

**Shanghai Manual**  
**A Guide For Sustainable Urban Development In The**  
**21<sup>st</sup> Century · 2018 Annual Report**

## Preface 1

The *Shanghai Manual* is the result of multilateral cooperation since the World Expo 2010 Shanghai, China, among the United Nations, the Bureau of International Expositions and Shanghai Municipality. The *Shanghai Manual* is composed of a general report, revised every five years, and an annual report. *2018 Annual Report* is the fourth edition, having been updated and released three times since its first launch in 2011. The *Shanghai Manual* has become an important reference internationally, to promote best practices on global urbanisation and sustainable development.

The official theme of World Cities Day 2018 is ‘Building Sustainable and Resilient Cities’. In line with this theme, ecological cities and green development has been selected as theme of this year’s annual report. The case studies shared in the *2018 Annual Report*, focusing on eco-city and green development, are an important contribution to our knowledge around implementing the seventeen Sustainable Development Goals and the *New Urban Agenda*.

*2018 Annual Report* focuses on three key elements. First, it probes the theme of ecological cities and green development from the six perspectives developed since the World Expo 2010: ecology, society, culture, economics, governance and international cooperation, rather than a singular approach focusing only on the ecological environment. In doing so, *2018 Annual Report* approaches the topic in an integrated and holistic manner, and highlights the importance of sustainable development, a fundamental principle of the United Nations. This also emphasises the importance of addressing the complexities of sustainable urban development through an integrated and interdisciplinary approach.

Second, *2018 Annual Report* further consists of a set of eighteen representative cases from the six perspectives. The cases comprise real practical cases, geographical representation, learning and replication.

Third, *2018 Annual Report* extracts and summarises policy suggestions through the eighteen case studies, seeking to inspire cities worldwide in their journeys towards sustainable urban development.

The preparation of the *Shanghai Manual* has involved a range of key partners. I would like to recognise this participatory approach and its role in successfully completing this fourth volume. I am convinced that the 2018 edition of the *Shanghai Manual* will be a valuable resource for sustainable urban development in our cities globally.



Ms. Maimunah Mohd Sharif  
United Nations Under-Secretary-General  
and Executive Director of UN-HABITAT  
October, 2018

## Preface 2

Expo 2010 Shanghai China, with its theme ‘Better City, Better Life’, fuelled global debates and the development of shared practices for designing, planning and building quality environments for urban life.

Combining these principles and experiences, the *Shanghai Manual* is a living legacy of the Expo and a unique exemplification of the spirit of the *Shanghai Declaration*. It recalls, renews and expands the ideas and practices that were developed and shared eight years ago.

Drawing on emerging approaches and outcomes from real life case studies, this 2018 annual report of the *Shanghai Manual* continues to support cities in addressing the challenges of urbanisation while meeting internationally agreed upon goals. It lays out a roadmap for urban development that respects social justice, sustainability and the environment. It carries on Expo 2010 Shanghai’s spirit of cooperation, knowledge sharing and capacity building for cities around the world and reinforces the longstanding cooperation of the United Nations, the Ministry of Housing and Urban Rural Development of China, the Shanghai Municipal Government and the BIE.

With its theme ‘Ecological Cities, Green Development’, this year’s edition features the latest useful approaches and experiences in the implementation of sustainable development policies, offering useful lessons for policymakers and city planners across the world.

World Expo 2010 was a catalyst for urban change in Shanghai, but it was also an accelerator of forward-thinking policies for greener, more liveable and more sustainable cities and a platform for experimentation, exchange and discussion.

When ideas—whether new or existing—show promising results, they ought to be shared so others can benefit from them. This edition of the *Shanghai Manual* serves as a unique collection of experiences and expertise on how we can create together a sustainable urban future. I strongly believe in the utility and vision of the Shanghai Manual, which, embodying the principles and spirit of Expo 2010, is of service to

all those who seek a more innovative model for urban development.

A handwritten signature in black ink, appearing to read 'Vicente G. Loscertales', with a long horizontal line extending from the end of the signature.

Vicente G. Loscertales

Secretary General of the Bureau International des Expositions

October, 2018

## Acknowledgements

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We owe a very special thank you to our colleagues from Ministry of Housing and Urban-Rural Development of the People's Republic of China and other colleagues from Ministry of Foreign Affairs who have given us support and suggestions during the compilation and review process of the 2018 Annual Report.

We also wish to say thank you to Mayor Ying Yong, Deputy Mayor Shi Guanghui, Deputy Secretary General Huang Rong, Deputy Secretary General Gu Jinshan of Shanghai Municipal Government for their support and care for the compilation of the 2018 Annual Report. We deeply appreciate Director General

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Shanghai Coordination Center of World Cities Day organized several expert teams to compile and revise each chapter of the *Shanghai Manual*, the leading experts of each team are as followed: Prof. Zhu Dajian, Dr. Chen Haiyun (who also designed the manual's structure), Prof. Peng Zhenwei from Tongji University, Prof. Yu Hai from Fudan University, Prof. Zhang Xueliang from Shanghai University of Finance and Economics, Mr. Yang Rongbing, Associate Director of Shanghai Library, Mr. Lu Ke, Director of Shanghai Institutes for Urban Planning and Design, and Research Fellow Yu Hongyuan from Shanghai Institutes for International Studies, et al (listed in the chapters' order). They are the ones who have made the 2018 *Shanghai Manual* possible. Therefore, it cannot be more right to express our most sincere gratitude toward them here. We would also like to take this opportunity to thank all the team members who have participated in the writing and compilation process of the manual for their outstanding contribution.

We owe a very special thank you to Research Fellow Tu Qiyu and Zhang Jiantao (Special Term Editor for finalizing the English version of the manual) from Shanghai Academy of Social Sciences, Research Fellow Qian Zhi from the Development Research Center of Shanghai Municipal Government, Research Fellow Ji Lude from Shanghai Institutes for International Studies, Associate Research Fellow Su Ning from Shanghai Academy of Social Sciences who have also made great contributions to the final compilation and editing process of the manual. We also appreciate the efforts and helps from intern Chen Miao, Wang Zhigang, Xia Li, Chen Yueming from Shanghai Coordination Center of World Cities Day in the administrative process that coordinated the works of each contributor.

At last, our deep appreciation goes to our publisher the Commercial Press, and our language service provider Lan-bridge (Shanghai) Information Technology Co., Ltd for all the painstaking and meticulous work done for the 2018 *Shanghai Manual*.

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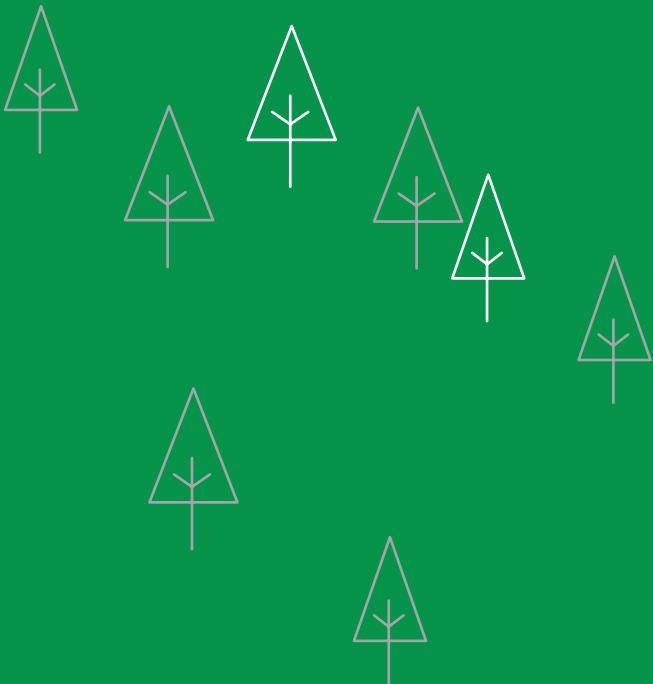
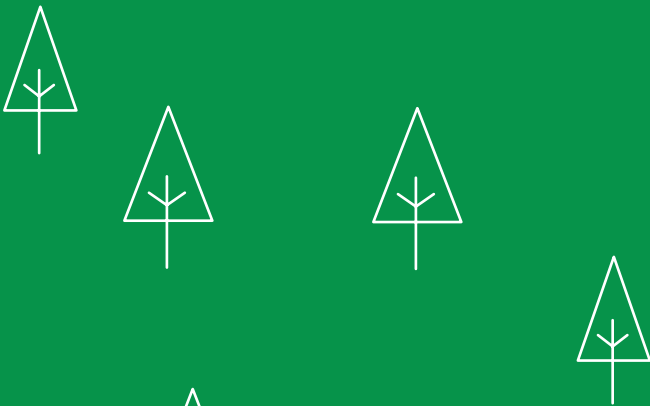


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# Chapter I

## Introduction





‘The Eco-city and green development’ is the calling of an era. The *Shanghai Manual—Sustainable Development Guidelines for World’s Cities in the 21st Century (2018 Annual Report)*, themed with ‘Ecological Cities, Green Development,’ thoroughly explains existing problems, challenges encountered, and experience gained, during the process of global and regional cities’ sustainable development, as well as future opportunities for and realizations regarding policies from the following six perspectives: ecology, society, culture, economics, governance and international cooperation. Each dimension selects cases of a node to support, these cases, consisting of background, the practice process, a problem analysis and an experience summary, will be used to support respective perspectives. Experience drawn from each case constitutes significant lessons for policy-making. The cases selected are significant for our time, representative, balanced and systematical. In conclusion, the *2018 Annual Report* relies on six perspectives, 18 representative cases and nearly 30 significant suggestions for policy-making to elaborate on ‘Ecological Cities, Green Development’.\*

## Background and Significance

Urbanization continues to gather pace worldwide. Currently, more than 50% of the world’s population (nearly 4 billion people) resides in urban areas. By 2030 that figure will have increased by over 60% (5 billion people). And by 2050, almost 70% of the world’s population will have been urbanized (over 6 billion people). Meanwhile, the number of cities with one million or more people worldwide has exceeded 500, which is expected to increase by at least 150 by 2030. The world also suffers from a series of development and governance-related problems attributed to growing urban populations and city sizes. Sustainable urban development has been negatively influenced and severely restricted by a series of ecological, social and economic issues, including ecological deterioration, environmental pollution, over consumption of energy, frequent occurrence of natural disasters, slow upgrade of public infrastructure and urban governance models to be creatively improved.

Therefore, all mankind need to figure out ways to effectively reply to and

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\* Chapter 1 is compiled by the School of Economics and Management of Tongji University, written by Zhu Dajian and Chen Haiyun.

settle issues arising in urban development and build inclusive, safe resilient and sustainable cities and human settlements. In response to that, the United Nations released *the 2030 Agenda for Sustainable Development*, which includes the subject as one of its seventeen Sustainable Development Goals. *The United Nations Framework Convention on Climate Change, Kyoto Protocol* and *Paris Agreement* all prove that countries across the world are striving to use diversified perspectives in different international arenas to figure out ways that are capable of addressing the problems mentioned above. Meanwhile, United Nations Conference on Housing and Sustainable Urban Development (Habitat III) released the *New Urban Agenda*, which reviews and summaries a series of urban development problems occurring in the past 20 years, drafts a blueprint and sets out goals for the world's sustainable urban development in the upcoming 20 years. *New Urban Agenda* identifies a series of visions and measures, which become the core missions for future sustainable urban development. For example, the theme of World Cities Day 2018 is 'Building Sustainable and Resilient Cities'. They include adoption and implementation of disaster risk reduction and management, reduction of vulnerability, building of resilience and responsiveness to natural and human-made hazards, advocacy of green life and production, creation of green, open and safe public spaces, promotion of structural transformation, effective and sustainable use of resources, energy conservation and emission reduction along with urbanization, as well as provisions for sustainable development and prosperity for all.

Facing such a grim reality and significant mission, all cities across the world must take the responsibility to seek answers for the following urban development-related questions: 1) How to help urban economic development achieve green innovation? 2) How to entice a variety of stakeholders to take part in the process, fight for the same goals while preserving differences as well as oversee each other? 3) How to incorporate verdant nature into our daily life? 4) How to create a more open and inclusive environment for diversified cultures, further development and self-promotion? 5) How to enable everyone to share the achievements of the eco-city and green development with innovative governance, inviting them to share and govern and finally achieve a win-win situation? Embarking on a new journey at the beginning of a new era, global urban administrators and all citizens should pool their wisdom and take actions to settle these issues, so as to build an inspiring, harmonious, green, open and sharing environment for the sustainable development and governance of global cities.

## Connotation and Structure

An eco-city is the one that enjoys harmonious coexistence between man and nature, and new social relationships grounded on people's profound understanding of their connections with nature and incorporating coordinated growth of society, economy and nature. It is also a combination of new production methods, lifestyles and livable environments, which scientifically and effectively take advantage of resources and environment to realize sustainable development. The eco-city's significance can be interpreted with the following perspectives.

**Ecological environment:** Protect and restore urban ecological environment, scientifically predict ecological safety and improve ecological resilience, in order to provide a more secured ecological barrier for cities;

**Social development:** Consistently pursue green lifestyle, active social participation and inclusive development, allowing social ecology to be more open, diversified and lively;

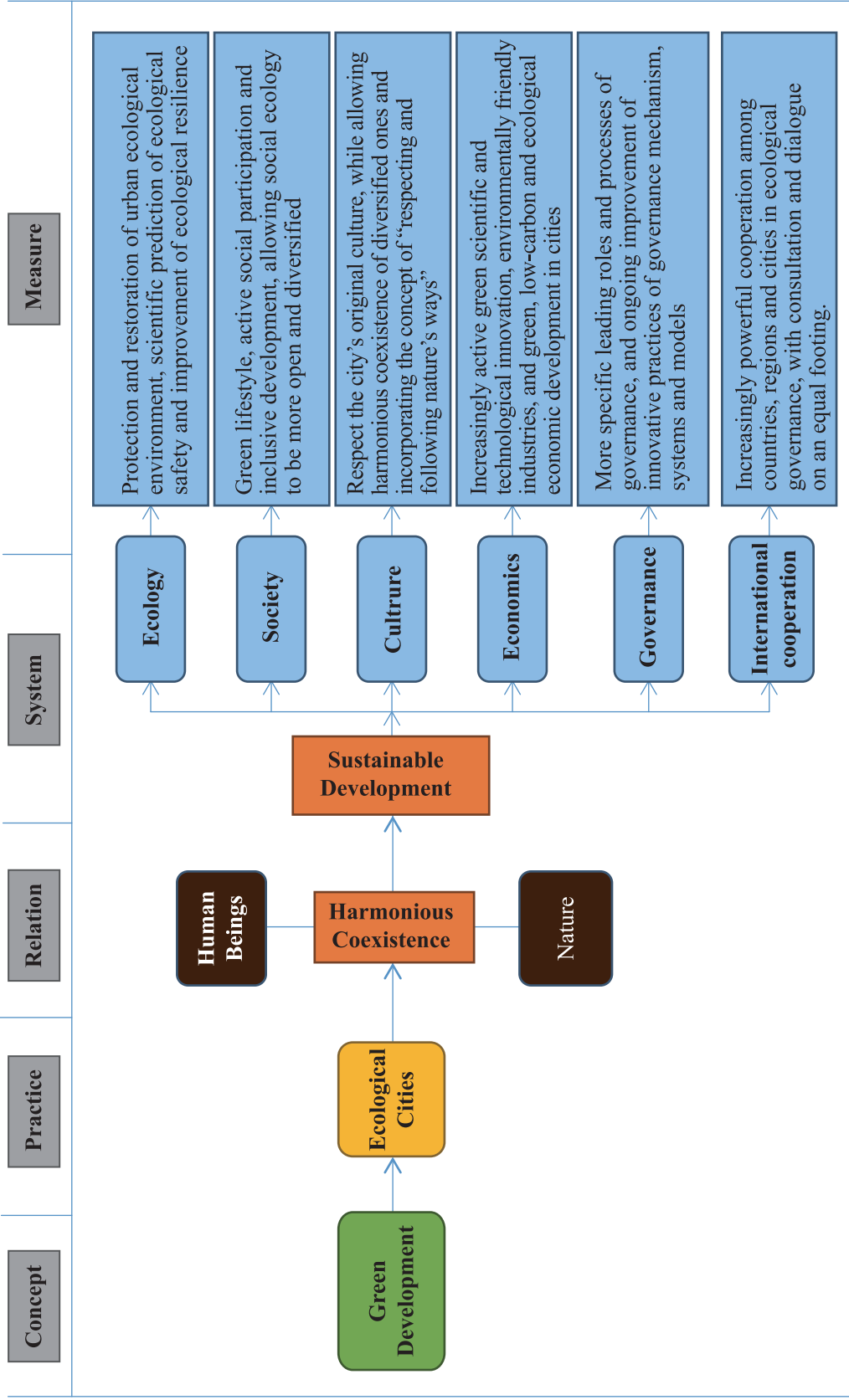
**Cultural inheritance:** Respect a city's original culture, while allowing harmonious coexistence of diversity. As human beings are a part of the nature, cultural inheritance shall incorporate the concept of 'respecting nature and following its ways';

**Economic development:** It exhibits some major features: increasingly important green scientific and technological innovation, the ongoing rise of environmentally friendly industries, and a progressively active green, low-carbon and ecological economic development in cities;

**Urban governance:** Stress the materialization of leading roles and processes of governance, and systematically elaborate the ways in which these leading roles realize the goals of eco-cities and green development with innovation in systems and mechanisms;

**International cooperation:** Emphasize wide cooperation among countries, regions and cities in eco-city and green development.

