China's urban planning legislation system in transition to a resource-saving and environment-friendly development

YING Yin

Abstract:
Recent years, China targets on transiting to a resource-saving and environment-friendly development, the realization of which is largely influenced by the performance of urban planning and building area. This paper proposes to identify the situation of urban planning legislations in terms of sustainable development, and to explore the potential for promoting environmental profile in urban planning legal system. The research methods here are based on literature review, document analysis and also the quantitative and qualitative study. In the beginning, this paper generally reviews the status and structure of current legislations and regulations on urban planning. Then, this paper adopts bottom-up strategy, to exam the legal system from detailed regulations to national laws, based on the principles and standards generated from *the main indicators of low-carbon eco-city development* [1] and *practical indicators of eco-city development*[2]. These generalized baselines are extracted into references for the examination of urban planning regulations in different level. The references include seven perspectives: urban function (land use), green transportation, green building, energy production and saving, ecological environment, waste management, water supply. Finally, it proposes some suggestions on how to strengthen the integration of environmental concerns into urban planning legislation system in China.
Key words: China, environment-friendly development, urban planning system, integration

1. Introduction

The concept of 'Construct an resource-saving and environmental-friendly society' was first specified as a basic national strategy in 'The 11th 5-year plan of the People's republic of China for economic and social development' (called 'the 11th 5-year plan' for short) in 2006, and then strengthened in 'The 12th 5-year plan' 2011. To construct environment-saving and environmental-friendly society is an inevitable choice of China for long-term development. China is a country which has a large number of population but short of main resources per capita, less than a half to one third of world average level. Meanwhile, with the fast increase of per capital income of residents, the transition of consumption level and structure will cause higher pressures on resources. (China's sustainable development strategy report, 2006) Considering these increased restriction of resource and environment, it is necessary to establish an idea of green and low carbon development, build up an resource-saving and environment-friendly pattern of production and consumption, and target for ecological modernization. (The 12th 5-year plan, 2011) The proportion of energy consumption separately in industry, building and transportation is 7:2:1 (China's research council of urban science, 2009), the transition of consumption level and structure will change this distribution in future. According to experience of developed countries, building and transportation will account for a large part of energy

[1] The main indicators of low-carbon eco-city development is developed in the 'China's low carbon eco-city development strategy' as an index of eco-city planning for 2020.
[2] Eco-city in China usually means an urban districts, in which residential area is the main function, is developed or redeveloped within a strong environmental-profile to achieve low-carbon emission and energy-saving targets.

consumption with GDP growth. Thus, to reduce the pollute emission and energy consumption in urban planning and building dimensions is crucial for a successful transition to an environment-friendly development.

Research problems

In last decade, a large number of researches and practices in urban planning were made to achieve sustainable development in China, but the progress goes very slowly partly because a lack of experience, knowledge and also a based foundation of legislation and regulation system. For instance, when implementing eco-cities, the absence of environmental profile in legislations or even contradict to become obstructions in the process. As the legislation and regulation system is considered as a crucial enforce for sustainable implementation in general, it is quite necessary to integrate environmental aspects into the systems. Although, until now, there are many specific studies on legislation and regulation systems in terms of either urban planning or environment protection area, but there is few researches focusing on combining them together. This paper is supposed to fill this gap by examining the integration of sustainable concern in urban planning legislation system.

Research goal and objectives

The goal of this paper is to explore potential possibilities to promote the legislation system of urban planning towards a resource-saving and environment-friendly development. Within the goal, two objectives are proposed: 1) Exam the integration of sustainable development into current legislation system of urban planning and points out its weakness; 2) Provide some suggestions on integrating environmental requirements into the structure and contents in the legislation system.

Research questions

To reach the research objectives, the paper develops a study by answering the following questions: 1) How does the regulation systems of urban planning work now? What is the relationship among different legislations and regulations? 2) What kinds of environmental aspects could be combined in the urban planning regulations? 3) How is the existence and absence of the environmental aspects in the current system? How to improve these combination?

