avoid is the deliberate homogeneity of disadvantaged groups in one housing estate, which unfortunately is exactly what many Chinese cities are doing, as demonstrated by the studied settlements in this research. What makes the matter worse is that, these so-called "economical and comfortable"

housing estates are placed in the peripheral locations of the city, which further segregated the disadvantaged groups and led them to deeper deprivation. A common practice in many developed countries of affordable housing provision is to enforce through planning control mechanisms a certain percentage of affordable housing on new commercial housing developments. In China, the same strategy is being experimented in some cities. However, as this study has revealed, both urban decision-makers and residents have reservations when it comes to the idea of mixing affordable housing with commercial housing. It therefore requires a change of mindset, more public investment and policy incentives to drive up a more sustainable route of affordable housing development.

It was concluded that the peri-urban settlement plans now in implementation in Tianjin lack integration of sustainability objectives that consider the holistic environmental, economic and social aspects. A clear framework, therefore, needs to be structured indicating priorities and goals, drawing out evaluation principles and procedures, and setting out benchmarks and performance targets for each of the sustainability aims. Restructuring of the current decision-making system would need to be implemented in order to set up a successful partnership amongst sectors of the society that includes authority, industry and most importantly, the public.

The case studies in Tianjin have demonstrated an inclination of the decision-makers for immediate actions to resolve existing urban problems. The need for immediate visible effect overrides participation and futurity needed for consideration of the longer-term impacts of the development. This kind of motivation favours a deterministic policy priority of immediate physical change, which is expected to lead to economic and social improvements, ahead of measures promoting longer-term sustainability, through continuous investment in people.

It has been argued that there are problems that exist within the institutional setting of the planning system, the value structure of decision-making, and the belief system of the professions, which were summarized into “institutional bias”, “economic bias” and “professional bias” in the previous section. It is therefore

recommended that interventions be made in the three areas in order to achieve long-term sustainability in future development practice.

Firstly, the institutional structure of the current planning decision-making system in China needs to be adjusted to grant more power to the private sector as the economy transfers to be more market-oriented. It is increasingly recognized that the private sector is more efficient than the public sector in most urban development activities and it is more sensitive to the demand of the market. The top-down planning system has been found to be limiting the capacity of the authority to understand the micro-level dynamics of urban development. The rationale of the market, on the other hand, has been more effective at bringing the recognition of public demand into decision-making. Therefore, the role of the private sector needs to be considerably expanded. Yet, public sector should still play a critical role in the provision of infrastructure and public services, environmental control and management, and the maintenance of urban public facilities. The planning and design professions, with their knowledge and expertise that planning for sustainability requires, need to be given more decision-making power in urban development affairs. On the other hand, public participation in planning decision-making needs to be introduced to allow direct input from the very users of the city spaces on affairs that directly impact their lives. That is, a "bottom-up" dimension to decision-making has yet to be explored and facilitated to ensure sustainable rural/urban community development. Rather than intervening in decision-making processes to rectify a perceived problem through devising policies and regulation or directly making plans, local authorities should take the role as facilitators of a mutual exchange of ideas between a wide range of actors relevant to the planning process.

Secondly, although there has been a policy shift towards more "pro-environment" and "pro-poor" urban development strategies, nonetheless, the "pro-growth" mentality is still strong among state and local authorities, with a persisting drive for economic growth notwithstanding environmental and social costs. Growth, in recent years, has been strongly linked with urbanization and the exploitation of land, which lies implicitly behind all types of settlement development described in this research. This implies that China has yet to resolve conflicting national

priorities and clarify goals and strategies in line with the sustainable development agenda. Failure on the decision-makers' side to recognise the immediate concerns of living outside the city core and the economic difficulties of providing the necessary infrastructure for distanced locations were found to be the main causes to the problems identified in the studied cases. The over-heated property market in Tianjin had also played a big part in leading to the decision of developing at a large scale peri-urban housing compounds. It was clear that, in the decision making of the peri-urban affordable housing developments, economic concerns overrode other concerns, such as providing high quality homes and convenient living for the neediest families. "Are housing social goods or commodities?" This is a question to be asked upon planning decision making. The findings from the study cases in Tianjin have shown that failure to appreciate the role of housing as providing social goods to the society not only may compromise the economic gains when they are treated as merely commodities, but also threatens to deteriorate the existing social conflicts of society. After three decades of fast economic growth, it is high time that urban developers take on more social and environmental responsibilities.