Green development is a concept of sustainable development, which means carrying out environmentally friendly economic and social activities in the context of respecting nature and following its ways. Construction of eco-cities is the realization of 'green development'. The concept attaches importance to systematicity, diversification and coordination of different perspectives including ecology, society, culture, economics and governance. 'Green development' must



lead the construction of eco-cities, which mainly plays the following three roles: bottom-line control, endogenous development and flexible adaptation. Bottom-line control refers to controlling of the overall consumption of resources and environment in urban development. Endogenous development strives to achieve economic and social benefits for the public. Realization of flexible adaptation relies on gaining more economic and social benefits with less consumption of resources and environment or eco-investment, as well as ongoing improvement of urban capability to withstand risks and recover from disasters. As a result, cities can achieve green innovation and sustainable development. Greening of the ecology should be effectively integrated with that of urban development. Construction of eco-cities should give parallel priority to green economic and social development and green protection of ecological environments. The process requires overall planning takes the goals of ecology, environment and resources into consideration. It embeds the idea of ‘greenness’ into the evolution of the urban form, a city of innovation and humanity and a call for the creation of green origins in industry, transportation and building, which are the core demands and significations proposed by the *New Urban Agenda* in the context of sustainable development.

Overall structure of *2018 Annual Report* is consistent with the Sustainable Development Goals (SDGs) and the *New Urban Agenda (NUA)*. The former enjoys 17 goals, more than 100 targets and over 240 indicators. It is worth noting that nearly half of the indicators are directly or indirectly related to ecological resources. Based on integration of ‘Big Ecology’ with international urban cooperation, *2018 Annual Report* effectively incorporates concepts, practices and applications concerning eco-cities and green development, and embeds ecological safety and resilience, social participation and inclusiveness, cultural promotion and inheritance, green and low-carbon economic development, innovation and exploration in governance and international cooperation in the sustainable development goals. Thanks to that, it establishes the core structure. Additionally, *2018 Annual Report* also comprises new ideas and visions on eco-cities and green development mentioned in the *New Urban Agenda*. *NUA* explains a common vision for a better and more sustainable future, where humankind is able to enjoy equal rights and opportunities as well as the public welfare offered by cities; where the international society is able to review and reconsider urban systems and spatial forms to realize the final goal. Cities will no longer be the cause of challenges faced by today’s world, but the cure. In response to that, the *2018 Annual Report* specially selects cases in each perspective, to discuss international consensus,



important fields and directions that are related to urban sustainable governance and concerned by SDGs, *NUA* and many other framework documents.

## Problems and Challenges

Building eco-cities and realizing green development have become the future goal for which many people strive in our time. Since the path ahead is long and tough, we need to calmly think about what problems and challenges still exist in this historical process. Only when we profoundly understand the problems and meet the challenges can we realize our vision of building eco-cities and realizing green development. To this end, we will sort out and analyze problems and challenges from the six perspectives of ecology, society, culture, economics, governance and international cooperation.

### 1. The Elastic Pressure and Demand for Ecological Resilience of Eco-cities Are Increasing

Intensified global climate change has caused many problems such as severely damaged ecological natural spaces, rising sea levels, increasingly frequent tropical storms, and growing ecological elastic pressure in the development of coastal cities. Many urban administrators around the world, including those of international metropolises such as New York, Shanghai and Tokyo, need to figure out ways to effectively improve urban ecological resilience, enhance basic protection equipment in coastal areas, and resist possible disaster risks. At the same time, since residents' demands for urban ecological resilience are increasing, urban administrators must think about how to deal with these new pressures and demands. If the threat of tsunami to a city comes from the outside, we must also face the internal threats caused by 'waste water, waste gas and solid waste' to urban development that continuously increase the ecological vulnerability of the city. The series of behaviors and activities of living and production in the process of urban development will discharge a large number of the 'three wastes' in cities where we live. But does our city have enough capacity to absorb all of the 'three wastes'? If not, how can we make it green and improve its ecological resilience? How to effectively advance ecological restoration and protection projects for ecological hotspots in cities? In the process, we must face and solve the following problems. How to design corresponding systems? How do residents participate? And how do enterprises cooperate?

## 2. Social Creation of Eco-cities Needs to Accept Positive Changes from Awareness to Behavior

The social creation of eco-cities and the green development of social governance require cooperation among different aspects such as lifestyle, social participation and inclusive development. However, in the process of promoting the concepts of the eco-city and green development, some people think that visible ecology and green are the symbols of eco-city, and a place with good natural ecological environment is an eco-city. However, the green attribute of a real eco-city cannot be only found in nature, but also in social behavior and mentality of people living in the cities. For example, each of us produces domestic waste every day. Everyone knows that the discarding and large-scale landfills of domestic waste will bring great consequences and harm to our quality of life and living environments. However, we ignore these hazards and think that they are still far away. For another example, we think that planting a sapling is called ‘protecting nature’. However, as the mobile internet and new media develop, they have either greatly impacted or are in the process of changing our traditional thinking. These changes have influenced, are influencing, or will continue to influence our daily lifestyles and behaviors. Through these new technologies, we can better popularize green and low-carbon life concepts and methods, enable environment for businesses and innovation, as well as livelihoods. Whether we have adequately prepared in thought and action to embrace these changes with a more positive and inclusive attitude is the key to realizing the sustainable development of eco-cities.

## 3. The Contradiction between Cultural Inheritance and Urban Development Is Increasingly Prominent

Cultures consist of many elements such as value systems, traditions and beliefs, affecting the relationships between people and others in the city and between people and the world, as well as restricting people’s behavior. Culture also contains people’s perception of nature and environment. Nevertheless, in some countries and cities where the urbanization process is advancing rapidly, due to continuous expansion and renovation of urban geographic spaces, the space occupied by urban cultural heritage is always faced with the contradiction between heritage protection and development and reconstruction. In addition, globalization has made cultural characteristics and expression forms of many districts increasingly similar, and the definition of local culture and heritage will also become narrow

and/or rigid, which is manifested in many cities with similar old-style revitalization strategies, or the same culture development plans of creative industries. We need strategic development policies that safeguard a diverse range of tangible and intangible cultural heritage and landscapes, and will protect them from potential disruptive impacts of urban development. However, we also need to pay attention to the regional practice between eco-cities and cultural inheritance. For example, in Africa, many countries are building their own eco-cities that are branded with significant cultural symbols. How to integrate their own traditional customs and cultures with the eco-cities? In many developing countries including China, the process of urbanization will continue. In the process of building and managing eco-cities, how to more completely inherit unique traditional customs and cultures is a severe test and challenge to many urban administrators.

#### 4. Urban Economic Structure and Development Models Need to Be Transformed and Upgraded

The ecological and green attributes of economic development are important guarantees for achieving eco-city and green development. The traditional urban economic structure and development models have made great contributions to the development of our human society at specific historical stages. However, as many countries are faced with the severe challenges of increasing deterioration of the ecological environment, depletion of natural resources and threats to ecological security in the process of urban development, we should consider how to transform and upgrade the previous extensive economic development models and industries. This includes the optimization of the investment models of traditional industry. In global actions dealing with climate change, will the new investment models or economic categories like eco-investment and green finance be recognized by the markets? How to convert ecological value of geothermal energy and geysers into economic and social value as much as possible during the process of development? How to incorporate more ecological governance methods in new urban economy? How to make the industrial innovation of green economy bring new vitality into the economic development of eco-cities? Whether these problems can be effectively solved will be the key to making urban sustainable development become more ecological and green.

#### 5. Urban Ecological Governance Systems and Mechanisms Need to Be Innovated

The innovation of the urban ecological governance systems and mechanisms is the key to solving problems concerning all the perspectives mentioned above. The way in which

cities are managed and governed has a direct impact on sustainability and resilience beyond administrative boundaries. As the social economy continually develops, the governance model under the traditional unilateral leadership of governments has been exposed to a series of problems, such as the inefficiency of governance, conflicts of interests, abuse of power for personal gain, and oversight failure, which urgently need innovation of the governance systems and mechanisms. For example, in the process of urban river basin governance, how can responsibility and power be clearly defined to greatly improve the government's efficiency? How to make all stakeholders actively participate in the governance process, conduct supervision and evaluation throughout it by utilizing incentive mechanisms? Similarly, how to entice community residents to participate in the process of optimizing the allocation of land resources, and achieve the coordinated development and protection of natural resources and ecological environments by using the idea of community land trusts? For another example, as the science and technology develop, how can advanced technologies such as artificial intelligence and big data be better applied to the urban development process to make it and the means of urban governance? How to better integrate these technologies with ecological elements to achieve green development? More importantly, the innovation of urban ecological governance systems and mechanisms requires not only the extensive participation and collective efforts of all stakeholders, but also the perfect combination of cutting-edge technologies and human wisdom to promote this innovation process.

## 6. The Game of Rights in the Process of International Cooperation Is Increasingly Complicated

With the continuous advancement of economic globalization and regional economic integration, the governance process of eco-cities is moving from an independent battle carried out by single cities to international cooperation among various cities. The goal of win-win cooperation is agreed on by everyone, but in the process of cooperation, due to different political systems, values, traditional customs and different levels of urban development, the complicated game of rights of all parties in urban international cooperation still exists. Urban centres worldwide, especially in developing countries, often have characteristics that make them and their inhabitants especially vulnerable to the adverse impacts of climate change and other natural and human-made hazards. However, how to seek common ground and find the greatest common denominator while reserving differences has become the problems and challenges that need to be addressed in the process of cooperation by many cities around the world. For example, in the global response to climate change, although the *Kyoto Protocol* in 1997 and the *Paris Agreement*

in 2015 are all signed in the name of countries, specific Practice Processes must be carried out by cities. So, how to realize that? For another example, how to understand and lead the changes of the role of international organizations in urban ecological civilization and sustainable development? Is there a game of rights in the process of cooperation among international organizations and different countries or cities? What are the positive and negative effects of this game? These issues, including those that aren't mentioned here, need to be considered and settled in the governance process of eco-city and green development.

## Case Selection and Related Principles

Construction of eco-cities and realization of green development need all stakeholders to make various contributions. This report will interpret 'eco-city and green development' from six perspectives, which are ecological safety and resilience, social participation and inclusiveness, cultural promotion and inheritance, green and low-carbon economic development, innovation and exploration in governance and international cooperation. It will analyze problems, challenges and experience of the above mentioned perspectives that are closely related to the focus of the 'eco-city and green development.'

The cases are pillars of the six perspectives and each one of these pillars is related to a corresponding topic, which discusses a key issue of the 'eco-city and green development' from one of the perspectives. Cities and topics selected are significant for our time, representative, balanced and systematical.

### 1. Being Significant for Our Time

The 'eco-city and green development' is the calling of the era. With continued development of economic globalization and worldwide urbanization, we have encountered unprecedented opportunities and unexpected challenges. A series of topics related to eco-cities and green development have been and will be of great concern to global people. However, the 2018 Annual Report of Shanghai Manual strives to select cases, in view of the awareness raising with a technological approach, with characteristics of the era to reply to questions like: What does modern eco-city governance look like? In which direction will green development head? For example, mobile internet and new media have introduced revolutionary changes to this era. 'Ant Forest,' a quantification and interaction medium of green life created by Alibaba, is committed to advocating green development

with promotion of green and low-carbon lifestyle and quantification of personal emission reduction. Additionally, Copenhagen used artificial intelligence and big data to make innovation in eco-city governance. Although these practices still need significant improvement, or might be replaced with better solutions, these tools undoubtedly crystallize the collective wisdom of people in this era.

## 2. Being Representative

All cases have their own reasons to be chosen. However, ‘being representative’ is one of the basic principles of selection. ‘Being representative’ can be defined as: first, the case selected is the best example of the ‘eco-city and green development’ from some perspective. For example, from the perspective of economics, although traditional models of eco-cities and green development play important roles, we shall figure out what new ecological and green economic development models look like. We should learn from the river ‘Renaissance’ in Liverpool, the United Kingdom, understanding how that can inspire diversified development of regional economy. The experience is significant to ecological governance in regional or even global cities. Two of the representative answers are eco-investment and green finance, which were developed during the process of coping with global climate change and promoting economic development of eco-cities through industrial investment and financing with new ecological concepts. And it’s worth noting that the two models have been widely utilized around the world. The ‘River Chief System’ is another outstanding representative in terms of covering groups and urban sizes, which is a policy used by many Chinese cities to govern river basins and an innovative urban eco-environmental governance model. And waste classification in Japan has witnessed ongoing development and improvement. Its design of mechanisms and processing of details are worth learning. The case of Liverpool and Mersey River is a representative of eco-friendly urban restoration in view of economic development, cultural renaissance and natural diversity.

## 3. Being Balanced

On one hand, selection of cases should take geographical locations of cities into consideration: these cities must come from all continents, particularly Asia, Europe, North America, Africa, Oceania, South America and the Caribbean. However, provided that the cities selected are representative in terms of some perspective under one topic according to their sizes and magnitudes, the number of cities cannot be exactly the same on each continent. On the other hand, selection of cases should take different levels of development of cities into consideration.

As *Shanghai Manual* targets local authorities across the world, it should be aware that developed and developing countries have different concepts and practices concerning eco-cities and green development. As a result, the urban development experience of a developing country may inspire itself, surrounding regions and other cities, even though this experience is not at the same level or magnitude of urban developmental stages of developed countries.

#### 4. Being Systematical

It mainly has two meanings. First, as for one case targeting one topic, the case shall undergo a systematic analysis from background and the Practice Process, to problem analysis and experience summary. Second, each topic is supported by several cases; the topic is organized as a systematic sharing of experience focused on the world or several regions with comparison and analysis of commonalities and differences between cases. In terms of culture, we have cases of cultural tolerance and historical inheritance in African eco-cities. Moreover, in the case of greening of the ‘Three Wastes’ (waste gas, waste water, industrial residue) worldwide, comparative analyses of commonalities and differences among Istanbul, Turkey, Stockholm, Sweden and Fortaleza, Brazil have been carried out.