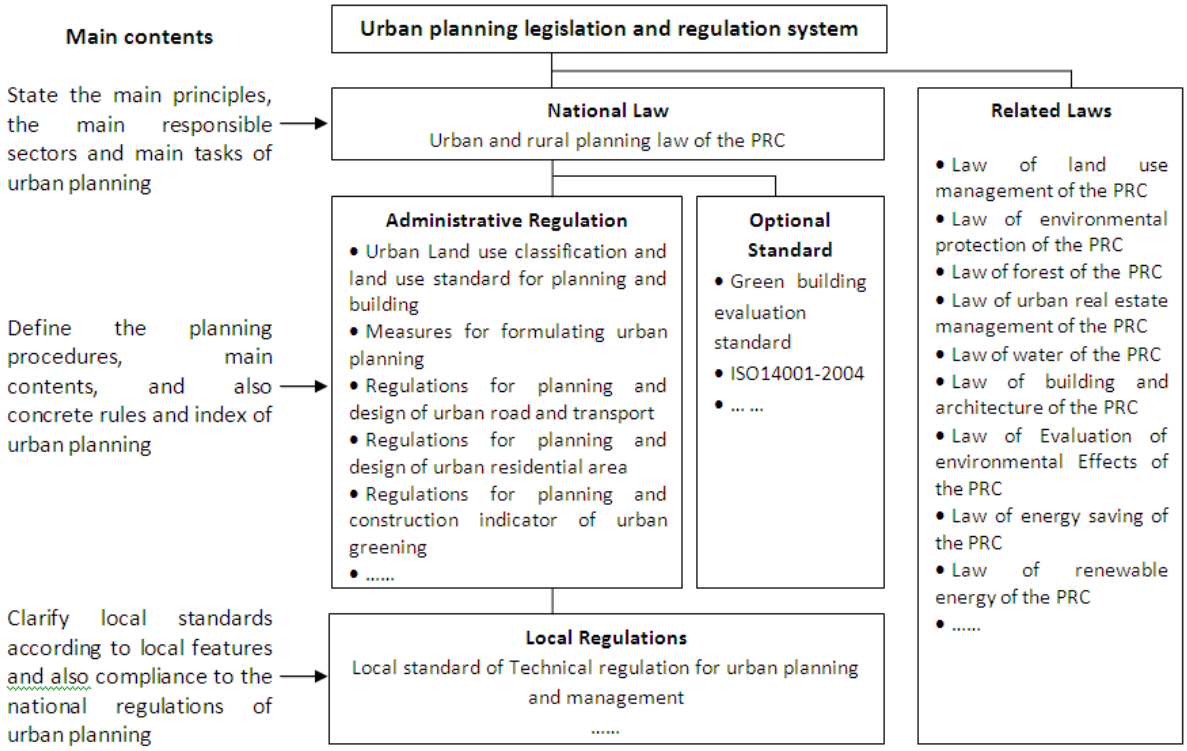
Research strategy and methods

According to two points, this paper uses bottom-up research strategy, which means exam the system from detailed regulations to the national laws according to the potential principles, standards and index, generated from *the main indicators of low-carbon eco-city development* and *practical indicators of eco-city development*. One point is that the regulation system of urban planning, including both vertical and horizontal sub-systems, is so abstract and wide-covered that it is difficult to manage the analysis from top-down. The other one is that the study should closely relate to planning practices to ensure the validity of the results. In recent years building eco-city has became a popular planning practice and important contributions to achieve resource-saving and environment-friendly development from local level. In this paper, the eco-indicator systems in two eco-cities is partly chosen as basic materials generated and extracted into references for the examination of urban planning legislations in different level. Another basic material is *the main indicators of low-carbon eco-city development* developed in the 'China's low carbon eco-city development strategy'. The references include seven perspectives: urban function (land use), green transportation, green building, energy production and saving, ecological environment, waste management, water supply. The research methods used in this paper are based on literature review, document analysis, and also the quantitative and qualitative study.

2. China's legislation and regulation system of urban planning

Urban planning system is usually divided into three parts: urban planning legislation and regulation, urban planning administration, and also the operational urban planning system. This study focuses on legislation and regulation because it works as a foundation for the administrational and operational system. In the vertical system of legislation and regulation, it contains three parts: national laws, administrative regulations and local regulations. （P_1） The main national law 'Urban and Rural Planning Law of the People's Republic of China (PRC)' was

enforced from 2008 in place of Urban Planning Law of the PRC' to state main principles, the main responsible sectors and tasks for urban planning formulation, implementation and management. The administrative regulations, for example, 'Measures for Formulating City Planning' and 'Detailed rules for Formulating City Planning', clarify the planning procedures, contents, and concrete rules and index, which direct the planning formulation, provides important basis for examining and approving urban planning results and implementation. There are also regulations in respective sector to be urban residential areas, transportation and urban green space, which provide concrete items for each dimension, such as 'Code of Urban Residential Areas Planning & Design'. At the bottom, the local regulations, such as 'Technical regulation of urban planning and management', are developed depending on different local conditions and could be stricter than national rules but looser.