And thirdly, adjustments need to be made within the planning and design professions to develop new skills to facilitate the operation of planning/design practice that relies less on public-sector control and more on partnership. This partnership includes the iterative exchange of ideas between the different disciplines within the professional teams as well as the collaboration between the professionals and the stakeholders at the grassroots. Sustainability is an all-encompassing target that requires an integrated approach with environmental, social and economic concerns. It also demands input from disciplines with the knowledge and expertise that can contribute to a holistic planning agenda. The professions, therefore, would need to look beyond the technical and aesthetic concerns that currently dominate planning decisions and seek systematic transformation towards enhancing the iterative exchanging of ideas between the various areas of knowledge essential for an integrated and holistic approach of developing sustainability. What is also needed is for the professions to walk out of the myth of "professionals know the best". It needs to be understood that planning is a profession that serves public good, and the public knows best of what they

need. A mechanism that caters for the involvement of public participation has not been established in the current planning system. It is suggested that more institutional support be granted for the sharing of information regarding urban development plans and adequate opportunities be provided for public consultation over plan proposals. Planning, therefore, needs to be taken as a joint action with representation of grassroots stakeholders.

Unquestionably, the notion of "sustainability" is becoming an increasingly important influence on peri-urban settlement development in 21st century Chinese cities. This requires a rethink of our conceptions about sustainable development, a reexamination of the current practice and a remodeling of the institutional structure that help to succeed in its making, for the knowledge of which, it is hoped that this research has made some contribution to.

8.4 Limitations of this research

It is hoped that the findings of this study will not only clarify the current situation regarding the sustainability of peri-urban settlement development in China, but they will assist in the enhancement of sustainability in future development schemes, as well as identify the pathways through which to achieve that end. However, it has to be admitted that there are limitations with this research, which suggest potentials for further research.

Firstly, the empirical evidence obtained in this research is based on case studies in one city rather than based on a nation-wide study. Although Tianjin may represent a typical case for peri-urban development in other Chinese cities, and some of the study cases chosen are planned as prototypes for later developments to follow, nevertheless, the problems found with the study cases may only be relevant in its specific context. Therefore some of the recommendations given in this research may not be applicable for the general context.

Secondly, it has been acknowledged that there are limitations with the evaluation of building performance based on user-survey, as the subjective evaluation by

users may not represent the true performance of the built environment, especially in the areas of energy efficiency and ecological impact. However, as this study has an overall stakeholder-centred perspective and focuses on the comparisons between different settlement types and between sustainability performance and stakeholder perceptions rather than the actual evaluation result, the use of subjective evaluation as a proxy for sustainability performance of studied settlements is considered adequate for the purpose of this research.

Thirdly, the inherit limitation with an integrated approach that looks at a series of issues may be that it lacks the detailed inquiry into each specific issue. This is probably the case with this research. Due to the limited scope and time-scale of a PhD research, this study has touched on a series of issues associated with sustainable development of peri-urban settlements in China, and aimed to present a holistic understanding, yet it may lack depth in its discussions within each chosen theme and issue for consideration.

8.5 Further research themes

The main contributions of this research to the existing literature are considered to be twofold. Firstly, it fills the gap in the existing literature on recent peri-urban settlement development in the context of Chinese cities; Secondly, it proposes an integrated research methodology by combining the evaluation of settlement performance with the examination of stakeholder perceptions, whereby contributes to empirical research in the context of sustainability. This section proposes some further research themes to address the limitations of this study as well as complement its contributions.

Given the scale and speed at which peri-urban development is being undertaken in China, peri-urban settlement development in Chinese cities and their implications for local and global sustainability merit continuous observation and examination. A broader-scale study that covers a wide region and a variety of geographical locations needs to be carried out to have a more comprehensive understanding of peri-urban development in China as a whole. The settlement cases that have been

studied in this research also require follow-up and continuous research in order to study their temporal changes in terms of achieving sustainability.