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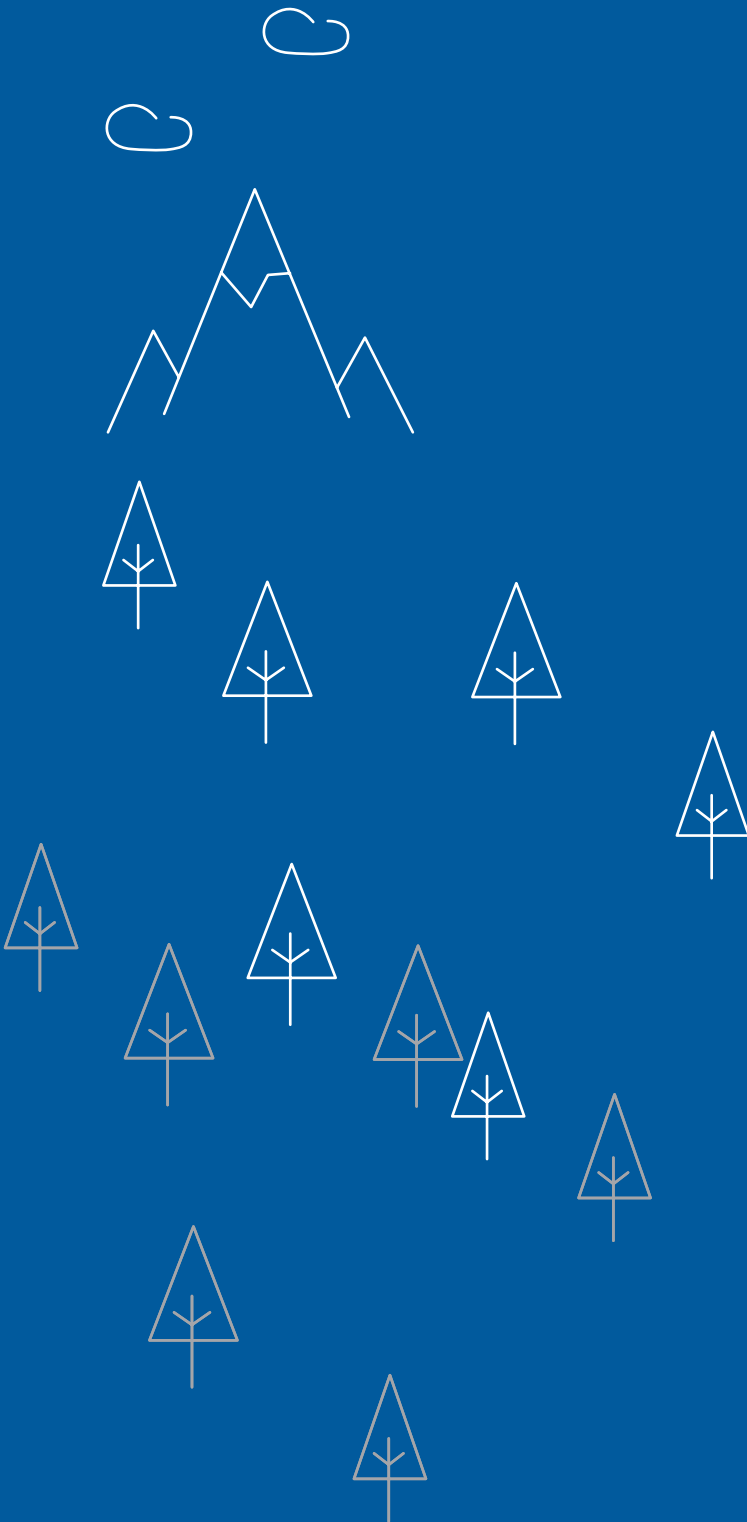
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# Chapter II

## Ecology







'Longhua Riverside', photographed by Qin Zhan (Shanghai Urban Planning and Design Institute).

## Introduction\*

Cities provide people with unprecedented material prosperity and spiritual enjoyment, but also place great pressures upon the natural environment—increasing impacts of cities on use of resources and ecosystems beyond urban boundaries. While urban environmental problems pose significant obstacles to the development of cities, they also engage in an interactive and mutual relationship with urban development. On one hand, city development generates eco-environmental threats via population growth, economic development, resource and energy consumption and regional expansion; on the other hand, the environment also has significant impacts on urban development through environmental selection and policies. The ways that cities are planned, financed, developed, governed and managed also have impacts on the environment. Thus the interaction between city development and the ecological environment has cyclical characteristics. In the context of the current status of eco-city and green development, the following paragraphs focus on new urban eco-environmental issues such as greenhouse gas emissions, coastal ecosystems, global climate change and flooding, brownfield site remediation and upgrade, and present deep analyses of typical global cases exhibiting innovative solutions to eco-environmental problems, before summarizing the innovative actions and policies used to deal with these problems. They aim to provide inspiration to other cities seeking to realize the goal of sustainable development.

The cases are drawn from six countries in Europe, North America, Asia, and South America, namely: Stockholm in Sweden, Istanbul in Turkey, Fortaleza in Brazil, St. Petersburg in Russia, Shanghai in China, New York in the United States. The cases highlight Stockholm's green development model in Sweden; Istanbul's solid waste energy utilization in Turkey; innovative digital wastewater treatment techniques of Fortaleza, Brazil and St. Petersburg, Russia; Shanghai's ecological landscape restoration of the Huangpu River Bank in China; New York's urban resilience and comprehensive tidal hydroelectric technology in the United States. The cases revolve around issues such as rising sea levels and flood disaster risk in coastal cities, urban sewage and solid waste management, soil pollution, river ecosystem degradation. They are presented within 'Background-Practice Process-

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\* Chapter 2 is compiled by the School of Architecture and Urban Planning of Tongji University, written by Peng Zhenwei, Yan Wentao, Wang Yuncai, Xiang Weining, Liu Baoguo (Henan Agricultural University), Xiong Zhehao and Luo Yuyan.

Problem Analysis-Experience Summary' framework and along with discussion of methods of eco-environmental protection, ecological security mechanisms and urban ecological resilience improvement.

## Reference Cases

### 1. New York, American: Comprehensive Solutions to the Resilience of Coastal Cities

#### 1.1 Background

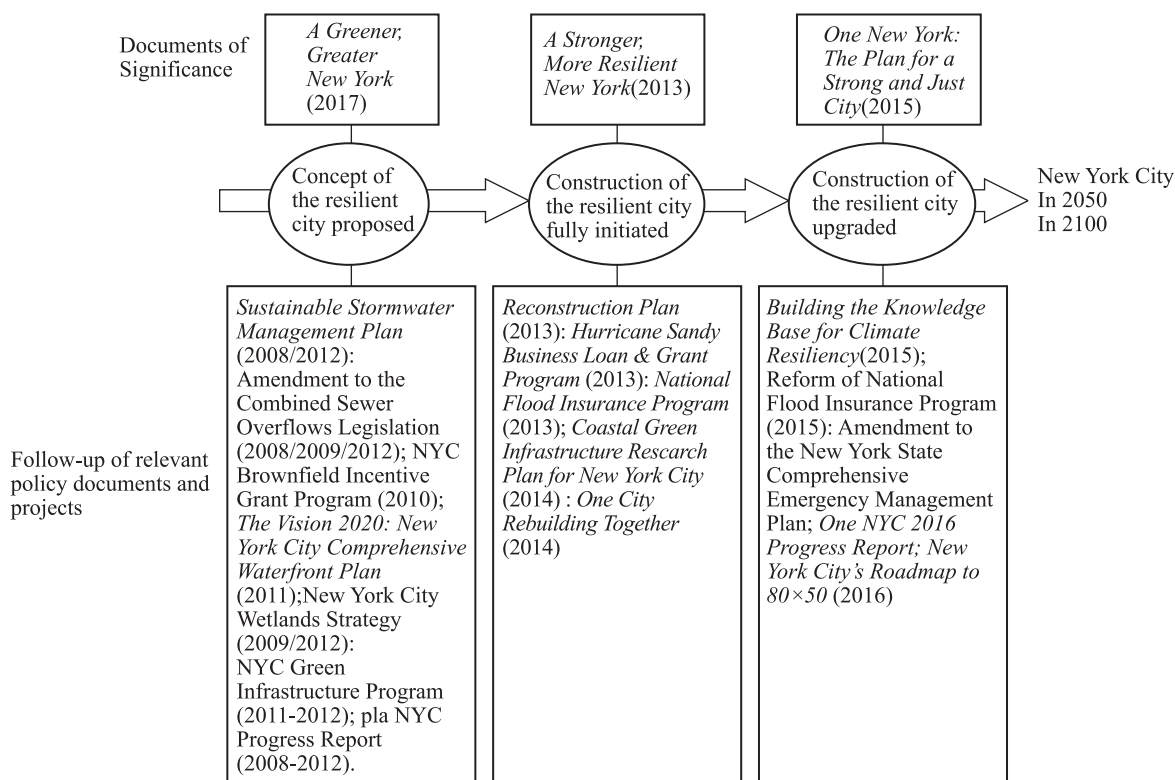
The problems caused by global climate change, including rising sea levels, tropical storms, and floods, are creating increasingly severe challenges for coastal cities. Research on ecological resilience in coastal cities has thus become a key topic in city management in recent years. On October 29, 2012, Hurricane Sandy swept across and severely affected New York City (NYC). Hurricane Sandy, a natural disaster which caused the greatest losses in American history, also killed at least 147 people in the Northeastern United States, Canada and the Caribbean, 48 of who died in NYC. A meteorological research report predicted that, given the continuously rising sea level caused by global warming, tropical storms would continue to become more frequent, with NYC being likely to suffer a large-area flood once every five years on average from 2030 to 2045.

To build a stronger and more resilient NYC and address the unknown flood risks the city may need to confront, the NYC administration formulated the *Adaptation Plan for New York City*, which proposes policies to adapt to climate change and emphasizes the ability to recover from changes and adverse effects, and enhance the city's prevention, preparation, response and rapid recovery abilities when faced with difficult situations. This plan has set an example for coastal cities worldwide. Numerous other city governments, research institutions and research scholars have proposed solutions and methods at various levels for coping with coastal city flood disasters, as well as strategies for improving the resilience of coastal cities in terms of their physical layout, structural planning, management regulation, along with specific technical measures.

#### 1.2 Practice Process

##### (1) Policy Formulation and Action Plan: A Stronger, More Resilient New York

Resistant construction and climate adaptation for NYC were proposed in *A Greener, Greater New York* in 2007. In 2013, the NYC administration formulated



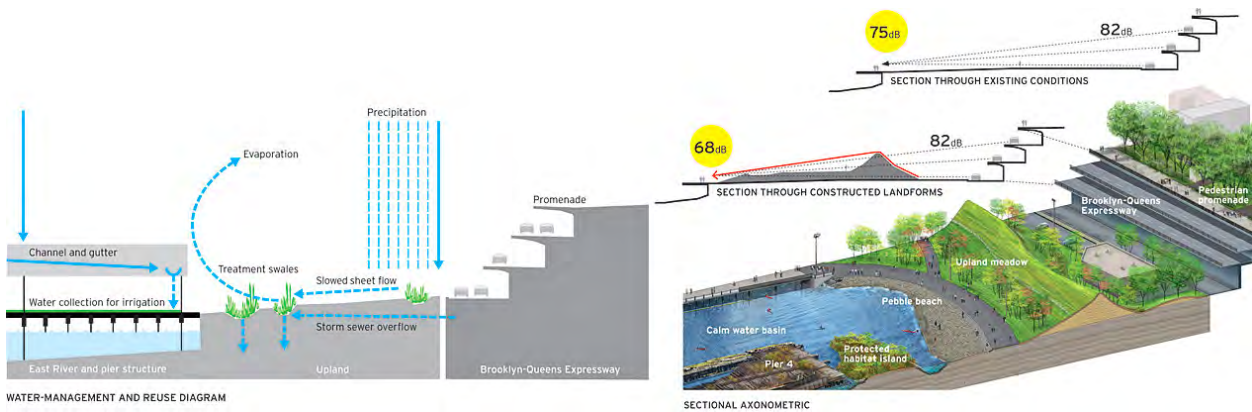
Source: Cao Liping and Zhou Fengqi, 2018.

Figure 2.1 Action Plan for a Resilient NYC

*A Stronger, More Resilient New York*, a plan to make the city resilient to climate change, and it proposed a 10-year construction plan for realizing the goal of a resilient city. In 2014, *One City Rebuilding Together* was released, a report aimed at strengthening and expanding the construction of the resilient city. This report proposes the establishment of an office responsible for resilient city construction and for promoting an updated version of city resilience construction concepts. In 2015, the NYC administration released *One New York: The Plan for a Strong and Just City*, containing updated and more complete plans for construction for climate resilience, and serving as the city's ongoing response to climate change (Figure 2.1). The plan includes interesting (more social) topics-integrated government & social services, housing, community resilience, awareness raising, inclusion, gender, etc. —that could be highlighted by the public.

### (2) A Resilient Waterfront: Brooklyn Bridge Park, NYC

Combined with the construction and changes of NYC waterfronts in history, a flood-protection strategy for resilient waterfronts in the context of climate change has been proposed after researching the project design and operation and maintenance mode (Figure 2.2). Besides, based on an advanced disaster risk



Source: re-drawing in combination with <http://www.zhulong.com/>.

Figure 2.2 Section of a Resilient Waterfront



Source: re-drawing in combination with <http://www.zhulong.com/>.

Figure 2.3 Resilient Waterfronts

assessment and safeguarded by sound laws and regulations, a multi-functional strategy for resilient waterfronts has been proposed to construct the blue network within the relevant region (Figure 2.3).

### (3) ‘U-shaped’ Systems for Flood Protection: the ‘U-Shaped’ Protective System of the Manhattan Waterfront

To handle problems such as hurricanes and sea level rise, Bjarke Ingels Group



Source: Ingels et al., 2017.

Figure 2.4 New Resilient Underground Infrastructure

(BIG) proposed ‘U-shaped’ protective systems for waterfront areas around Manhattan, creating a new image for the future of resilient coastal construction and urban development in that area. Resilient restoration of Manhattan’s waterfront areas creates ‘buffer zones’ in the urban flood-protection system, protecting communities from storm surges and sea level rise. The creation of various landscape spaces in coastal cities can also help explore methods to stimulate broader diffusion of social benefits via flood-protection infrastructure (Figure 2.4). The urban transformation initiated by project construction has strengthened city-waterfront connections, not only providing neighboring communities with outdoor space and amenities, but also demonstrating the necessity of incorporating both urban development and allowances for sea level rise into the adaptation strategy. When maintaining the diversity of the local natural marine environment, the project also unifies site flow lines with activity planning (Figure 2.5).

Practical flood risk reduction strategies include two categories of resilient urban water systems (UWS) for the adaptation to climate change. The first includes structural measures in flood retarding basins, eco-friendly channel and building materials, and, covers UWS elements such as eco-friendly channels and infiltration systems. It can be divided into four sub-strategies: runoff management, flood adaptation, flood regulation, and construction of flood-protection. The second focuses on non-structural watershed management measures, such as disaster warning and experiential learning. It covers introduction of new management practices and improvement of existing management practices (including strategies such as disaster warning, community participation and public education).



Source: Ingels et al., 2017.

Figure 2.5 Comparison before and after Sea Level Rise

#### (4) Recovery of ‘Fresh Kills Park: Lifescape’

On the western margin of Staten Island, NYC, Fresh Kills Park covers 2,000 acres (over three times that of Central Park, NYC) including a complete tidal wetland and wildlife habitat. But the area served as a refuse landfill from 1948 until its closure in 2001, and is currently ‘dying’ due to garbage pollution. Breathing ‘fresh life’ into the park is a great challenge (Figure 2.6). NYC’s goal is



Source: [www.nyc.gov/freshkillspark](http://www.nyc.gov/freshkillspark).