Picture 1 The structure of urban planning legislation and regulation system in China

3. What could be integrate into urban planning regulations?

According to the new requirements from environment-friendly and resource-saving development, the following part analyzes what kinds of requests should be involved, how the current integration is, and how the future integration should be in regulation systems of urban planning.

3.1 Main indicators in 'China's Low-carbon eco-city development report'

The main indicators of low-carbon eco-city development were developed by China's urban science council to guide low carbon city development, from 6 perspectives, in which 4 of them are directly related with sustainable urban planning in physic sense and shown in Table 1. They are level of living standard, resource-saving, environment-friendly and environmental culture.

Table 1 Main indicators of low-carbon eco-city development

Types of indicators	Currnet	2020

Level of life standard	Green capacity rate [3]	>1.5	>1.8
	The radio of commute time which is less than an hour（%）	>85	>95
Level of resource saving	Storm water utilization（%）	>10	>30
	Reclaimed water Reuse rate（%）	>20	>50
	Domestic water consumption （L/day/person）	<150	<120
	The ratio of green travel（%）	>70	>90
	The ratio of green building（%）	>10	>30
Level of environmental-friendly	CO2 emission（t/year/person）	<1.8	<1.6
	The ratio of Cleaning energy in total energy(%）	>5	>20
	The ratio of urban domestic sewage treatment（%）	>70	100
	The ratio of in-noxious treatment for urban residential waste（%）	>90	100
	The coverage of urban area of noisy standard（%）	>75	>90
Level of environmental culture	The penetration rate of education and publicity of ecology and environment protection（%）	>80	100

3.2 Eco-indicators in eco-cities planning in China

Eco-indicators, which are the important carrier for implementing ecological strategy, and the crucial management mechanism and evaluating basis for eco-city construction reflect the practical requirements for fulfilling sustainable urban development according to general environmental principles and local conditions. This part chooses indicator systems of two eco-cities in China as part of basic resources for generating the checking references for the whole study. They are Sino-Singapore Eco-city in Tianjin, Sino-Swedish Low-Carbon Eco-City in Wuxi.

3.2.1 Sino-Swedish Low-Carbon Eco-City, Wuxi

Sino-Swedish Low-Carbon Eco-City (2.4 km^2) is located at Taihu new city (150 km^2) which also carries a strong environmental profile. But considering the demonstrative goal of Sino-Swedish Low-Carbon Eco-City, its construction standards are higher than other areas in Taihu new city, in which two sets of indicator systems and implementing guidelines are adopted. The implementation guidelines are supposed to decompose the indicators into details and provide some technical solutions for guiding managers and constructors in implementation.

Eco-indicator system in Taihu new city – a demonstrative district of national low-carbon eco-city （2010-2020）

This system includes 6 dimensions, urban function, green transportation, energy and resource, ecological environment, green building and social harmony，providing a comprehensive and concrete guideline and standards for eco-constructions in Taihu new city. (Table 2)

Table 2 Eco-indicators in Taihu new city

Indicator level	Indicators	Second-level indicators
Urban function	The compact and efficient layout	Comprehensive FAR of construction land
		The ratio of neighborhood with mixed functions
		Coupling of public activities center and public transport hub
		Combined degrees of underground space development and public center
	Public Facilities	The rates of free public facilities in 500m walking distance
	Public transport facilities	Density of bus route network
		Density of slow traffic road network

[3] Green capacity rate is developed for scientifically guiding and controlling green indicator in Master Planning, Regulatory planning, Detailed Planning, Green system planning, Special planning of green space system , urban design.