The limitation of adopting a single method for the evaluation of a complex issue such as that of settlement sustainability suggests that, a more comprehensive methodology may be required, if the evaluation of the actual performance is the focus, one that incorporates quantitative modelling/measurements with qualitative analysis. Currently such comprehensive evaluation tools are lacking at the meso-level of urban settlement or neighbourhood, especially in the context of Chinese cities. Further research can be done in this area to address the research gap by developing a multi-method evaluation tool to be used on the assessment of sustainability in urban/peri-urban communities of Chinese cities.

This study has concluded that many of the problems in the current peri-urban settlement development can be attributed, to a large extent, to the lack of understanding of user perspectives on the decision-makers' side. Further research can be extended to focus on a user-centred perspective of sustainability study on urban settlements, especially how users perceive and use their living environment and how the sustainable planning/design interventions impact on people's lives and well-being.

This research has touched on a variety of issues related with sustainability in the peri-urban context. Further research may be considered, based on the findings of this study, to focus on some of the specific issues and provide a more in-depth inquiry. Possible research themes may include:

- Further evaluation of energy/water consumptions and ecological impacts of peri-urban settlements
- Studies on the change of transportation patterns brought about by peri-urban settlement development and the associated environmental implications
- Further evaluation of the quality of life of peri-urban residents
- Further evaluation of the impacts of the EZA programme, especially in

terms of its ecological and social implications

- Studies on neighbourhood change and social stratification associated with peri-urbanization
- Studies on pathways to increase engagement of public participation in the planning and design decision-making of peri-urban settlement development.

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Appendix I: Questionnaire A - Performance Evaluation of Peri-urban Settlements in Tianjin

Dear residents,

The survey is part of a PhD study focusing on ***Sustainable Peri-urban Residential Settlement Development.*** For definitions of sustainable community please refer to the box below. To achieve sustainable development there are certain principles to guide the planning and design of communities. How do the constructed peri-urban settlements perform against these principles? This is the question this survey aims to answer. Therefore, the purpose of this questionnaire is to understand your opinion on the sustainability performance of your community.

A sustainable community is:
• A community that uses its resources to meet current needs while ensuring that adequate resources are available for future generations • A community that seeks a better quality of life for all its residents while maintaining nature's ability to function over time by minimizing waste, preventing pollution, promoting efficiency and developing local resources to revitalize the local economy • A community that resembles a living system in which human, natural and economic elements are interdependent and draw strength from each other

The questions in this questionnaire are structured into ***<u>two sections</u>*** covering issues related with:

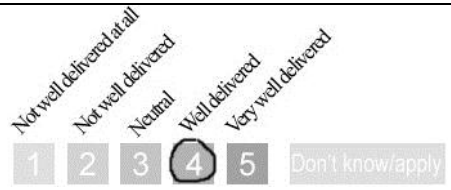
1. Your Home 2. Your Community

In each section, you are asked to consider:

"To what extent do you think this sustainability feature is delivered in your home/community?"

Please fill in the questionnaire in the way as demonstrated by the example below and return it to the Residents' committee/Property management office and COLLECT YOUR GIFT!

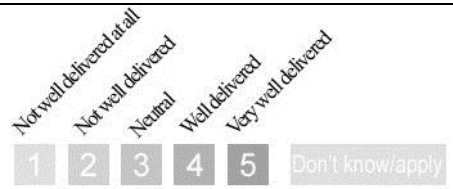
For Example:

No.	SUSTAINABILITY FEATURE	EVALUATED PERFORMANCE
1	**<u>Building orientation:</u>** *e.g. the orientation of living space towards the south*	

Explain: This respondent feels that the building orientation of their home is *well delivered* in the design of their home (response "4").

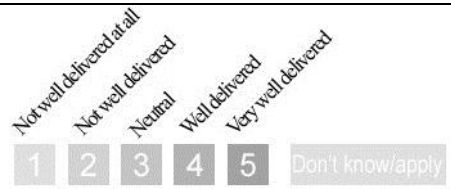
SECTION 1: Your Home_____

In this section, the questions are related to the immediate surroundings of your home.