Figure 2.6 Fresh Kills Park (LIFESCAPE)



to transform Fresh Kills Park into a model for renewable projects worldwide, and eventually an ecological resilient city oasis in the 21st century. Specific solutions are as follows: introducing the concept of ‘Lifescape’, emphasizing that the landscape is both a place and a process; improving regulations and laws; strictly limiting landfill; improving the environmental quality of wetlands, soil and air in biological habitats.

### 1.3 Problem Analysis

NYC, a typical coastal city which has suffered floods, has formulated policy and guidance to enhance disaster resilience in coastal cities, and proposed a series of innovative technologies and implementation strategies. But some potential practical problems remain evident.

#### (1) Hurricane-induced Ecological Disasters in Urban Waterfront Spaces

Coastal waterfront spaces—a characteristic of coastal cities—face a prominent ecological hazard in the form of natural disasters such as hurricanes. ‘Buffer zones’ featured in urban flood-protection systems, such as the ‘U-shaped’ ecological and safety framework around Manhattan, maintain the diversity of the local natural marine environment. However, since those measures can only slow and diminish some forms of flooding, their ability to deal with these natural disasters seems marginal.

#### (2) Long-term Marine Erosion of Urban Waterfronts

Marine erosion is common in coastal cities. Flexible and natural plants and gravel can help to effectively buffer this erosion and the impact of sea water on waterfronts. Multi-functional waterfront activation system strategy-derived measures, such as creation of reliable, resilient safe spaces, can be adopted, but require expensive maintenance and period continuous long-term follow-up.

#### (3) Long-term Monitoring of the Environmental Impact of Landfill Refuse Is Essential

Landfill in coastal cities results in serious runoff pollution, a challenge already hampering regeneration of abandoned and contaminated lands worldwide. Improvement of water, soil, and air quality in biological wetlands habitats is a complex and systematic project. Despite the introduction of the ‘Lifescape’ concept which advocates human and ecological security, sustained implementation will be required to verify that such ecological strategies constitute effective solutions to the complex issues faced by terrain and wildlife habitats in coastal cities.

#### (4) Continuity of Waterfront Eco-spatial Structure Limited by Property Rights in Waterfront Areas

While the ecological link between urban residences and waterfronts has

been strengthened, providing neighboring communities with outdoor space and amenities, and demonstrating the necessity of an adaptation strategy for rises in sea level incorporating urban development, property rights impose limits on the accessibility of waterfront space in coastal cities.

#### 1.4 Experience Summary

NYC, a typical coastal city, has formulated a resilient city plan, and proposed relatively complete targeted solutions to the challenge of climate-change-related natural disasters, which take into account the characteristics of coastal cities and the impact of global climate change. In retrospect, the key elements at each stage of the implementation of resilience in NYC included government policy support and construction funding. These were required to ensure that NYC could continue the implementation of resilience improvements. The task of building a resilient city involves long-term system engineering, which is barely possible in any city without coordinated development of various social and ecosystems. NYC's establishment of the Office of Resilient City Construction has proven helpful in the promotion of formulation of new resilient city policies, and of continuous implementation of resilient projects.

One strategy key to the construction of resilient NYC is the construction of resilient flood-protection facilities and protective infrastructure for storm surges in the form of landscape integration. The Manhattan waterfront area's 'U-shaped' protective system can effectively alleviate problems such as hurricanes and sea level rise. Creating diversified urban coastal spaces can help explore methods of stimulating broader diffusion of social benefits via flood-protection infrastructure. The urban transformation initiated by project construction has strengthened city-waterfront connections and demonstrated the necessity of incorporating both urban development, and allowances for increases in sea level, into the adaptation strategy. Urban resilience engineering-based on construction of traditional urban flood-protection facilities-can, via continued innovation in concept, planning and design, continue to develop, and thus further reduce the risk exposure and improve the adaptability of the built environment to flooding.

Ecological rehabilitation and construction of resilient waterfront parks and coastal zones in special areas have been significant in the construction of resilient NYC. NYC, faced with climate change-related threats, developed a 'resilient waterfront park' construction strategy for Brooklyn Bridge Park, designed to protect ecosystems and natural buffer zones, and alleviate possible floods as well as other disasters in the city. Landfill reclamation in the coastal zone, led

by ecological remediation, is of great significance to coastal city resilience improvement, through the social learning processes engendered by community participation.

## 2. Stockholm, Sweden etc: Greening the ‘Three Wastes’, the Globe on the Move

### 2.1 Background

Environmental protection is an important theme for sustainable urban development. The development of a city unavoidably creates a large amount of waste. Sophisticated treatment of the ‘three wastes’—waste gas, wastewater, and industrial wastes—is an important indicator of a city’s green development, and the efficacy of waste treatment modes largely determines a city’s environmental quality and development prospects. Below, we focus on exploration of technologies for treatment of the ‘three wastes’, and analysis of these technologies from the perspectives of development mode and key technologies and techniques, with the aim of providing examples and guidances for green and sustainable urban development. Our choice of cases takes chronology, key treatment strategy and local conditions of each city into account. We have covered cases typical of the three main areas: comprehensive treatment, solid waste recycling and reuse, and wastewater management.

Stockholm’s Green Development Model adopts comprehensive treatment strategy as the goal, and it is committed to building a global city brand with valuable environment assets. Disposal methods for solid waste and wastewater in other cities mainly reflect technological and regulatory innovation. This ensures a position of leadership in the field and brings economic benefits. In addition, from the perspective of implementation, Sweden and Russia have set up regional governmental regulatory departments responsible for formulation of urban development strategies including greenbelt renewal and public wastewater treatment facilities, with the goal of developing long-term high-efficiency models in these areas. For cities whose citizens lack executive force, Turkey’s Istanbul has used gas-to-energy projects developed by new energy companies (with government investment) to improve its recycling and solid waste treatment capacity. In Fortaleza, Brazil, companies directly manage and control the projects, and continue to develop their own digital wastewater treatment technologies. These typical cases can help to provide an overview of the treatment of the three wastes by cities at home and abroad, and their forward-looking development models and cutting-edge

technologies also provide valuable guidance to cities seeking to improve waste management.

## 2.2 Practice Process

### (1) Balanced Development—Stockholm’s Green Development Model

Green development not only stresses sustainable and inter-generationally balanced development, but also emphasizes the coordination of economic development with the natural environment. It can thus be seen as a process of balanced development (Table 2.1). The core green development model Practice Process comprises three mutually-integrated systems. The first is recycling and reuse of rain and wastewater, the second is transformation of waste into energy, and the third is the construction of a set of intensive energy utilization systems—developing regional sections and ecological structures in the protected regions. These measures have together created Stockholm’s sustainable development path.

Table 2.1 Goals and Technological Measures of Stockholm’s ‘Green Development’

System	Goal	Technological Measure
Environmentally-friendly Energy System	Energy demand to be met by fuels produced within the city where possible	Stockholm has built the first biological carbon energy conversion system. Its energy supply comprises three elements. Half of its energy is transmitted by the city grid. Some is converted from solid waste and wastewater produced by residents. The small remainder is supplied by new energy technologies including fuel cells, solar energy PV cells, and solar heat collection panels.
Rubbish Recycling and Reuse System	Sorted rubbish collection, reuse of organic biomass as fertilizer or for power generation	Automatic rubbish treatment system. Complete underground pipeline systems connect rubbish bins to central collection stations. The vacuum suction system delivers all types of rubbish to different storage sites.
Rain Water Collection and Sewage Treatment and Reuse System	Purified sewage to be discharged into natural watercourses	Sewage undergoes chemical, physical and biological treatment. Methane can be derived from decomposing wastewater. All rain water and melted snow treated on the spot. Green roofs for houses.
Urban Planning	Develop regional nodes and protect regional green structure	Optimize land usage structure, use mixed development to significantly cut daily commuting and other daily traffic volumes, and introduce traffic policies encouraging green commuting. Construct parks so that all Stockholm residents can walk to parks of about 4.86 hm <sup>2</sup> within 5-10 minutes.

(2) Wastewater Treatment—Fortaleza Digital Wastewater Treatment Technology and Saint Petersburg Public Sewage Treatment Technology

This section compares different wastewater disposal methods in Brazil and Russia, draws attention to the technological innovations of small countries and the importance some large countries attach to public management, and identifies the value of adjusting measures to local conditions. In Fortaleza, CAGECE is the most important water supplier and sewage treatment company in northeastern Ceará state. The company decided to install Elipse E3 controllers in its two centers to increase the automation of sewage treatment. The whole process was finished within two years, significantly improving the collection and treatment of water and sewage by CAGECE. Since its implementation, the E3 application program has been regularly upgraded to the latest available level of automation technology. Both centers allow monitoring communications between Elipse E3 and the Remote Terminal Unit (RTU) (Figure 2.7), and monitoring of wastewater levels in reservoir and sewage lift stations (Figure 2.8), therefore allowing utilization of each area’s daily discharge quota within operator determined time limits. The Russian wastewater treatment facility is an independent public service department of the local government. Saint Petersburg’s wastewater public utility department provides professional and emergency wastewater collection and transport services

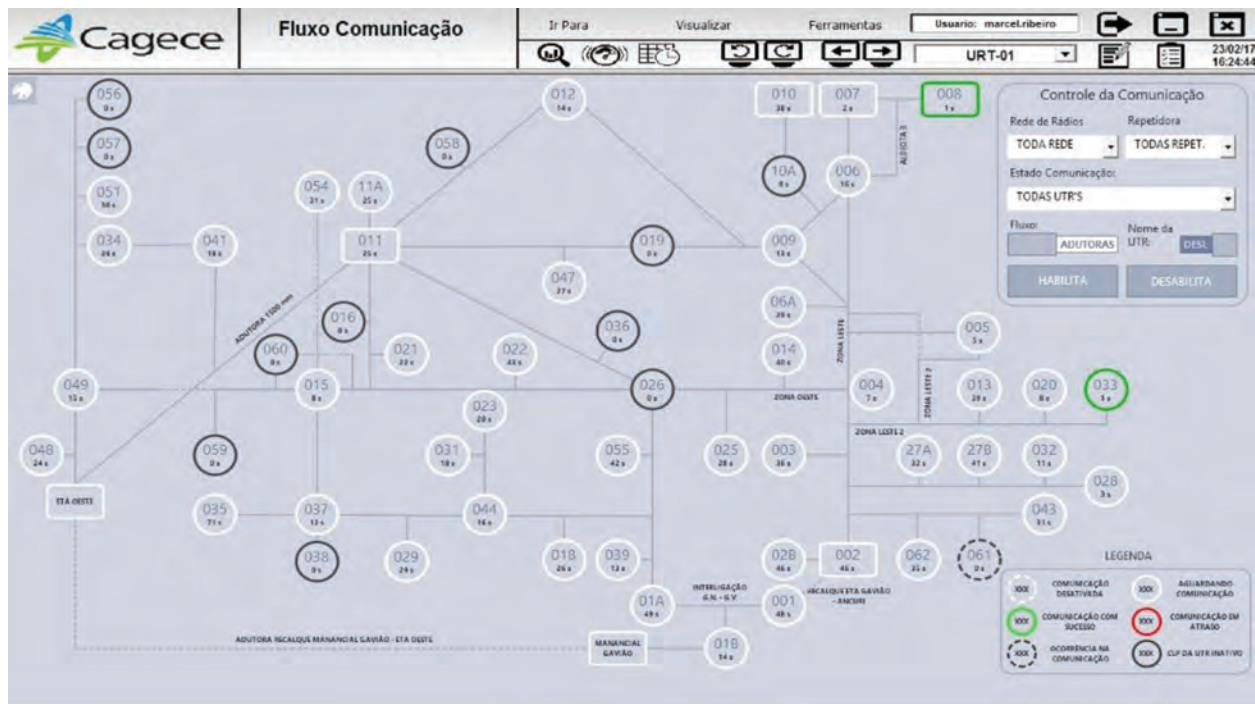


Figure 2.7 Communications Flow between E3 and RTU

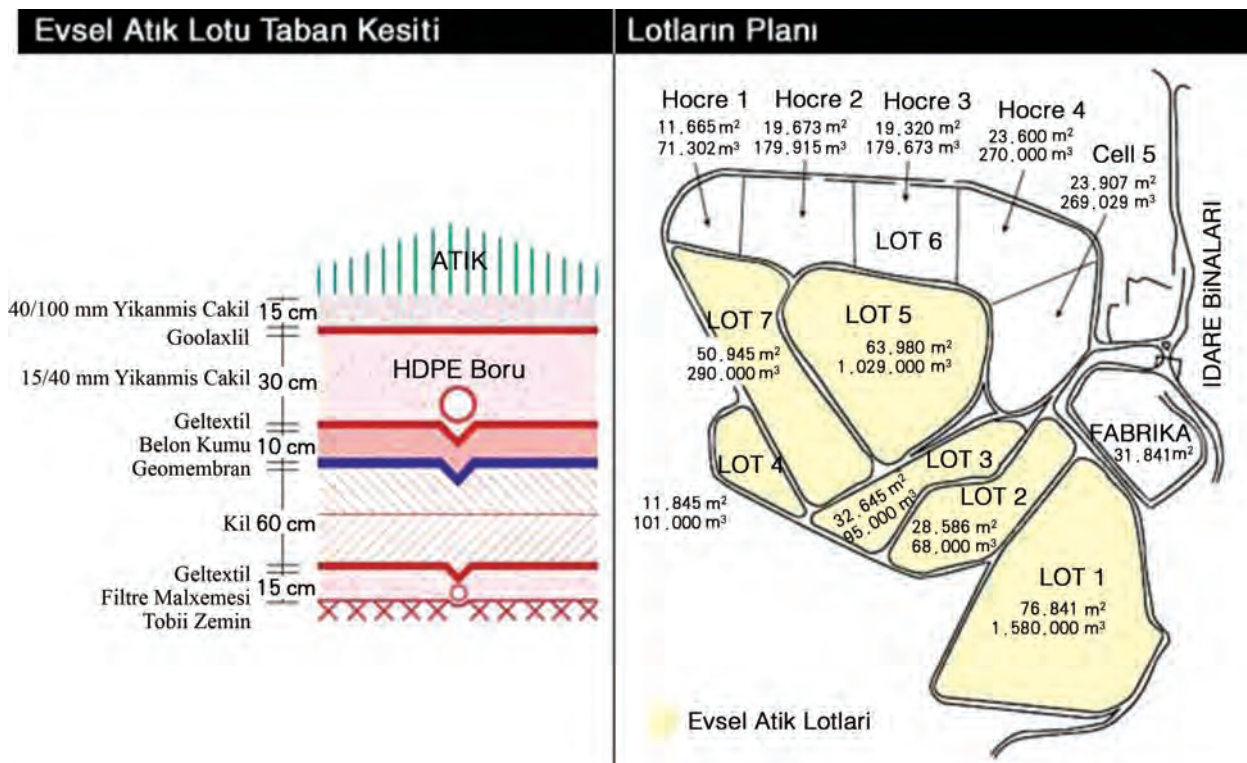


Figure 2.8 Highly Severity Warning-Low Sewage Level at Station 076

for residents, tourists and companies. The department’s duties include the building, operation, maintenance and repair of the urban sewage collection system. Staff members use the Vactor online-operated cleaner and Ques camera system to monitor wastewater infrastructure. The operation of the system as a whole mainly includes sewage collection and treatment. St. Petersburg South West Wastewater Treatment Plant (SWWWTP), which is the most critical facility in St. Petersburg, is listed as one of the top priorities of this region. Every day, about 1,220,000 liters of unprocessed wastewater was directly discharged into the sea. Such wastewater is now reused after collection and treatment by this project.