Green transportation		The proportion of bus stations in 500m walking distance
	Clean energy for public transport	The ratio of clean energy for public transport
	Green Travel	The ratio of green travel
	BRT system	The average speed of bus
Energy and resource	Energy	Energy saving rate of new residential and public building design
		Building energy consumption per unit area
		The proportion of renewable energy
		District cooling and heating coverage
	Water	Water consumption per capita/day
		Water pipeline leakage
		Coverage of water-saving appliances
		Coverage of water-saving irrigation
		Coverage of water sub-metering
		Utilization of non-traditional water sources
		Urban sewage treatment rate
		Compliance rate of industrial wastewater discharge
	Solid Waste	Waste emissions per capita/day
		Construction waste
		Classification rate of garbage collection
		Garbage recycling rate
		In-noxious treatment rate of garbage
Ecological environment	Natural Environment	The number of days of air quality ≥ standards II
		Environmental quality of surface water
		The coverage of urban area of noisy standard
		The ratio of wetlands and water
	Micro-climate	Wind speed in pedestrian area
		Compliance rate of settlements of sunshine standard
		Heat island intensity of outdoor settlements per day
	Landscape environment	Native vegetation index
		Plant species
		Green land rate of completion area
		Green coverage of completion area
		Forestation rate
		Public green space per capita
		Park area of each residential area (3-5 million)
		Shade rate of slow road
		The proportion of permeable ground
Green building	Green Building	The ratio of green building
	Building materials	The ratio of green material
		The ratio of local material
Social harmony	Low-carbon economy	Energy consumption per unit of GDP
		Water consumption per unit of GDP
		Solid waste emissions per unit of GDP
		Carbon emissions per unit of GDP
		The proportion of enterprises with ISO14001 certification
	Livable life	The ratio of green community
		The ratio of green schools (kindergarten, primary and secondary schools)
		Green hospitalx
		The rate of barrier-free facilities
	Social security	The ratio of replacement house
		The balance index of employment and housing
	Public satisfaction	The public satisfaction of environment and social service

The eco-indicator system in Sino-Swedish Low-Carbon Eco-City（2010-2020）

It contains seven perspectives，Urban function, Ecological environment, Energy utilization, Water and sewage, Waste management, Green transportation and Green buildings, with 47 items of indicators. (Table 3)

Table 3 Eco-indicators in Sino-Swedish Low-Carbon Eco-City

Indicator level	Indicators	Second-level indicators
Urban function	The compact and efficient layout	Comprehensive FAR of construction land
		Coupling of public activities center and public transport hub
	Public facilities	The coverage of municipal pipeline network
		The rates of free public facilities in certain walking distance
Ecological environment	Natural environment	Natural landscape
		The quality of surface water
	Green landscape	Average public green space
		Native vegetation index
		Species diversity
		Planting rate of green space
Energy utilization	Energy saving	Building energy consumption per unit area
	Renewable energy	The proportion of renewable energy
Water and sewage	Water resource saving	Water pipeline leakage
		Coverage of water-saving appliances
	Water health and hygiene	The coverage of drinking Water
	Water recycling and reutilization	Storm water utilization
		Urban sewage treatment rate
		The rate of grey water treatment and reclaimed water reuse
Waste management	Garbage collection and management	Classification rate of domestic garbage collection
		Vacuum waste transport system
	Garbage reutilization	The rate of garbage reutilization
Green transportation	Energy use of transportation	The proportion of renewable energy
	Facilities convenience of transportation	Density of bus route network
		Density of slow traffic road network
		The proportion of bus stations in 500m walking distance
Green buildings	Environmental friendly and energy-saving building	Natural environment design
		Energy-saving material utilization

3.2.2 Sino-Singapore Eco-city, Tianjin

In Sino-Singapore Tianjin Eco-city, related to physical planning, the indicator system regulates from national environmental and resources, living styles, municipal facilities and recycling economy. (Table 4)

Table 4 Eco-indicators in Sino-Singapore Eco-city, Tianjin

Indicator Level	2nd level of indicators	Vale and period
Natural and artificial environment	Surface water quality	Standard IV of GB3838 (from now)
	Tap water compliance rate (%)	100 (from now)
	The coverage of urban area of noisy standard（%）	100 (from now)
	CO_2 emission（t-c/ one million dollar）	150 (from now)
	Net lose rate of natural wetlands	0 (from now)
	Green building rate (%)	100 (from now)
	Local plant index	≥ 0.7 (from now)
	Public green space (m2/person)	≥12 (2013)
Life style	Domestic water consumption（L/day. person）	≤ 120 (2013)
	Average waste production (kg/day.person)	≤ 0.8 (2013)
	The ratio of green travel（%）	≥30 (2013); ≥70 (2020)
Municipal facilities	The ratio of urban residential waste reuse（%）	≥60 (2013)
	The rates of residential area within free public facilities in 500m walking distance （%）	100 (2013)
	The ratio of in-noxious treatment for urban residential waste（%）	100 (from now)
	The rate of barrier-free facilities （%）	100 (from now)
	The coverage of municipal facilities	100 (2013)
Recycling economy	The ratio of renewable energy in total energy (%）	≥20 (2020)

	The ratio of untraditional water utilization (%)	≥50 (2020)

4. Examine the integration of environmental improvement in urban planning legislation system

According to those indicator systems above, this paper sums up the crucial principles and indicators, which could be integrated into urban planning legislation system and checks their existence, absence and performance in the current system. According to the relevancy to physically sustainable development, the paper chooses several regulations as checked objects shown in Table 5. And the summarize of those indicators is also categorized as checking contents into three levels in terms of current legislation structure: A. Main seven principles, B. Sub-principles under main principles, C. Concrete standards and indicators. (Table 5) As regulations in different levels should be analyzed from different views, the checking process is made by considering the structured correlation between summarized data and selected regulations. (In following sections the corresponding numbers are used to represent checked objects (regulations as shown in Table 5).