No.	SUSTAINABILITY FEATURE	EVALUATED PERFORMANCE
1	**Building orientation:** *e.g. the orientation of living space towards the south*	
2	**Natural lighting:** *e.g. rooms are designed to be naturally lit where possible*	1 2 3 4 5 Don't know/apply
3	**Natural ventilation:** *e.g. the provision of natural ventilation in the home to ensure adequate amount of fresh air intake and reduce excessive heat*	1 2 3 4 5 Don't know/apply
4	**Energy-efficient building envelope:** *e.g. walls and windows that have good air-tightness and thermal performance*	1 2 3 4 5 Don't know/apply
5	**Energy-saving products:** *e.g. the installation and promotion of energy-saving light bulbs and appliances*	1 2 3 4 5 Don't know/apply
6	**Water-saving equipment:** *e.g. the installation of water saving equipment such as dual-flush toilets and water-saving taps*	1 2 3 4 5 Don't know/apply
7	**Provision of Separate Refuse Collection/Recycling Systems:** *e.g. separation of refuse to enable recycling*	1 2 3 4 5 Don't know/apply
8	**Adequate space:** *e.g. the provision of adequate room and space to meet the demand*	1 2 3 4 5 Don't know/apply
9	**Construction quality:** *e.g. ensured good construction quality to allow for life-cycle low maintenance*	1 2 3 4 5 Don't know/apply
10	**Affordable Housing:** *e.g. the provision of housing options that are more affordable than commercial housing products*	1 2 3 4 5 Don't know/apply
11	**Safety** *e.g. the provision of surveillance equipments to ensure safety; the design of a safe environment*	1 2 3 4 5 Don't know/apply

SECTION 2: Your Community_____

In this section, the questions are related with your community AS A WHOLE.

No.	SUSTAINABILITY FEATURE	EVALUATED PERFORMANCE
12	**Renewable energy systems:** *e.g. solar-water system, biomass boiler and using waste energy from industry (Combined Heat and Power)*	
13	**Preservation of natural green land and water body:** *e.g. the preservation of natural green land/wetland/water bodies within or near community*	1 2 3 4 5 Don't know/apply
14	**Protection of natural species and habitat:** *e.g. the protection of local bird/animal species and their habitats during construction and occupation*	1 2 3 4 5 Don't know/apply
15	**Protection of natural topography and geology:** *e.g. the minimization of the alteration of natural topography and geology during construction and occupation*	1 2 3 4 5 Don't know/apply
16	**Integration of Built and Natural Environment:** *e.g. the design of the built environment so that it blends in with the natural surroundings*	1 2 3 4 5 Don't know/apply
17	**Convenient and comfortable walking and cycling environment:** *e.g. provision of pedestrian/cycling – prioritized environment*	1 2 3 4 5 Don't know/apply
18	**Reduction of parking space:** *e.g. the reduction of parking space to discourage car use (ought to be promoted together with improvement of public transport provision)*	1 2 3 4 5 Don't know/apply
19	**Proximity to public transport:** *e.g. being close to public transit nodes*	1 2 3 4 5 Don't know/apply
20	**Access to work location:** *e.g. provision of job opportunities within community and/or location of community to be near work*	1 2 3 4 5 Don't know/apply
21	**Access to educational facilities:** *e.g. schools, kindergartens, nurseries*	1 2 3 4 5 Don't know/apply
22	**Access to public service facilities:** *e.g. hospitals, shops, post offices*	1 2 3 4 5 Don't know/apply
23	**Access to public green space:** *e.g. communal green fields and community gardens*	1 2 3 4 5 Don't know/apply