### (3) Solid Waste Disposal—Istanbul ‘Solid-Waste-to-Energy’ Technology

Solid waste disposal technologies have now matured to the point that they can transform waste into energy for reuse. In 2010, Istanbul’s investment in a refuse landfill-gas-energy project made it the site of the largest refuse landfill-natural-gas-energy facility in Turkey (Figure 2.9). The facility is equipped with automatic measurement devices which can adapt to changes in gas flow and can produce 50 Mwh/hour, providing electricity for 20 thousand households. The project is composed of two power plants, situated close to the K m rc oda and Odayeri refuse landfill sites. Each landfill can treat 12,000 tons of solid waste per day. Through wells and pipelines dug into the solid waste, they collect



Source: <https://clu-in.org/wales/download>.

Figure 2.9 Rubbish Natural Treatment Technology

methane, transferring it to heat exchangers and mist eliminators for cooling and dehumidification. This processed gas then fuels internal combustion engines, driving power generators which supply power to the state grid. This refuse landfill-natural-gas-to-energy project has also reduced methane emissions by an amount equivalent to 1.2 million tons per year between 2011 and 2015. Istanbul's solid waste management cycle can not only generate power and composted waste from different waste flows, but also divert excess heat to greenhouses, increasing their productivity, and thus turning this into a by-product. The excess heat is trapped and sent to increase yields in 3,200 m<sup>2</sup> of greenhouses near the landfill sites. The organic waste processing area also produces fertilizers for greenhouse usage. Each month, the project greenhouses produce 600,000 flowers for parks and gardens around the city.

### 2.3 Problem Analysis

The different cities faced various problems with regard to their traditional treatments of the three wastes. Stockholm, Istanbul and Fortaleza thus adopted innovative technologies and measures for the treatment of solid waste and wastewater, and derive quite significant environmental and social benefits from

these. However, their practices remain potentially susceptible to some problems:

#### (1) Initial Technology Update and Replacement Requirements

‘New energy’ sources, including fuel cells, solar PV cells, and solar heat collection panels, and wastewater and solid waste heat-exchange devices, are unstable: the variation in their supply can impact on the regular power grid. Increased usage of distributed new energy models will increase the tidal changes in line load, complicating voltage adjustment. At the same time, differences between distributed power generation sources could easily lead to voltage flicker, producing imbalanced voltages and harmonic pollution. New technology is required to solve this problem.

#### (2) Good Solid Waste Sorting Is a Prerequisite for Recycling via Vacuum Pipeline

If solid waste is not sorted at source, failure rates in the underground pipeline collection system connecting household rubbish bins and central collection stations will increase. These vacuum suction systems can only effectively deliver different types of rubbish to storage points and onward through pipelines for landfill, composting or burning (for power generation) if the input is adequately sorted. Thorough solid waste sorting at source is, therefore, a prerequisite for the efficient functioning and good performance of pipeline vacuum suction systems. This creates a need to foster suitable waste-sorting behavior amongst residents, through education, legislation, and increasing environmental awareness.

### 2.4 Experience Summary

Sweden’s Stockholm stands as the best example of a city with green and balanced development. Its green development policy has been clearly and accurately positioned, and the establishment of an integrated policy system provides a safeguard for the city’s green development, which includes urban land and water resource planning and development of green transport and energy-saving buildings. Together these have consistently delivered benefits on economic, social and environmental levels.

The treatment of the ‘three wastes’ in the other three cities is more professional. In the future, R&D and application of digital sewage treatment technology, automated rubbish collection systems, and resource reuse technologies will be critical areas of development. Istanbul’s landfill-natural-gas-energy conversion project has become an ongoing leading example for solid waste treatment. Technologies including Tokyo’s fully-enclosed automatic rubbish collection system and Northern European countries’ transformation of household rubbish into



biomass energy provide further inspiring examples in the solid waste treatment. Systems which apply digital technology to sewage collection, transport and treatment, as represented by those of Fortaleza, Brazil and Saint Petersburg, can be continuously updated to reflect the latest levels of automation technology available.

### 3. Shanghai, China: Ecological Landscape Restoration on Banks of the Huangpu River

#### 3.1 Background

Ensuring balanced development of the two banks of the Huangpu River is a measure of great importance in the enhancement of Shanghai’s overall competitiveness. According to *The Optimization Plan for Both Banks of the Huangpu River*, the regions concerned stretch from Lupu Bridge in the South to Xiangyin Road-Wuzhou Avenue in the North, and include the 40-kilometer-long flood control walls running along both sides of this stretch. To satisfy the requirement of the ‘Grand Plan, Centennial Masterpiece’, Shanghai is striving to redevelop the function of the riversides and improve public environment along the riverfront, creating new coastal, ecological, historical and cultural landscapes fitting for a prosperous international metropolis. In 2015, it launched the *Three-Year Plan for Public Space Construction on Both Banks of the Huangpu River (2015-2017)* (Figure 2.10).

Huangpu River is the largest river in Shanghai and the most downstream body of

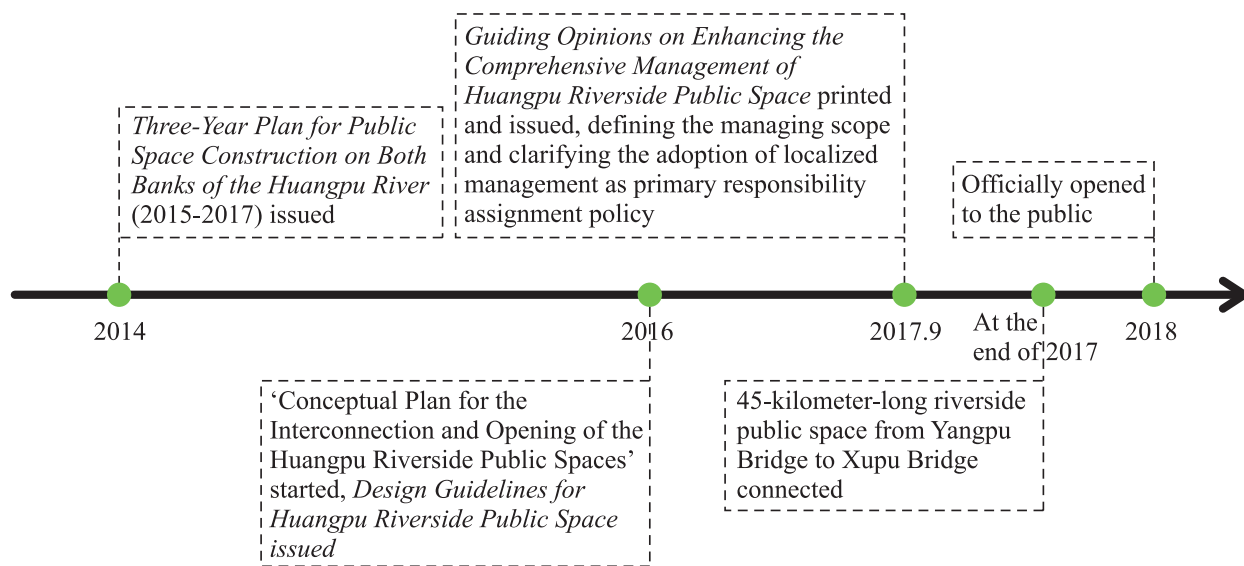


Figure 2.10 Action Plan for the Huangpu Riverbanks

water in the Taihu Lake Basin. Based on Chinese drinking water standards, about 86.5% of Chinese rivers are ineligible for direct use as drinking water sources. The Huangpu River water body is mainly contaminated by organics—primarily industrial wastewater and sanitary sewage—followed by livestock and agriculture pollutants, pollution sources which have grown more serious in recent years. The construction of public spaces on both banks of the Huangpu thus provides new opportunities for water purification and ecological restoration.

Major problems in the development phases include: 1) the still-discontinuous, unformed nature of riverside public space, which currently comprises multiple sections and regions that have yet to be effectively linked; 2) the still-inadequate cultural, landscape, and ecological features of the riverside public space, and its need for construction quality improvements; 3) the inadequacy of public transportation facilities and lack of accessibility. A proposed green slow traffic system has also yet to be implemented. Since the launch of the action plan, the public transportation system has been improved and gradually connected, accelerating the pace of industrial transformation along the riverside and distinctly improving the riverside environment. The leisure facilities established, which provide a combination of tourism and culture, have given rise to infrastructure with convenient transportation and, promote ecological restoration of the riverside area and the improvement of its public environment. The two banks of the Huangpu River have gradually been transformed into key areas for public activities in the city (Figure 2.11).



Source: Baike. baidu.

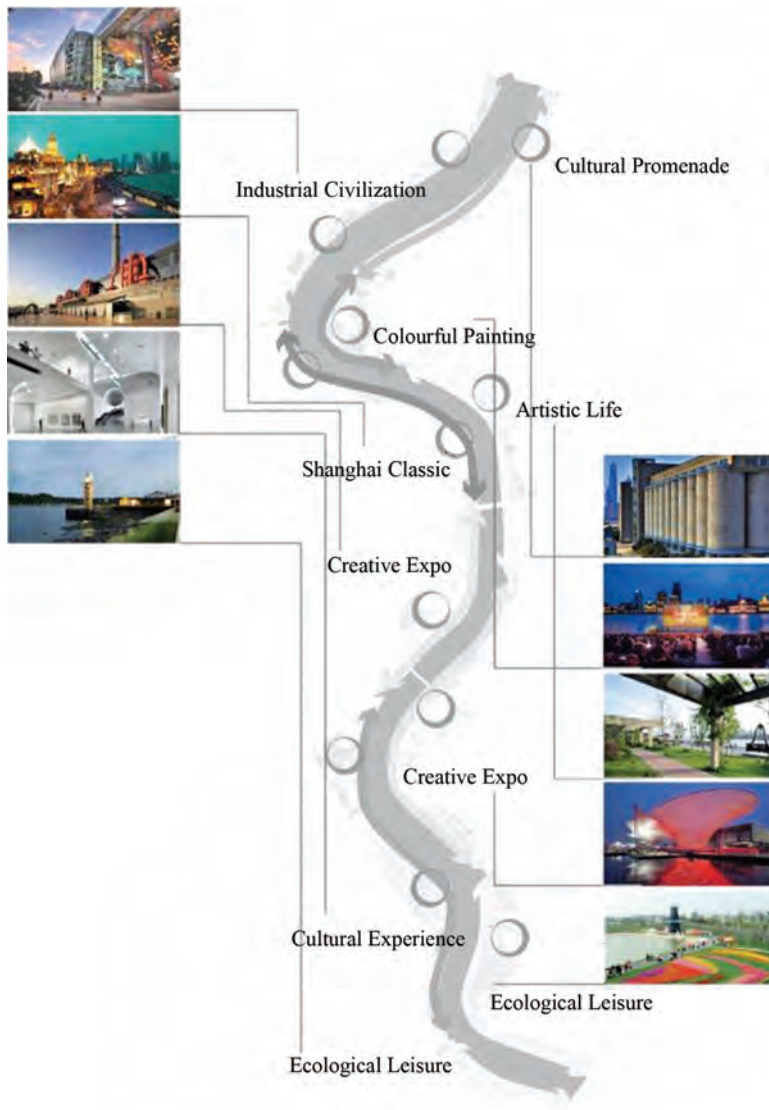
Figure 2.11 The Comparison before and after the Launch of the Huangpu Riverside Public Space Construction Plan

### 3.2 Practice Process

Overall accessibility of both sides of the Huangpu River is an important factor in the establishment of the city's riverside green corridor. From industrial land for production, to ecologically-friendly green areas for living, the city has developed open spaces, including about 260ha of green public land and green parks with vibrant ecological environments in downtown areas. Since the *Three-Year Plan for Public Space Construction on Both Banks of the Huangpu River (2015-2017)* launched in 2014, the riverside space has been opened to tourists after four years of construction.

#### (1) Overall Positioning of the Connection of Riverside Public Space

The 'Conceptual Plan for the Connection and Opening of Huangpu Riverside



Source: *Conceptual Plan for Connection and Opening of Huangpu Riverside Public Space.*

Figure 2.12 Schematic Diagram of All Phases of Huangpu Riversides

Public Space’ officially launched by Shanghai Planning and Land Resource Administration Bureau, delineated six concepts designed to enhance the Huangpu River’s role in leisure and sightseeing (Figure 2.12), improve the construction of public landscape, and create more cultural and ecological riverside areas. These are ‘Opening Riverside’, ‘Beautiful Riverside’, ‘Cultural Riverside’, ‘Green Riverside’, ‘Dynamic Riverside’, and ‘Comfortable Riverside’, concepts which have guided the development of the Huangpu River banks into a destination where citizens of and visitors to Shanghai can experience local atmosphere, history, culture, landscape and spirit. The concepts have demonstrated that public space are designed and managed: 1) as multifunctional areas for social interaction and inclusion, human health and well-being, economic exchange and cultural expression and dialogue among a wide diversity of people and cultures; 2) to ensure human development and to build peaceful, inclusive and participatory societies, as well as to promote living together, connectivity and social inclusion.

Among them, the ‘Green Riverside’ concept emphasizes the ecological landscape restoration of the Huangpu River’s waterfront public spaces. The aim of riverside space restoration is the construction of a safe, pleasant, and green coastline. By restoring green areas along the river and clearing many blockages, the city has succeeded in connecting resources such as ecological parks, wetlands, and public squares, knitting the riverside green belt and the inland public environment tightly together, while cultivating the Huangpu’s riverine and green ecosystem.

To satisfy public requirements for flood control and waterfront accessibility, the city has also modified the design of flood control walls. These now not only deal with rainwater and river flooding, but also provide pleasant public waterside environments.

## (2) Ecological Landscape Restoration Philosophy

Riverside space plays a significant role in city ecosystems. Huangpu River thus has an important influence on Shanghai’s ecosystem and regional climate, and is of great importance in the mitigation of the urban heat island effect and the maintenance of the integrity and biodiversity of the city’s ecology. In designing the connected ecological landscape along the Huangpu’s banks, the city focused on existing problems and proposed nature-oriented strategies, which integrated into local ecological patterns to construct a pleasant and accessible green coastline. Respecting the naturally-formed wetland system along Huangpu River, it has built an ecological system satisfying the habitat requirements of local fauna, whose ecological environment has been permeated inland via new and rebuilt flood control dikes and usage of other natural anchorage points. The post-industrial landscape along the Huangpu River includes

industrial sites—especially architectural complexes—with distinctive landmark features. Through its reshaping and re-use of such facilities and elements, the city has meticulously combined them with waterfront green landscape and Shanghai’s leisure facilities. Its preservation of landmark industrial features such as docks, tower cranes, and observation towers, has created stretches of riverbank landscape with historical post-industrial features. The two unblocked riversides are organized around low-level footpaths, middle-level running paths, high-level cycle paths, a ‘golden’ tourist route, and the preserved light railway line, creating a space where ‘above green land and blue water, all routes are enjoyable’. This layout not only focuses on coordination with the overall landscape, but also highlights scenic spots along the 22 kilometer stretch, taking social and ecological requirements into consideration in the formulation of its human-centered design.

### (3) ‘Three-Path Connection’ Strategy for Ecological Landscapes

For non-motorized traffic, walking, running, and cycling paths are provided. 1) The walking path satisfies people’s desire to walk through riverside public spaces. As an ideal route to reach the water, it connects the major activity sites. 2) The running path satisfies the need for fitness activities such as running and walking race in public spaces along the riversides, and thus has special requirements in terms of width, slope, and signage. 3) The bicycle path must remain clear for cycling activities in the riverside public spaces, and also has special requirements in terms of width, slope, and signage.