Table 5 Checking box of structured correlation between summarized data and selected regulations

Levels	Selected regulations	Main tasks	Checking contents
National law	① Urban and rural planning law of PRC	State the main principles, the main responsible sectors and main tasks of urban planning	**A**. Seven main principles **B**. Sub-principles under each principle
National administrative regulations	② Measures and detailed rules for formulating city planning	Define the planning procedures, main contents	**A.** **B.**
	③ Code of urban residential areas planning & design ④Code of transport planning on urban road ⑤ Regulation for indicators of urban green planning and construction	Define concrete contents, rules, technical solutions and the value of controlling indexes	**B.** **C.** Concrete standards and indicators
Local regulations	⑥ Technical regulation of urban planning and management of Jiangsu Province	Clarify local standards according to local features and also compliance to the national regulations of urban planning	**B.** **C.**

4.1 Ecological Environment

Ecological environment protection and construction as one of main principles is largely concerned in China for many years, and it is also clearly stated in the urban planning regulations. In terms of the data collected above, the principle of ecological environment protection and construction within the urban planning area could be divided into three sub-principles: natural environment, green capacity, microclimate built. Green capacity as a new concept for improving green spaces has not been used in any regulations, neither of micro-climate built. The compulsory contents stated in the Measures and detailed rules for formulating city planning are mostly the planning of green landscape structure and green land use layout which is more concerning the morphology but from sustainable aspects. From the table, the most frequent concrete standards and indicators in the regulations is about average public green area per person, green land rate and green coverage of completion area. And for these indicators, the focus is more on the quantitative regulating but qualitative guiding, and also the content of indicators are simplex and uniformed for all the areas in China. A number of concrete indicators are absent, or although some indicators like *native vegetation*, *species diversities*, *species diversities* are already mentioned in the regulations, the way to be indicated is quite unclear, especially in 'Code

of urban residential areas planning & design', and 'Regulation for indicators of urban green planning and construction'. (Table 6)

Table 6 The including or excluding of indicators on Ecological Environment in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Protect and construct ecological environment	① ②	Natural environment protection	① ②	The air quality	--
				The quality of surface water	--
				The coverage of urban area of noisy standard	⑥ not clear
		Green capacity construction	--	Public green space per person	③ ⑤ ⑥
				Green land rate of completion area	② ⑤ ⑥
				Green coverage of completion area	⑤ ⑥
				Native vegetation	③ not clear
				Species diversities	⑤ not clear
				Species diversities	⑤ not clear
				Planting rate of green space	⑤ not clear
				The rate of natural wetlands	⑤ not clear
				Shade rate of slow road	--
				The proportion of permeable ground	--
		Micro-climate built	--	Wind speed in pedestrian area	--
				Heat island intensity of outdoor settlements per day	--

4.2 Urban function

Effective and compact urban function is clearly stated in national law and regulations. Following that, compact and efficient layout and effective public facility are also included in national law as sub-principles, but the concrete standards on how to approach these targets are lack in regulations. Although the requirements on *the Far of construction land, combination of underground space development and public center and the coverage of municipal pipeline network* are specified in some codes, more than half of the concrete standards are still absent, such as *the rate of neighborhood with mixed function, Coupling of public activities center and public transport etc.*. (Table 7) Mixed functions of land as an effective way to contribute to efficient land use, less vehicle travel of citizens and also an active neighborhood is still absent in the regulations. In the land use category, there is no category of mixed land use, and on the contrary, the main principle for land layout is clear function separation and centralization.