No.	SUSTAINABILITY FEATURE	EVALUATED PERFORMANCE
24	**Access to outdoor activity space:** *e.g. basketball courts, tennis courts, football fields*	Not well delivered at all 1 · Not well delivered 2 · Neutral 3 · Well delivered 4 · Very well delivered 5 · Don't know/apply
25	**Avoidance of glare:** *e.g. from street lighting*	1 2 3 4 5 Don't know/apply
26	**Avoidance of pollution from domestic sources:** *e.g. from boilers, waste collection and treatment*	1 2 3 4 5 Don't know/apply
27	**Avoidance of noise pollution:** *e.g. through spatial planning (separation of residential and industrial areas) and through urban design (plantation to buffer noise source)*	1 2 3 4 5 Don't know/apply
28	**Development design at appropriate community density:** *e.g. development incorporating compact units and building layouts to reduce land use whereas providing good quality living environment*	1 2 3 4 5 Don't know/apply
29	**Minimization of loss of agricultural land:** *e.g. avoidance of building on agricultural land*	1 2 3 4 5 Don't know/apply
30	**Provision of opportunities to perform agricultural activities within or near development:** *e.g. allotments, community farm*	1 2 3 4 5 Don't know/apply
31	**Diversity of household types in the community:** *e.g. provision of a variety of housing unit types to accommodate a variety of household types*	1 2 3 4 5 Don't know/apply
32	**Integration with existing surrounding communities:** *e.g. the new development/community is not gated and is closely connected with neighbouring communities*	1 2 3 4 5 Don't know/apply
33	**Design character and sense of community** *e.g. design to create unique character and enhance community interactions*	1 2 3 4 5 Don't know/apply
34	**Access to public meeting space:** *e.g. sitting area in community gardens; community play/meeting rooms*	1 2 3 4 5 Don't know/apply
35	**Participation by residents in community management:** *e.g. through residents' committee*	1 2 3 4 5 Don't know/apply
36	**Participation by residents in the planning and design process:** *e.g. public consultation before and during planning/design stages*	1 2 3 4 5 Don't know/apply
37	**Access for residents to knowledge of sustainability:** *e.g. provision and dissemination of knowledge of sustainability to residents by community management body*	1 2 3 4 5 Don't know/apply

Something About Yourself _____

The information that you provide here will be kept anonymous and will only be used to help in the analysis of the survey results collected.

1. Your gender: Female ☐ Male ☐

2. Your age: 17-24 ☐ 25-35 ☐ 36-50 ☐ 51-65 ☐ > 65 ☐

3. Your household structure: Age <18: __people Age 18-65: __people Age >65: __people

4. Your household registration type: Rural ☐ Urban ☐

5. Your level of education: Primary school graduate ☐

Middle school graduate ☐

University graduate ☐

University post-graduate ☐

6. How long have you lived in this community:

<6 months ☐ 6-12 months ☐ 12-24 months ☐ >24 months ☐

Appendix II: Questionnaire B - Stakeholders' Perceptions on Sustainable Peri-urban Settlement

This survey is part of a PhD study focusing on ***Sustainable Peri-urban Residential Settlement Development.*** To understand the sustainability issues in the context of peri-urban areas of Chinese cities it is necessary to obtain an understanding of the perceptions and attitudes of the different stakeholders involved in the planning and design of these settlements. In this questionnaire, a list of 37 parameters is presented as key performance indicators to evaluate the sustainability of a peri-urban settlement. The purpose of this survey is to understand your opinion on their importance in gauging the sustainability of a peri-urban settlement. Your kind support to this research is greatly appreciated.

Six themes of sustainable peri-urban settlement

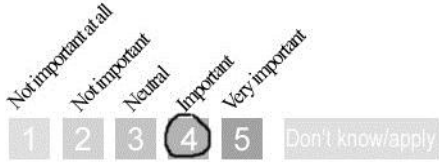
The key sustainability performance indicators of a peri-urban settlement cover six themes, which form the six sections of this questionnaire:

Theme1: Ecologically responsible development
Theme2: Reduced reliability on automobile use
Theme3: Quality of life
Theme4: Minimized land consumption and compact urban form
Theme5: Social cohesion and sense of community
Theme6: Public participation in development and management process

In each section, you are asked to consider:

"To what extent do you think this indicator is important for the evaluation of sustainability in peri-urban settlement?