This ‘Three-Path Connection’ strategy improves the accessibility of separated tracts, but two considerations make it difficult to implement. First, wharf areas are under the jurisdiction of different government departments; all parties concerned must coordinate to promote the connection. Second, by the north of the river, some existing business buildings, building clusters and riverside green areas, constrain the scope for positioning of non-motorized traffic routes. There are four main methods adopted for connecting the separated tracts scattering along the river banks. 1) To build sightseeing platforms to bridge separated parts of wharves. For example, public platforms constructed over ferry stations at Fuxing East Road and Dongjiadu Road enable pedestrians to walk across the wharves there. 2) To build overwater platforms like Nanpu Bridge and Lupu Bridge or redevelopment of existing high-pile wharves into overwater platforms. 3) To set belt passage. For example, Lujiabang Road ferry station and the three watergates of the Expo Park utilize the existed belt passages to connect the public spaces. 4) To build bridges. Separated parts of Rihui Port are now connecting by bridges, and pedestrian bridges have been built connecting riverside space in Xuhui District, thus eliminating barriers between previously-separated areas.

### 3.3 Problem Analysis

Lack of ‘accessibility’ and ‘connectivity’ along the Huangpu River waterside was the factor causing the major problems related to the ecological landscape restoration project. The major problems are as follows.

(1) Balanced development on both sides of Huangpu River was hampered by problems such as division of land ownership and inability of related service facilities to meet the demand of quality. Coordination with landowners to carry out unified management on the three waterside route systems and their supporting service facilities have thus been necessary.

(2) Some existing topographical elements interrupted public space along the Huangpu River, including the official maritime ports, ferry ports, public security buildings, sanitation facilities, and others. These continue to divide the ecological landscape space somewhat, lowering the utilization of services it provides.

(3) The hardening of flood control facilities along the Huangpu riverside conflicts with public leisure and rest requirements. Therefore easy access to the waterfront and the enhancement of flood control performance cannot be met simultaneously. Meanwhile, the requirements for hardening the embankment also pose technical problems for ecological restoration: it is necessary to apply ecological technology on the basis of guarantees of the safety of riverside green lands.

(4) The objectives of various infrastructures are contradictory. For example, the objective of optimizing the overall arrangement of the riverside tourist wharves, ferry stations, and official wharves is in contradiction with that of connecting the riverside routes. Thus there is a need to rank these objectives, prioritizing some, in order to optimize the system overall by integrating all of the infrastructure facilities.

### 3.4 Experience Summary

Restoration of the ecological landscape along the Huangpu riversides focuses not only on local fauna and human considerations, but also takes into account urban space requirements and the skills-scientific, technological, and in terms of innovation-available. Time is still needed to fully evaluate the results. Based on the relevant statistics and experience, the status and ongoing policies of the Huangpu riversides can be summarized as follows:

Enhancing openness and connectivity is an important means to renew and reactivate Shanghai’s Huangpu riverside space. Accessibility along the long stretches has created sightseeing corridors, and returned eco-friendly space to the river. By optimizing the relevant infrastructure, the city has also successfully created a high-quality, multifunctional, and ecologically sustainable residence

environment, and enhanced the value of the site. Reuse and preservation of industrial sites has served to represent the historical features of the Huangpu River, strengthen people's memory of these sites and enhance their sense of belonging and identity, enabling these regions to serve as memorials to bygone days, and as beacons highlighting the importance of education.

Environmental remediation has created green, active waterfront space, with technological innovations serving to mitigate contradictions between infrastructure and space functions. It has also promoted interconnection with surrounding areas and integration of the ecosystems. Meanwhile, the city also espouses an eco-friendly philosophy, reliant on new ecological patterns enabled by emerging technology, and has adopted ecological measures from vegetation planting to plant maintenance. It has not only taken ecology, culture, and society into overall consideration, but also been successfully in connecting ecological scenery along the Huangpu River, and thus in forming a comprehensive riverside ecosystem. In addition, Shanghai has also stimulated the vitality of the region, by creating ecological space and increasing the accessibility of the relevant sites, thus developing ecology-related industry, and inspiring the revitalized approaches to new cities based on riverside open space.

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[https://www.ase.org/sites/ase.org/files/fortaleza\\_brazil.pdf](https://www.ase.org/sites/ase.org/files/fortaleza_brazil.pdf).

[https://www.elipse.com.br/wp-content/uploads/2017/03/Case\\_cagece\\_enu.pdf](https://www.elipse.com.br/wp-content/uploads/2017/03/Case_cagece_enu.pdf).

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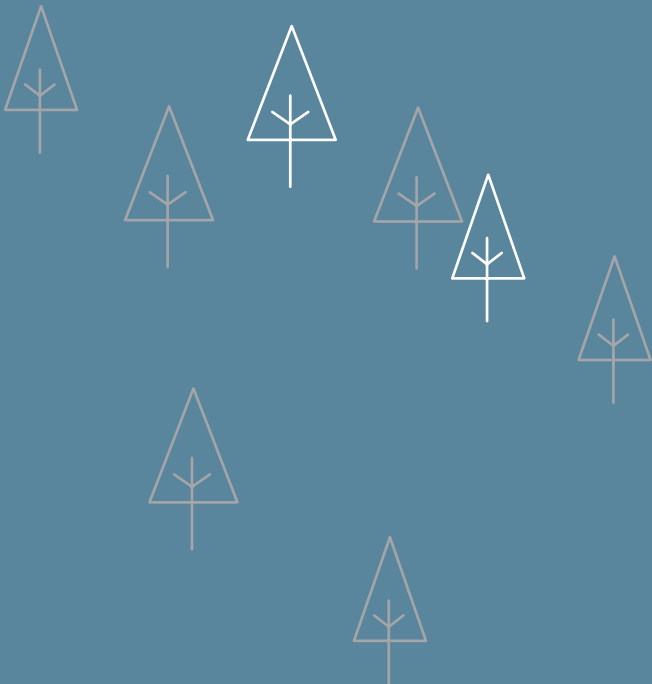
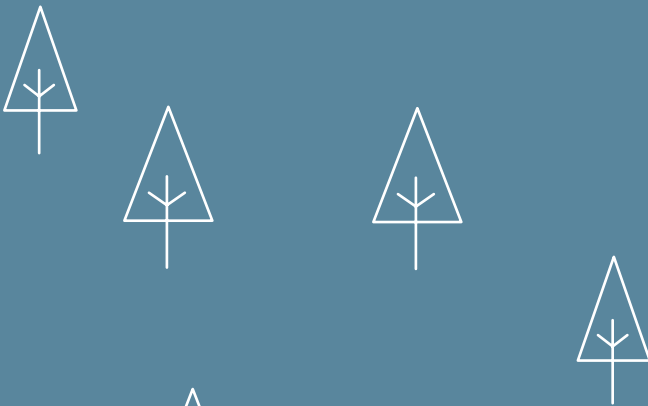
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# Chapter III

## Society





## Introduction\*

This chapter on society with the theme of ecology refers to the ‘social ecology empowerment of the eco-city path’ and the ‘green development of social governance path.’ Empowerment means implementing people’s rights to realize a city’s sustainable development—both the natural ecology and the social ecology. When the development is green-oriented, the benefits are shared by all, and it’s necessary to follow a path of common governance. In other words, only when all sectors of the society have been mobilized, can the development be realizable and sustainable. The two themes of the ‘social ecology empowerment of eco-city path’ and the ‘green development of social governance path’ include three keywords of ‘lifestyle’, ‘social participation’, and ‘inclusive development’, and have expanded and innovated the traditional understanding of ecologically sustainable development. The core target is highlighting the inseparable internal relationship between natural ecology and social ecology. Historically, the unsustainability of natural ecology was the negative result of human development patterns and lifestyles since the modern industrial revolution. In essence, the problems of social ecology are the most to be blamed for the deteriorating natural ecology. Therefore, ecological restoration and protection is both environmental and social governance, that means only by treating the two ecologies together can human society develop in a truly sustainable way.

The chapter starts with the three keywords of ‘lifestyle’, ‘social participation’, and ‘inclusive development’ combines three cases of the Ant Forest program by Ali, waste disposal in Tokyo, community gardens (Green Self-governance Map) in Shanghai, and one box case (Bahnstadt Heidelberg), with the expectation of providing references for the inclusive development of eco-cities.

### 1. Lifestyle

As the major expression of personal consumption, lifestyle is the fundamental factor affecting urban ecology. To change people’s lifestyles, it is necessary to advocate green consumption by encouraging the individual consumer to realize a green lifestyle. Sustainable consumption is a new type of moderate consumption behavior and process

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that highlights preventing or reducing damage to the environment, advocating nature conservation, and ecological protection. So-called ‘green consumption’ includes not only purchasing green products and selecting green travel methods (Ant Forest), but also the recycling of materials (waste disposal in Tokyo), the effective use of energy (Bahnstadt Heidelberg), and the protection of living and species environments (Green Self-Governance Map). The promotion and practice of a green lifestyle is the essence of social morality in terms of bearing responsibility for future generations, as well as a fashionable living concept that can benefit all in our time.

Lifestyle is determined by our habits, which is nearly a second nature for human beings so that it is not easy to exact change. Philosophers have said that the pursuit of superiority over others is the natural passion of human beings. The case of Ant Forest is an important attempt to alter lifestyles. This practice has no intention to change mankind’s nature to pursue superiority but intends to transform the competition for superiority from materialism to environmentalism and advocates a green-oriented change of lifestyle. By awarding such low-carbon actions as traveling by bus, e-payment, and walking for exercise, it not only enables individual daily consumption to make direct and indirect contributions to the bettering of urban ecology but also cultivates people’s low-carbon habits in daily life. It has never changed, but rather smartly utilized people’s pursuit of superiority over others, which is not only an individual achievement but will also do good for the public.

## 2. Social Participation

Community development has been the goal, the method, and the consistent proposition of the United Nations over the past several decades. This year’s *Shanghai Manual* is themed on ecology and takes ‘green’ as the starting point for urban management, community participation, and social self-governance. The reason why we consider ‘ecology’ to be an issue for both the environment and society is that only through the participation of the entire society, can we realize ecological sustainability and green development. We utilize the theme of ecology and advocate the integrated development and promotional relationship between social ecology and natural ecology. And we also believe that only by involving all people in ecology and green development, can it be inclusive and benefit all.

The ‘Green Self-Governance Map’ in this chapter provides the best case for practicing the above concepts. The voice for self-governance of residents has never stopped in the past twenty years, but the main body of it has yet to see actual practice. The initiator of this project is a professional organization, and the major actors are community residents.

‘Green’ is just the inroad, and the objective for participating in ecological construction is to enhance social communication, improve the vitality of the neighborhood, and explore the development pathway for a community governed, constructed, and shared by all. And the essence of this project is stimulating social vitality through green development. ‘Green self-governance’ is not only the ecology-related map gradually spreading in Shanghai, but also the city’s ascendant social construction map.

In addition, the effective public policies and dependable technical support are important factors contributing to the success of waste reduction and resource recycling in Tokyo and Bahnstadt Heidelberg, and we should never deny the indispensable element of the extensive participation of people. ‘Extensive’ here means power and will bring diversified interests and propositions. Then, the method in building a communication and negotiation mechanism that involves all residents will be the key to successful implementation and sustainability of the project and a model for the construction of a ‘social participation.’

### 3. Inclusive Development

Green development also has an inclusive character. After finding the disadvantages of a development model, which combines capital and power, takes obtaining the maximum benefits from land and space as the target, and exclusively depends on talented groups, while rejecting disadvantaged ones, we started a new bottom-up development pattern featuring extensive participation and based on local resources. So-called inclusive development is about the shift from a shared pattern involving all disadvantaged groups to self-governance status where all people are capable of contributing to environment improvements, which is in accordance with *Shanghai Manual*. Under this concept, the opposition between talent and grassroots will disappear, and the traditional division between the developed and the backward will fail. Instead, innovative experience may emerge from sectors that were looked down on before. In this regard, we must be adequately sensitive and keep open and inclusive attitudes to all potential developments.

#### Zero Carbon Community: Bahnstadt Heidelberg

Bahnstadt Heidelberg, covering 116 hectares, was transformed from a freight yard at Heidelberg Central Station in Germany into a new area (see Figure 3.1). Bahnstadt not only coordinates with the old urban areas and neighboring communities, but also pays attention to the internal energy conservation and functional complex. With

innovative proposal and large-scale implementation of the ‘Passive House Standard’ (the world’s largest Passive House development project), the Bahnstadt project has become a highlight of the sustainable development of the world cities. The Bahnstadt project can be said to be a perfect interpretation of the three key words of this chapter—‘lifestyle’, ‘social participation’ and ‘inclusive development.’



Source: A Snapshot of Heidelberg Map.

Figure 3.1 Location of Bahnstadt in Heidelberg

## 1. Social Participation: Design Competitions Promote the Construction of Bahnstadt

The construction of the Bahnstadt project was mainly controlled by the government, but social participation was an important force. In 2001, Heidelberg hosted a competition for the general conceptual planning of Bahnstadt to formulate a planning concept that linked Bahnstadt with the historic core areas of Heidelberg, in which ecological sustainability, social stability and economic feasibility must be demonstrated. Under the joint efforts of all parties, the construction was promoted in an orderly way: In 2003, the government, based on the winning plan, worked with property developers, landowners and the City Council, to revise the urban design, and formulate a general plan and urban development framework, covering Bahnstadt’s future urban layout, land-use planning, public space and transport networks. In 2006, the City Council adopted ‘a special town planning development scheme’, empowering Heidelberg to reuse vacant land and industrial areas to meet living demands. In fall 2007, the City Council made a political decision to support the Bahnstadt project, detailing all development aspects of Bahnstadt, whose

blueprint had been gradually completed. The project commenced its construction in 2008. Subsequently, a residential design competition was held in 2008 and a nursery design competition was held in 2010 to serve specific construction projects.

## 2. Lifestyle: Science and Technology Help to Realize Green Living

The Bahnstadt project is fundamental to the change of people's lifestyle, practicing the green lifestyle from all levels. First, the establishment of Passive House Standard: According to the political decision-making of the project in 2007, both residential and nonresidential buildings in Bahnstadt shall conform to the energy-conservation Passive House Standard (see Figure 3.2). Buildings designed in this way need 50-80% lower than a conventional residential building in energy. Second, abutting Pfaffengrund, the wood-waste combined heat and power (CHP) plant has provided 100% renewable energy heating for Bahnstadt. Third, households here are all equipped with a smart meter (see Figure 3.3), enabling residents to have an immediate understanding of information about energy consumption, and adopt energy-efficiency measures. Fourth, thanks to LED light bulbs and the remote management system used on the street, the lighting can satisfy actual demands, to ensure lower energy use in the aspect.



Source: Photographed by Buck.

Figure 3.2 Ventilation System of the Passive House



Source: Passive House Institute.

Figure 3.3 Energy Consumption Monitoring of a Smart Meter

## 3. Inclusive Development: Functional Complex Creates a Vibrant Block

Bahnstadt is a mixed function block that integrates living, learning, scientific



research, entertainment and commerce. Functional complex has given infinite vigor to Bahnstadt and lays the structural foundation for inclusive development. The distances between the internal functional areas of the Bahnstadt are very short. It is located in the center of Heidelberg, the traffic is unblocked and convenient. As for the community living, there are meeting places with mixed functions represented by Community Center 'B<sup>3</sup> Gadamerplatz', day-care centers and child-care facilities with a rational layout in the neighborhood, the Zollhofgarten Park known as 'the green heart' with an area of approximately 7,600 m<sup>2</sup>, as well as various theme parks and passive home theaters, and cultural sites converted from industrial facilities, all of which have provided residents with great material foundation for their daily and social life. The 22-hectare campus, numerous research institutions and technology companies make Bahnstadt a center of science and education.