Table 7 The including or excluding of indicators on Urban Function in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Effective and compact Urban function	① ②	The compact and efficient layout	①	The comprehensive Far of construction land	② ③ ⑥
				The rate of neighborhood with mixed function	--
				Coupling of public activities center and public transport	--
				Combination of underground space development and	⑥

				public center	
		Effective public facility	①	The coverage of free public facilities of residential areas in appropriate walking distance	--
				The coverage of municipal pipeline network	③ ⑥
				The rate of barrier free facilities	--

4.3 Green Transportation

Green transportation includes three perspectives: improve public transport facilities, use clean and renewable energy for transportation, and transit to green travel model, in which only renewable energy is not contained. The public transport facilities is promoted by several standards in 'Code of transport planning on urban road', whereas there are some requests missing. The items indicating travel modes and commute time are existing in the regulations. And at the same time, a number of items target for encouraging private vehicles not restricting them, for example, in 'Code of urban residential areas planning & design', there is an item '8.0.6.1 parking rate of private cars for residents should not be less than 10%' , but no maximum limitation. And although the green travels mode of walking, bicycles and public transport are encouraged in some provisions, they are sometimes hindered unconsciously by other standards. For instance, in 'Code of urban residential areas planning & design' there is item '8.0.1.2 the crossing vehicles should be avoided in the residential neighborhood' which is to ensure the security and good living environment for residents. But as many neighborhoods are in large scale exclusion of the buses in the area and also public feasibilities out of walking distance increase demands of private vehicles which are not sustainable. (*Hai*, *Xiaopan*, *2009)* The absence of standards on density of slow traffic road network indicates that the travel space and facilities for non-motorized vehicle has not been well concerned as vehicle travel. (Table 8)

Table 8 The including or excluding of indicators on Green Transportation in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Green transportation	--	The convenience of public transport facilities	②⑤	Density of bus route network	④
				Density of slow traffic road network	--
				The proportion of bus station in appropriate walking distance	④⑥
				BRT system	④
		Clean and renewable energy use for public transport	--	The ratio of clean and renewable energy use	--
		The ratio of green travel	--	Distribution of travel modes	④
				The ratio of commute time which is less than an hour	④

4.4 **Green Building**

The principles of green building design and green material use are seldom mentioned in current regulations, especially in upper levels (Table 9). Only in 'Code of urban residential areas planning & design', there are several standards talking about utilize sunshine and natural wind to improve micro-climate, but the start point is not to maximize energy efficiency and reduce unit energy consumption of buildings. More controlling and guiding standards from resource-saving of green buildings are needed to be complement. But considering the main focus of urban planning legislation is on larger scale space rather than building design, the indicators on green building should not be too detailed.

Table 9 The including or excluding of indicators on Green Building in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Green building	--	**Green building design**	--	Natural environment/ Micro-climate design, e.g. utilize sunshine, wind etc.	②③⑥
		Green building material	--	The ratio of green material	--
				The ratio of local material	--

4.5 Energy production and saving

As the national strategy of environmental-friendly and resource saving, the target of the energy production and saving is clearly specified in the general principles of national law and regulations, but there are not any concrete items on energy saving and renewable energy utilization. (Table 10) Most items concerning on energy production and saving are quite general and has not integrated in urban planning system.

Table 10 The including or excluding of indicators on Energy production and saving in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Energy production and saving	①②	Energy saving	①	Building energy consumption per unit area	--
				Energy saving rate of new residential & public building design	--
				District cooling and heating coverage	--
		Renewable energy	--	The ratio of renewable energy in total building energy consumption	--

4.6 Water utilization

For the water utilization, there are four aspects related: utilization of non-traditional water resources, water resource saving, sewage treatment, water quality and health, in which non-traditional water resources is a new subject which hasn't been integrated in current regulations. (Table 11) And as the situation of energy production and saving, three sub-principles are stated in upper levels, while most of the standards and indicators are missing, such as the requests on using water-saving appliances, urban domestic sewage treatment.

Table 11 The including or excluding of indicators on Water Utilization in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Water	--	**Utilization of non-traditional**	--	Storm water utilization	--
				Reclaimed water reuse	--

utilization		**water resources**			
		Water resource saving	① ②	Water consumption per capita/day	②
				Water pipeline leakage	--
				Coverage of water-saving appliances	--
				Coverage of water-saving irrigation	--
				Coverage of water sub-metering	--
		Sewage treatment	① ② not clear	Urban domestic sewage treatment	--
				Compliance rate of industrial wastewater discharge	--
				Grey water treatment	--
		Water quality and health	① ②	The coverage of drinking water	-

4.7 Waste management

The principles and indicators on waste management, recently considered as important aspects for resource saving, is only unclearly mentioned in terms of waste collection. The domestic waste production, waste collection and treatment approaches are regulated as the compulsory content in the sector planning of environment and sanitary facilities in master planning, but there are no guidelines to formulation of these planning. As we see from the table, waste management is also a new area which are absent but need to be closely integrated in urban planning regulations. (Table 12)

Table 12 The including or excluding of indicators on Waste management in urban planning legislations