For Example:

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
1	**Building orientation:** *Requirements: Achieve enhanced energy efficiency by creating the optimum conditions for the use of passive and active solar strategies.*	

Explain: This respondent feels that building orientation is *important* for the evaluation of sustainability in peri-urban settlement (response "4").

SECTION 1: Ecologically responsible development

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
1	**Building orientation:** *Requirements: Achieve enhanced energy efficiency by creating the optimum conditions for the use of passive and active solar strategies.*	Not important at all 1 · Not important 2 · Neutral 3 · Important 4 · Very important 5 · Don't know/apply
2	**Natural lighting:** *Requirements: Design building layout and orientation to take advantage of sun light.*	1 2 3 4 5 Don't know/apply
3	**Natural ventilation:** *Requirements: Design for natural and mechanical ventilation to improve indoor air quality.*	1 2 3 4 5 Don't know/apply
4	**Energy-efficient building envelope:** *Requirements: Encourage the design and construction of energy efficient buildings to reduce environmental impacts from energy production and consumption. The design and construction of buildings satisfy the national and local energy-efficient building design guidelines.*	1 2 3 4 5 Don't know/apply
5	**Energy-saving products:** *Requirements: Use energy-efficient products on lighting, water and wastewater pumps and treatment systems.*	1 2 3 4 5 Don't know/apply
6	**Water-saving equipment:** *Requirements: Minimize water use in buildings and for landscape irrigation to reduce the impact to natural water resources*	1 2 3 4 5 Don't know/apply
7	**Renewable energy systems:** *Requirements: Encourage on-site renewable energy self-supply in order to reduce environmental and economic impacts associated with fossil fuel energy use.*	1 2 3 4 5 Don't know/apply
8	**Provision of Separate Refuse Collection/Recycling Systems:** *Requirements: Establish the system for separate collection, transportation and treatment of domestic refuse.*	1 2 3 4 5 Don't know/apply
9	**Preservation of natural green land and water body:** *Requirements: Avoid development on natural green land, wet land and water body. Avoid development near the city water source.*	1 2 3 4 5 Don't know/apply
10	**Protection of natural species and habitat:** *Requirements: Protection of local bird/animal species and their habitats during construction and occupation*	1 2 3 4 5 Don't know/apply

11	**Protection of natural topography and geology:** *Requirements: Minimization of the alteration of natural topography and geology during construction and occupation*	1 2 3 4 5 Don't know/apply
12	**Integration of Built and Natural Environment:** *Requirements: The built environment should coincide with the natural environment, cityscape and culture of the surrounding area.*	1 2 3 4 5 Don't know/apply

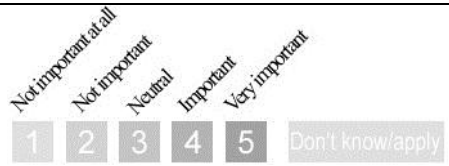
SECTION 2: Reduced reliability on automobile use

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
13	**Convenient and comfortable walking and cycling environment:** *Requirements: Provide appealing and comfortable pedestrian street environments to promote pedestrian activity. Promote cycling and transportation efficiency*	Not important at all, Not important, Neutral, Important, Very important 1 2 3 4 5 Don't know/apply
14	**Reduction of parking space:** *Requirements: Design parking to increase the pedestrian orientation of project and to minimize the adverse environmental effects of parking facilities.*	1 2 3 4 5 Don't know/apply
15	**Proximity to public transport:** *Requirements: Locate project on a site where easily accessible transit rides daily and/or make arrangements for public transit lines to cover the development site.*	1 2 3 4 5 Don't know/apply
16	**Access to work location:** *Requirements: Locate project near locations where job opportunities concentrate. Create job opportunities within the development and encourage residents to work locally.*	1 2 3 4 5 Don't know/apply
17	**Access to educational facilities:** *Requirements: Locate or design the project so that at least 50% of the project's dwelling units are within walking and cycling distance to daycare centres and schools.*	1 2 3 4 5 Don't know/apply
18	**Access to public service facilities:** *Requirements: Locate or design the project so that at least 50% of the project's dwelling units are within walking and cycling distance to public service facilities.*	1 2 3 4 5 Don't know/apply