Heidelberg is a key town of science and education. Bahnstadt, which makes full use of modern science and technology to assist the operation, not only meets the needs of environmental protection, but also provides high-quality urban life. Residents of the city will inevitably internalize this green lifestyle to help the city truly achieve ecological sustainability.

Source: Alicja Matgorzata Graczyk. 'Implementation of Sustainable Development in the City of Heidelberg. Acta Universitatis Lodziensis.' *Folia Oeconomica*, 2015, 2 (313).

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## Reference Cases

### 1. Ant Forest: Quantification and Interaction of Green Life

#### 1.1 Background

The greenhouse effect is the main cause of global climate changes. In order to reduce greenhouse gas emitters and increase greenhouse gas sinks, the international community and nations adopted global governance measures including carbon-sink transactions to achieve the goal of reducing the total emission of developed countries. The current green financial mechanism mostly focuses on nations and

large institutions. What can green finance do for individuals? After all, the need for transport and consumption is an important driving force to drive economic activity and increase energy consumption and carbon emission. The reduction of carbon emissions by individuals means a lot. But because of the lack of policies and rules related to green consumption, coupled with the lack of a market driving force for technological innovation, the low-carbon supply is not established. On the consumption side, since the green consumption awareness education and marketing targeting the public have just begun, incentives for consumers are not enough. The public lacks environmental protection responsibility awareness and green lifestyles. Against such a background, ‘Ant Forest’ tried a positive mode of ‘company launching and public participation’ to effectively promote the formation of individual green life habits.

## 1.2 Practice Process

Ant forest is a product of Alipay used in individual carbon transaction market management. It is committed to promoting individual carbon emission reduction. Through certain calculations, this product can measure the low carbon emission reduction behaviors of users recorded on the third party payment platforms including walking, taking the subway, online payment of water, electricity and gasbills, or traffic fines, online hospital registration, online purchase of tickets towards certain energy values which can be used to grow virtual trees in Alipay. When the tree grows up, cooperating organizations including organization for public goods and environmental protection enterprises will buy the trees of consumers and grow real trees in desert regions. These trees will play the role of blocking winds, stabilizing sands and optimizing the environment.

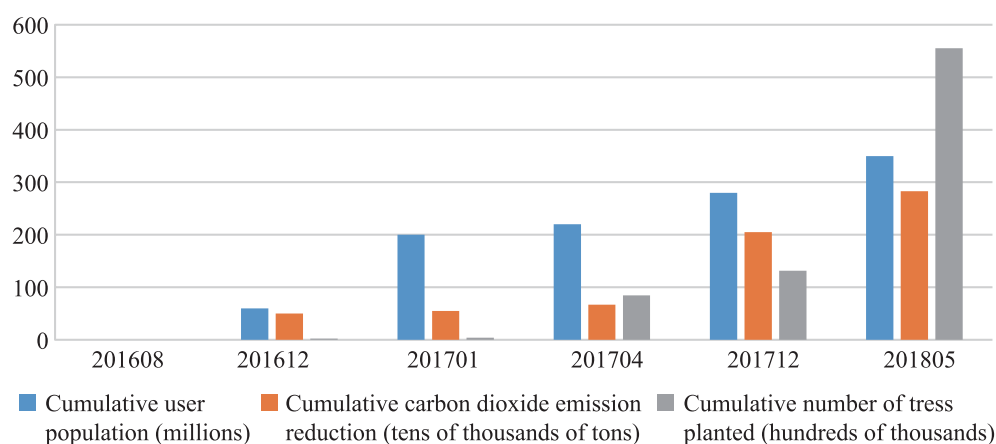
In August 2016, Ant Financial set up an individual carbon account, ‘Ant Forest,’ for its 450 million users on the Alipay platform. The original reason for this action was to make users learn about the relationship between their daily life and low carbon emission reduction through their carbon account. As the ‘carbon accounts’ is not well known, the founding team designed interesting and interactive products to popularize green and low carbon lifestyles among the public. Through quantitative calculations, the users can understand more clearly individual emission reduction and green life.

During the Chinese Spring Festival in January 2017, Ant Financial designed interactive games including on-line red envelop exchanges. In one month, the

number of users of Ant Forest exceeded 200 million. Unlike the interactive games of social software in the past, users can develop low carbon life habits for accumulating energy values including walking, taking the subway, on-line payment of water, electricity and gas bills, on-line purchase of tickets, and on-line payment of traffic fines and on-line hospital registration. These behaviors remained, and the number and viscosity of users continued to increase. By the end of April 2017, the number of users of Ant Forest exceeded 220 million. They have cumulatively reduced emissions by 670,000 tons, and have grown a total of 8,450,000 saxaul shrubs. Cooperative partners of this platform which specialize in public charity planted and maintained trees in Alaxa and Erdos in Inner Mongolia and Minqin in Gansu. By the end of 2017, the users of Ant Forest on Alipay exceeded 280 million. They have planted and maintained a total of 13,140,000 trees which protect 12,111 *mu* of land. Currently, the number of users of Ant Forest has exceeded 300 million. By the end of 2018, the total investment of the company in ecological protection will exceed RMB 500 million. In 5 years, Ant Forest plans to have planted 500 million trees on 6 million *mu* of land.

Through over one year's practice, the online carbon emission reduction scenarios have been enriched, and the number of trees they planted off-line has increased as well, promoting the continued optimization of carbon emission reduction algorithms in practice. The project has established an individual carbon emission reduction expert committee. Authoritative experts have upgraded the current algorithms and unified rules of new algorithms. They have rolled out the first large-scale individual carbon emission reduction algorithm standard in the world. They have cooperated with CBEEEX to optimize the algorithms, encompassing online purchase of bus tickets, taking the bus, online payment of fees, walking, e-payments, e-invoices, etc. The aim is to make the algorithms more accurate, easier to handle and more transparent. In this way, the algorithms cannot only serve Ant Forest more scientifically, but will have important value in exploration and practice across the globe.

At the beginning of 2018, Ant Financial and UNEP established the first Green Digital Financial Association (GDFA) on Davos Forum, to seek a path to global sustainable development and explore Ant Forest across the globe. This is the first time UNEP has joined hands with a Chinese enterprise to establish an international alliance in the 45 years since its establishment.



Source: The Official Data of Ant Financial.

Figure 3.4 Statistics of Ant Forest Products

### 1.3 Problem Analysis

#### (1) Green Consumption Lacks Motivation and Incentive Mechanism

As described above, because the public awareness of environmental protection and social responsibility is not strong, and green consumption lacks a mature incentive mechanism, most residents lack a strong will for green consumption. Green consumption is called ‘sustainable consumption.’ It aims to meet ecological needs. Its basic idea is to benefit health and protect the environment. It is a general term for all sorts of consumption behaviors and consumption modes that meet the standards for the health of people and environmental protection. The meaning of green consumption covers a lot of areas. It does not only include green products, but also include recycling and reuse of goods and materials, effective use of energy, protection of living environments and species, etc. It seems to cover all aspects of production behavior and consumption behavior. Green consumption is a new type of consumer behavior and process that features moderate consumption, prevention or reduction of damage to the environment, revering nature and the protection of ecology. Green consumption reflects that contemporary consumers are proactively achieving low energy consumption, low pollution and low emissions in the process of consumption with an attitude of being responsible for society and posterity. This consumption mode which benefits ourselves and others should not only be advocated as a fashionable and economic life concept but also become the shared value orientation of the whole society.

But because of the lack of policies and rules related to green consumption, the institutional environment advocating green consumption is not wholesome. In addition, a market driving force for technological revolution is lacking, the low

carbon production at the supply side is immature. The whole-process of low carbon control in the stages of product R&D, design, production and sales has not been achieved. At the consumption side, the public is the ultimate consumers of low carbon products. The building and popularizing of the green consumption mode must be supported by the public participation. But the education and popularizing of green consumption concepts among the public lack a long-term mechanism, and the galvanization of consumers is not enough.

### (2) Green Finance Lacks Personal Products and Common Standards

In addition to policy guidance, market mechanisms are also a driving force for the individual's development of green living habits. Compared with the mature green finance market in developed countries, financial institutions in many developing countries lack professional expertise on environmental protection and quantifiable standards. The environmental protection and social responsibility awareness of stakeholders, investors and staff of financial institutions are not strong. Most financial products including green credit, green insurance and green securities do not target individual consumers. Currently, the quantifiable evaluation standards targeting carbon emission of enterprises, pollution and damages have gradually matured. However, it is still a major challenge worldwide to estimate the effort of individuals in emission reduction. Large-scale individual carbon emission reduction methodology lacks a unified global standard.

### (3) Green Public Welfare Lacks Policy Guidance and Cooperation Mechanisms

Green welfare refers to welfare with the goal of the green development of mankind. It advocates the principles of willingness, acting according to one's capacities and safety, and the principles of respect, tolerance and accommodation. However, as the policy guidance and cooperation mechanism are not mature, current organizations and projects for the public good can hardly meet the principle requirements raised by green welfare such as 'public and transparent', 'open', 'conservation and protection of resources for the public good', 'democracy', 'correct social positioning', 'inter-organizational coordination and cooperation', etc.

The Ant Forest project realized the green welfare goal of afforestation while advocating individual low carbon lifestyles. Its public welfare route is 'users create on-line green energy—Ant Forest buys trees from organizations of public good—buying of off-line green energy with real trees.' In this transaction, users paid attention and made green behaviors in return for public welfare funds. Companies paid the fees in return for the attention of the users and its brand image. This is a green welfare case involving the coordination of on-line and off-line, multiple

subjects and a focus on both social and biological effects.

#### 1.4 Experience Summary

##### (1) Carbon Account: Quantifiable Green Life

Each Alipay account has a carbon account, which, together with a funding account and a credit account, constitutes the three account types of Alipay. The low carbon behaviors of users every day can be converted into carbon emission reduction figures and cumulated in the carbon accounts of users. The traditional carbon sink trading system is a national system. Countries can offset certain amounts of carbon dioxide they emit by producing carbon sink through afforestation, etc. Carbon sink trading can not only take place within one country, but can also take place internationally. Developed countries can offset part of their emissions of carbon dioxide by joining hands with developing countries to implement the forestry carbon sequestration project. Carbon trade can make the carbon emission reduction of individuals measurable and cumulative through the Internet and big data.

There is no unified standard for large-scale individual carbon emission reduction methodology in the international community. Ant Forest established the Individual Carbon Emission Reduction Expert Committee (hereinafter referred to as the ‘Expert Committee’) in June 2017 and rolled out the first large-scale individual carbon emission reduction algorithm standard in the world. It cooperated with professional institutions including Beijing Environment Exchange(China) to continue to upgrade and optimize the current algorithm. The unified standard can make the algorithm more accurate, easier to handle and more transparent. It can serve Ant Forest more scientifically, and moreover, the global leading individual carbon emission reduction scenarios has important value for exploration and practice globally. On this basis, quantified individual cumulative carbon emission reduction can be put on the carbon market for transaction. It can be sold to companies or even traded on the international market. The main method in the current stage is for the public good. The aim is to achieve the perfect integration of the benefits of carbon emission reduction in individual green travel, poverty alleviation and environmental protection. In the future, it can be exchanged for economic benefits.

Of course, Ant Forest is a project launched by an enterprise. The commercial motive of enterprises means that the current algorithm serving the goal of profit for the enterprise is unavoidable. The record of all low carbon behaviors must be certified by the third party platform. All data and interactions must be made

#### Algorithm for Ant Forest

1. Walk. The longer you walk, the more energy there is. For each step there is 0.0166 g of energy, and the upper limit for energy created by walking is 296 g/day.
2. Pay off-line. You can get green energy by using Alipay to pay off-line. The energy created is 5 g/transaction, the daily upper limit is 10, and you must pay at least RMB 1 for it to count.
3. Living payment. You can get green energy by paying water, electricity and gas bills. The energy created is 262 g/transaction. The upper limit is 10, on the same electricity meter, the upper limit is 1.
4. Buy tickets online. Buying movie tickets and performance tickets on taobao.com. The energy created is 180 g/transaction. The upper limit for each month is 10.
5. Buy railway tickets online. Buying railway tickets using Alipay on 12306.cn/ fliggy.com. The energy created is 136 g/transaction, and the upper limit for each month is 10. Even after you get refunded, the energy created is still there.
6. Appointment register, the upper limit for energy creation is 5 transactions/month. The energy created is 277 g/transaction.
7. ETC payment, for each payment of a fee there is a green energy. The energy created is 23 g/transaction.
8. The energy creation upper limit for e-invoices is 5 transactions/day, and the energy created is 5 g/transaction.

Source: Alipay Website.

**Figure 3.5 Carbon Emission Reduction Behaviors Supported by Ant Forest**

through activating the app. The pursuit of user viscosity and vitality becomes an important obstacle to the fairness and transparency of the indices. Therefore, the participation of scientific research institutions, third-party social organizations and the international cooperative network would be indispensable in case of an internationally-recognized individual carbon sink indicator and algorithm.

#### (2) Social Willingness Develops Habits

Everybody hates haze, and many people want to do something to reduce it, but it is difficult to persist since the green behavior of one individual cannot directly affect the world. Lacking positive feedback and incentive mechanisms makes it difficult for an individual to develop a persistent motive for green consumption and a low carbon lifestyle. Ant Forest is an attempt to affect the consumption behavior of users through the Internet and encourage green consumption. By setting goals (growing a virtual tree), joining in interaction (friends water the trees of each other, collect energy) the awareness of users to participate in environmental protection will continue to improve. The most direct manifestation in Ant Forest is—in order to get more energy, users use Alipay more frequently to make payments and therefore develop habits of use. Social communication is the most basic need of

mankind. Although this was not the original intention of Ant Forest in designing the product, it can be seen from the interaction rate of Ant Forest that it has brought users the pleasure of interaction in social games. Through comparing fitness exercise situations (daily steps), cooperating to grow trees, ‘stealing’ one another’s energy, users increased interaction with friends out of touch for a long time.

The green life habit is developed unconsciously. Some users commented, ‘It is Ant Forest instead of my dreams, that wakes me up every morning.’ A little boy lost 3.5 kg in order to accumulate energy. The children of some parents were born on the same day as the tree. They said one day they would go and see the tree and tell its story to their child.

### (3) Daily Wellbeing Promotes Common Good

Ant Forest is like a point system which encourages users to use Alipay constantly. But the points it accumulates become energy. The thing that can be converted turns goods into behaviors for public good—growing a real tree in the desert for wind blockage and sand fixation. Ant Financial attracted more users to Alipay for making payments by attracting users to take part in the game. It also fulfills the wish of users to do deeds for the public good without spending money. At the same time, it advocates the concept of ‘low carbon’ and protects the environment. The project not only popularized the green lifestyle, but also added more elements of public good to daily life. Each tree that is donated through green energy will have a unique number and certificate, galvanizing the achievement motive of agents of good deeds. Ant Forest has added a function for watching the tree in real-time and via satellite so that users can watch the woodlands and feel the improvements to their ecology. Users commented on-line, ‘After growing the tree, I finally feel that the world is a bit different because of my presence.’ Some people said, ‘This tree is the first thing that is endowed with life by me during my 20-odd years.’

As an Internet enterprise which was born to solve social issues, the project execution company itself has endogenous corporate social responsibility. Through such green financial activities for public good as Ant Forest, enterprises have developed a good image, the ingenuity of staff has galvanized, and the interaction among users has significantly improved, which is well recognized by all circles of society. *Fortune* Magazine released the list of 50 World-Changing Companies in 2017 with the aim of selecting some companies that dare to challenge the most serious difficulties and benefit mankind while creating benefits for themselves. Ant Financial grabbed a spot on the list because of its product, Ant Forest. The report



of Green Digital Finance Alliance also praised the company. This product extends affection towards public good and its power in the virtual world, to the off-line world. It overcomes difficulties in execution, and creates a highly efficient and transparent implementation system.