Main principle	Included	Sub-principle	Included	Concrete standards and indicators	Included
Waste treatment and reuse	--	**Reduce waste production**	--	Waste emission	②
				Construction waste production per km^2	--
		In-noxious treatment for urban residential waste		The rate of in-noxious treatment for urban residential waste	--
		Waste collection and reutilization	① ② not clear	Classification of domestic waste collection	②
				Vacuum waste transportation system ????	--
				The rate of domestic waste reuse	--

5. Discussion

Chart 1,2,3 show that more than half related indicators are not included in urban planning legislations, from main principles, sub-principles to concrete indicators and standards. This means the current legislation system is somehow out of date and inconsistent with practical sustainable urban planning requirements. Some strategic principles, like *environmental protection and construction, effective and compact land use, and resource and energy saving and utilization are pointed,* are clearly in the 'Urban and Rural Planning Law of the PRC' and Measures and detailed rules for formulating city planning. The principles on green transportation, green buildings, water utilization, waste treatment and reuse are poor stated in the upper levels. (Chart 1) As shown in Chart 4,5, the integration from perspectives of Green building and Energy production and saving is quite weak, while the concern from urban function principle is relatively strong comparing to other principles. The integration of renewable energy use into green building design, green transportation and waste recycling is an aspect to be promoted with large potentials.

As it has already been stated in section 4, the task of concrete standards and indicators is more on quantitative regulating but qualitative improving. And also the requirements of these indicators are so simplex and uniformed that they can not reach the environmental targets, and at the same

time meet different local requirements. Quantitative indicator is difficult to be a common value for the whole county, so effective standards on qualitative requirements and also the instructs on implementing these indicators are necessary. This problem also indicates a structural weakness of urban planning regulation system, the tasks of legislations and regulations on each level are mixed and ambiguous.

Another issue found in the analysis is the conflicts between sustainable indicators and items in current urban planning legislations, as stated in the checking on principles of Urban function and Green transportation. China is still in a certain condition of fast urbanization and transition, leading to rapid transportation dependent, and emphases on fast and centralized urban expansion, which contracts with the compact and efficient layout and green travel modes. These conflicts, which must result in obstacles when planning and implementing sustainable urban projects, should be figured out in good time in urban planning legislation system.

6. Concluding remark

To popularize sustainable urban planning in China, the revision of the regulation system is essential and imminent towards comprehensive content and clarified hierarchy structure. Based on above analysis and discussion, here there are three main problems need to be solved and improved. Firstly, in the urban planning legislation system, more than half of the principles, standards and indicators concerning on seven aspects stated in the paper are absent, because these regulations, developed in 1990's, are out of the date for the goal of resource-saving and environmental-friendly. The update of urban planning legislations is urgent. Another is there is a gap between national laws (general principles) and planning regulations (detail indicators), lack of operational guides. The structure and content of standards and indicators are quite mixed and ambiguous in the current system, this will lead the incoherence between principles and indicators, because the controls of concrete standards in middle level are absent. As the standards are supposed to be nexus between principles and indicators, this confusion and lack of the middle-level standards in regulations will lead the incoherence of principles which are unable to be implemented, and indicators which are given improper values. What's more, the principles in current urban planning system sometimes are apparently contradictory to some environmental goals, which should be given a balance and mediate during the future legislation formulations.