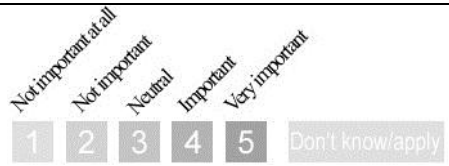
SECTION 3: Quality of life

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
19	**Adequate space:** *Requirements: The design and construction of buildings satisfy the national and local building design guidelines for minimum dwelling space.*	Not important at all 1 · Not important 2 · Neutral 3 · Important 4 · Very important 5 · Don't know/apply
20	**Safety** *Requirements: Provision of surveillance equipments to ensure safety; the design of a safe environment.*	1 2 3 4 5 Don't know/apply
21	**Access to public green space:** *Requirements: Design the layout of buildings within the site so that the percentage of green area accords with the residential planning regulation. Design community gardens to allow easy access for most of the residents.*	1 2 3 4 5 Don't know/apply
22	**Access to outdoor activity space:** *Requirements: To provide a variety of open spaces close to home to encourage walking, physical activity and time spent outdoors.*	1 2 3 4 5 Don't know/apply
23	**Affordable Housing:** *Requirements: Provision of housing options that are more affordable than commercial housing products*	1 2 3 4 5 Don't know/apply
24	**Construction quality:** *Requirements: Ensure good construction quality to allow for life-cycle low maintenance*	1 2 3 4 5 Don't know/apply
25	**Avoidance of glare** *Requirements: Control excessive lighting from within and surrounding community*	1 2 3 4 5 Don't know/apply
26	**Avoidance of pollution from domestic sources:** *Requirements: Control pollution within development. Control pollution from boiler, waste collection and treatment.*	1 2 3 4 5 Don't know/apply
27	**Avoidance of noise pollution:** *Requirements: Design for the reduction of noise from within and surrounding the development.*	1 2 3 4 5 Don't know/apply

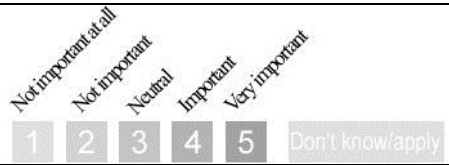
SECTION 4: Minimized land consumption and compact urban form

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
28	**Development design at appropriate community density:** *Requirements: Design project to have the appropriate density according to the requirements of the master plan of the area. Encourage compact development and also allow for appropriate insolation level required by building regulation.*	
29	**Minimization of loss of agricultural land:** *Requirements: The amount and the quality of agricultural land do not decrease after development.*	
30	**Provision of opportunities to perform agricultural activities within or near development:** *Requirements: Make provisions for and encourage agricultural activities within or near development.*	

SECTION 5: Social cohesion and sense of community

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
31	**Diversity of household types in the community:** *Requirements: Include a sufficient variety of housing sizes and types in the project to enable citizens from a wide range of economic levels and age groups to live within a community.*	
32	**Integration with existing surrounding communities:** *Requirements: Promote communities that are physically connected to each other. Foster community and connectedness beyond the development.*	
33	**Design character and sense of community** *Requirements: Design to create unique character and enhance community interactions*	

SECTION 6: Public participation in development and management process

No.	SUSTAINABILITY PARAMETER	IMPORTANCE
34	**Access to public meeting space:** *Requirements: Provide space in the community for the purpose of indoor and outdoor gatherings and meetings.*	
35	**Participation by residents in community management:** *Requirements: Establish residents' community to help in making decisions on the management of the community.*	
36	**Participation by residents in the planning and design process:** *Requirements: Invite representative of local residents to participate in the project planning and design process.*	
37	**Access for residents to knowledge of sustainability:** *Requirements: Provision and dissemination of knowledge of sustainability to residents by community management body*	

How would you describe yourself?

1. Government official ..... ☐
2. Urban planner ..... ☐
3. Architect ..... ☐
4. Real estate developer ..... ☐
5. Resident of peri-urban settlement ..... ☐

Other, please specify _____

Would you like to receive further interview?

1. Yes ☐ Please provide your contact details: _____
2. No ☐