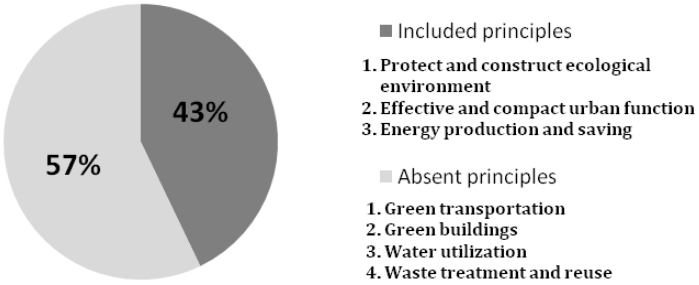


Chart 1 Coverage of main principles in the Regulation ①②

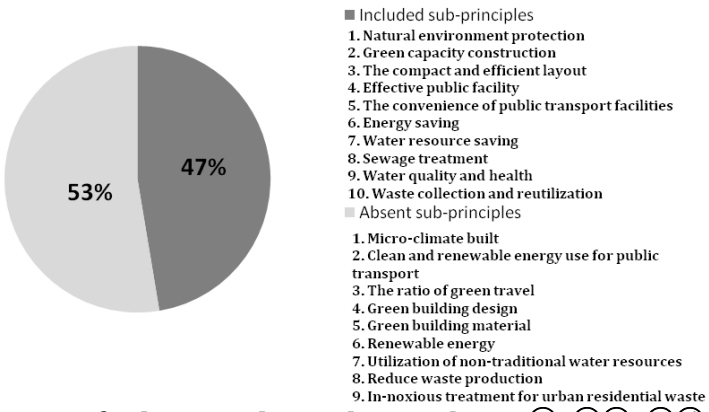


Chart 2 Coverage of sub-principles in the Regulation ① ②③ ④⑤ ⑥

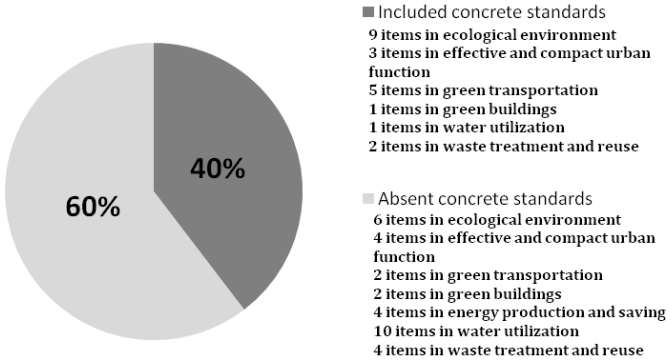


Chart 3 Coverage of concrete standards in the Regulation ③④⑤ ⑥

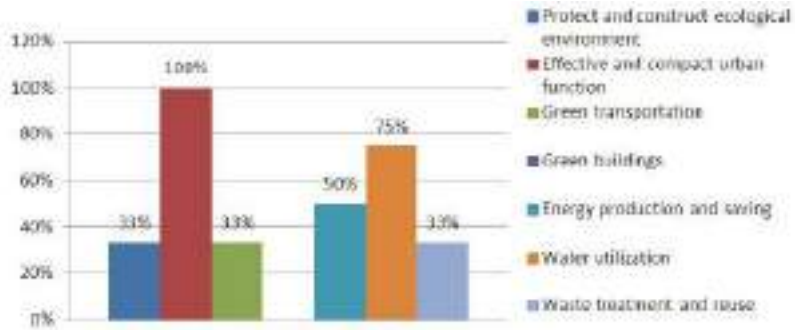


Chart 4 Ratio of included sub-rules of each category in the Regulation ① ②③ ④⑤ ⑥

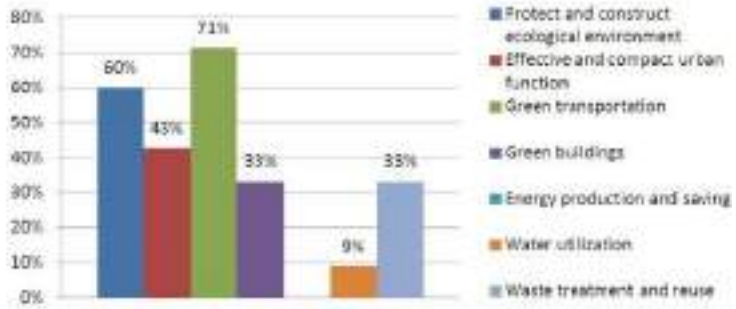


Chart 5 Ratio of included concrete standards of each category in the Regulation ③④ ⑤⑥

Reference

The outline of '9th Five-Year' Plan of development of national economic and social development and 2010 long-term goal in P. R. C (1996, National People's Congress Committee)

The outline of '10th Five-Year' Plan of development of national economic and social development (2001, National People's Congress Committee)

The outline of '11th Five-Year' Plan of development of national economic and social development (2006, National People's Congress Committee)

The outline of '12th Five-Year' Plan of development of national economic and social development (2011, National People's Congress Committee)

The Status of China's Ecological Environment and its Prospective Strategy during the '12th Five-Year' Period, Research group of '12th Five-Year' Plan in Planning Research Center of State Department, 2010, Innovation, Volume 2

Eight key points of '12th Five-Year' Plan, Develop and Reform Committee, Video and Telephone Conference on Compilation of '12th Five-Year' Plan, 2009)

China's sustainable development strategy report, 2006 — building a resource-saving and environment-friendly society, Research group of sustainable development strategy in China's scientific institution

China's low carbon eco/city development strategy, 2009, China's research council of urban science, China city press

Hai, Xiaopan, Report III_Strategy research for sustainable urban planning, 2009, in China's low carbon eco/city development strategy, 2009, China's research council of urban science, China city press