Figure 3.6 User Interface and Donation Certificate

With the development of financial technology and other digital technologies, it is a future development trend to unite individual citizens from bottom-up to work towards sustainable development. But there will also be many challenges. For example, the users of Internet products are mainly college students and young office workers. How can green financial products reasonably subdivide the user market and adopt different sales strategies towards different customer groups? Can users maintain such low carbon life over long-term repetitive product experience? Can unified algorithms and financialization of individual carbon trade be popularized in China as well as the whole world?

## 2. Tokyo, Japan: Urban Regeneration from Waste Disposal to a Circular Economy

### 2.1 Background

Japan is internationally advanced in waste classification and disposal technologies. More importantly, during its years of implementation, there has been a citizen-oriented management mechanism for waste classification with the all-round participation of society. Japan's waste classification is also elaborate.

Classified wastes are not immediately recycled, and there are strict rules on the recycling date. Citizens have access to specific information by means of newspapers and government websites. Japan implements the pay-as-you-throw (PAYT) policy, in which more waste means higher fees for recycling. Thanks to relevant laws on various waste classifications formulated by the government as well as its strict execution, such a complex policy for waste classification can be promoted and popularized among residents. In addition to government regulation, Japan also pays a lot of attention to public awareness in waste classification and the cultivation of environmental awareness. Education for waste sorting methods and resource recycling processes starts from kindergarten. Visiting garbage incineration plants is a regular activity for Japanese students. Since its implementation, the whole society, from governments and enterprises to the public, has formed a comprehensive waste disposal system with multi-party collaboration and participation.

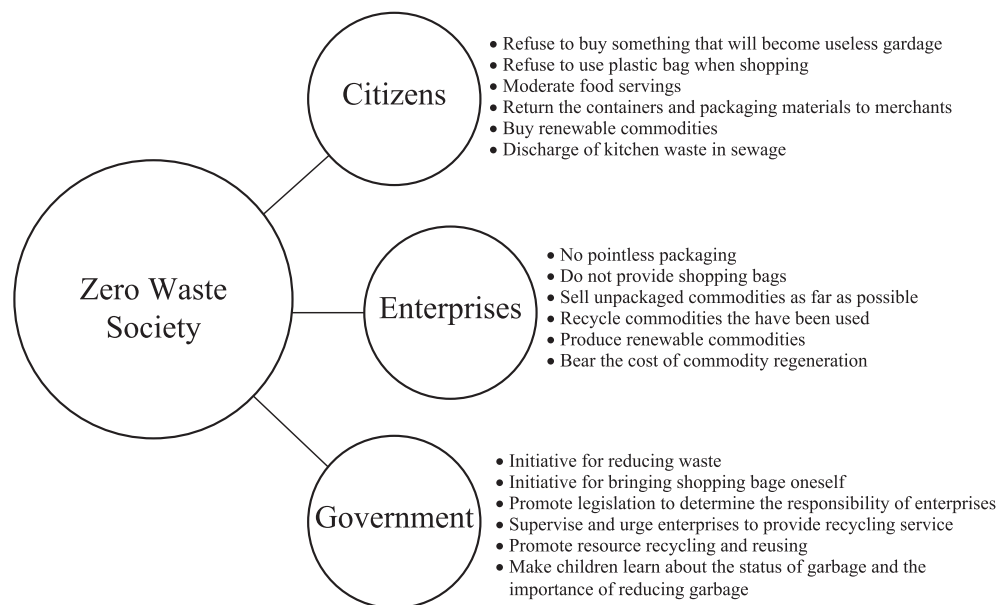


Figure 3.7 Comprehensive Waste Disposal System with Multi-party Collaboration in Hino, Tokyo Prefecture

## 2.2 Practice Process

Tokyo enjoys a hundred-year history of development in waste disposal, including eight stages since the Edo period. However, what has aroused wide attention is the successful management experience in progressive realization of waste classification and recycling utilization since the declaration of the waste war in the 1970s.

In 1973, Tokyo initiated the classification of household waste into combustible waste and non-combustible waste from food waste and other waste. In order for

residents to adapt to the change, Tokyo carried out numerous dialogues, meetings, and briefings to address the problem. According to the record, just between April and June of that year, 1,213 briefings for classification were held, with an attendance of 110,000 residents. In 1989, the Tokyo Metropolitan Government launched the ‘Tokyo Slim’ campaign to reduce waste, putting up posters on major railways and metro platforms, and holding dialogues and roadshows. Since the Japanese Government revised and enacted the *Waste Management Act* in 1991, the extensive drainage way has gradually come to an end. Waste classification and reduction have become regimens strictly observed by residents, and permeate the lives of people. After launching a comprehensive waste reduction strategy in 1993, the government started to encourage waste reduction and recycling in local communities in various ways, including but not limited to direct cash subsidies, the offer of tool subsidies for repairing or transforming wastes, as well as public exhibitions of recyclable materials. Tokyo Bay still encourages residents to participate in collective recycling via bonuses for the regular recycling of local organizations composed of residents from 10 families or above, including town associations, self-government associations, and parent-teacher associations. Japan’s *Basic Law for Establishing the Recycling-based Society* enacted in 2000 stipulates basic principles of waste recycling and utilization, including: inhibiting waste production, improving the recycling rate of waste classification, reusing disposed waste and using resources in the process. From the front-end waste classification, to the back-end reduction and recycling, a comprehensive waste disposal system has been improved and great social effects achieved. Twenty-three special wards (central urban areas) in the Tokyo Metropolis, for example, produced about 4.9 million tons of household waste in 1989, reaching



Figure 3.8 Waste Classification in Public Places



Figure 3.9 Waste Classification in an Ordinary Family

record peaks, with a landfill capacity of approximately 2.4 million tons, an incineration capacity of about 2.9 million tons, and resources recycled of about 100,000 tons. In 2015, 23 special wards produced about 2.8 million tons of household waste (per capita waste generation is 0.83 kilograms per day), with a landfill capacity of approximately 360,000 tons, an incineration capacity of about 2.78 million tons, and resources recycled of about 600,000 tons .

Table 3.1 Historic Stages of Waste Management in Tokyo

	Waste Classification	Management Method	Resource Recycling	Resident Engagement Mechanism
1920s — Before World War II	To reduce air pollution, wastes were categorized into food waste, combustible waste and other waste	Because of the lack of manpower and transport capacity before World War II, the government advocated to halve the waste and to burn or bury it wherever possible	The government played a leading role in restoring villages with food waste, and establishing waste incineration plants in places such as Fukagawa	In 1933, because of the dust pollution from Fukagawa Incineration Plant, the “Women’s League for Municipal Purification” required the implementation of waste classification; local residents committees, as well as women, would collect all waste for recycling

	Waste Classification	Management Method	Resource Recycling	Resident Engagement Mechanism
Post-war Period—Oil Crisis	In 1947, the classification of food waste and mixed waste was restarted, and was suspended in 1961, when centralized incineration dominated	The environmental sanitation bureau, no longer affiliated to the health administrative department, was established and became an independent administration with more legislative regulations	Lack of awareness of waste reuse	The public resold waste products
1970s and 1980s	According to the <i>Waste Disposal and Cleaning Law</i> , wastes include industrial waste and general waste. The latter was divided into household waste and business waste. It focused on the declaration of combustible waste, non-combustible waste (metals, plastics, and glass), and bulky waste, mainly recycled by the government	Tokyo declared the beginning of ‘War against Waste,’ established the ‘War against Waste Strategy Department,’ put forward the environmental sanitation slogan of ‘timely, clean, free and standard,’ and advocated the principle of ‘disposing waste in the ward’	Because of the halfway screening and recycling after classification, the recycling rate was not high	The “Metropolis Association” was set up to invite residents to participate in consultations; trans-regional waste transfer caused numerous contradictions; non-governmental organizations carried out collective recycling of waste products
1990-2000	The government focused on waste reduction of enterprises and institutions and started to subdivide the recycling of zip-top cans, glass bottles, plastic bottles and hazardous articles, to promote the marketization of waste recycling	Since landfills ran low, a plan for waste reduction was proposed	Industrial development was promoted, and environmental governance and protection were enhanced	Recycling centers were established in communities and office buildings to raise residents’ awareness; massive publicity was conducted about ways, reasons and effects of waste classification; resident groups and volunteers were organized to participate in collective recycling



Figure 3.10 Key Points of Japan's Three Basic Plans to Promote the Recycling-based Society

### 2.3 Problem Analysis

#### (1) Waste Piles Cause Resource Crisis

With rapid post-World War II development, Tokyo could not avoid a confrontation with an urban waste crisis because of finite land resources. Because Tokyo had depended on landfill disposal-marine reclamation land in Tokyo Bay, resulting bad effects on the ecological environment and marine traffic led to protests and opposition by residents. Moreover, the existing landfill capacity had been close to saturation, and plans for the establishment of new landfills had been suspended or postponed due to a variety of NIMBY campaigns. In resolving dilemmas such as the waste-surrounded city and the war against waste, Japan has experienced different development stages of urban waste management, from defining the principle of local waste disposal, and gradually advocating waste classification, to implementing comprehensive charges for waste and launching a strategy of resource recycling.

#### (2) Excessive Reliance on Incineration Technologies

With years of history in waste incineration, Japan has boasted increasingly advanced and all-inclusive incineration technologies. When engaging in waste reduction and recycling, the public has also generated a growing dependence on waste incineration. Although hazardous substances produced by waste incineration have decreased, they still exist and harmful gas emissions are still the main source of air pollution in Japan. In addition, most food waste, accounting for a high proportion of household waste, is simply included with combustible waste to be disposed of together, resulting in a low overall utilization rate of household waste.

Although residents are encouraged to sort out food waste for composting, it is hard for such an international metropolis with limited public space like Tokyo to implement it locally.

### (3) Part of Commercial Waste is Indistinguishable from Household Waste

Tokyo, compared with other cities in Japan, is peculiar because household waste here only accounts for about 35% of general waste, 65% of which belongs to waste from enterprises and institutions. How to classify waste from enterprises and institutions and conduct effective accountability is a huge challenge confronting Tokyo in waste disposal. Since Tokyo is a prosperous urban commercial center, waste from such commercial tenants as restaurants and ballrooms is indistinguishable from the household waste of surrounding residents. Although restaurants and ballrooms are enterprises and institutions, they enjoy free waste disposal services as those for residents, by the government. As waste disposal is not mandatory for these enterprises and institutions in the legislation, there is little effect.

## 2.4 Experience Summary

### (1) Promoting Living Habits by Waste Charge

Urban waste problems involve thousands of households on streets and alleys, which means that the government must change the current single management to establish a multiple governance pattern, and pay more attention to the consultation and communication mechanism with public participation. Since 1998, Hino, Tokyo, attempted to implement charges for household waste disposal, removed usual dustbins, and required residents to buy designated combustible waste bags and dispose of waste according to appointed times and given locations. The governor recruited 150 civil servants as volunteers in groups to explain waste reform in 250 local self-government associations, and set up a communication platform for environmental sanitation departments and citizens, so as to promote public meetings on waste reduction and print a quarterly information newsletter about waste. According to a poll in 2001, the reform raised public concerns about environmental problems to 90% from 34%, and local per capita waste generation per day decreased by 0.1-0.2 kilograms.

### (2) Establishing a Consultation and Communication Mechanism with Public Participation

In communities, waste classification and recycling are mainly carried out by basic-level self-government organizations—non-governmental organizations composed of voluntary family representatives in communities, including local

self-government organizations, town associations, parent-teacher associations, and children's societies. Since there will be a certain amount of income for their organizations thanks to their active participation in collective waste recycling, public funds can be accumulated to support community activities. For example, local organizations composed of residents from 10 families or above in Tokyo Bay, including town associations, self-government associations, and parent-teacher associations, can sign contracts with waste recyclers, to organize regular and quantitative collective classification and recycling of resource waste, and receive a bonus of JPY 6 per kilogram, based on the weight of recycled waste. Generally, town associations and self-government associations are also responsible for transferring part of their revenue to the women's association in the community, because housewives play a leading role in implementing the recycling and classification of such household waste as newspapers, zip-top cans, glass bottles, PET bottles, plastic cases and milk cartons.

The Tokyo Metropolitan Government started holding the 'Tokyo Waste Conference' in 1991, and invited numerous private businessmen and consumer groups to participate in the conference, influencing hundreds of thousands of visitors every year. In the same year, the government, in order to improve waste reduction and recycling, and enhance its cooperation with residents and businessmen, launched the establishment of the Tokyo Waste Management Advisory Committee composed of 11 resident representatives, 24 business representatives, and seven government representatives. The committee has made a specific action plan for waste reduction, and launched various activities to bring waste reduction and recycling into the lifestyle of Tokyo residents, including second-hand markets, simplified packaging, and BYOB (Bring Your Own Bag) Campaigns.

### (3) Taking Sustainable Terminal Disposal Measures

Waste classification is only the front end of comprehensive waste disposal. In order to further raise residents' awareness of waste reduction and recycling, the Tokyo Metropolitan Government has set up a series of recycling centers in communities, to demonstrate how to transform, repair and reuse expired goods, including bulky waste, and encourage residents to conduct regular trading of second-hand goods in communities. These measures are conducive to more voluntary recycling activities among communities. In addition, non-governmental organizations formed by consumer groups hold liaison meetings for thinking about hazardous waste, carrying out in-depth investigation in stores in Tokyo, and



requiring solutions to over-packaging problems for vegetables, fruits and other commodities. In 1990, focusing on 887 department stores, supermarkets and line organizations in Tokyo, they conducted a large-scale investigation which found that, residents could promote minimal packaging for produce such as tomatoes and hyacinth beans.

Thanks to ways and attitudes toward waste disposal, Japan has given birth to a number of second-hand industries and new fashion cultures. For example, there are over 170 used-book stores in the Kanda Jimbocho Bookstore Area (Chiyoda)-the largest commercial area for used-book stores in Japan and indeed the world. Located in Omotesandou, Pass the Baton-a charity and second-hand shop-promotes the novel idea of the recycling of urban life: encouraging individuals to consign their unique second-hand goods and donate 50% of the proceeds to the charity, cooperating with numerous cultural brands and designers to put some waste back on the shelf through design. The rise of reuse and second-hand industries not only enrich Tokyo's informal economy, but also develop a new community economy based on public welfare and creativity.



Source: Photographed by Zhu Yi.

Figure 3.11 Second-hand Charity Store in Tokyo



Source: Photographed by Zhu Yi.

Figure 3.12 A Second-hand Charity Store in Tokyo

### 3. Shanghai, China: Green Self-Governance Map: The Green Development with Social Participation

#### 3.1 Background

Since the 1980s, Shanghai has experienced a period of fast development. From 1980 to 2010, the per capita road area of Shanghai grew from 0.8m<sup>2</sup> to 18 m<sup>2</sup>, per capita green space area grew from 0.44 m<sup>2</sup> to 17 m<sup>2</sup>, and per capita housing area grew from 4.4 m<sup>2</sup> to 17.5 m<sup>2</sup>. The large-scale urban renewal model led by the government and capital swiftly renewed the appearance of Shanghai and the daily living space of its residents. However, as the city developed and people acquired benefits, some problems occurred. Urban landscaping is not only expensive but also lacks social participation. Private housing developed fully, but community public spaces and exchanges among neighbors have shrunk. In 2015, Shanghai Municipal People's Government released the 'Implementation Methods of Urban Renewal of Shanghai,' and raised the concept of 'organic urban renewal' and 'spatial restructuring and community revitalization with people put first'. The shaping of community living space with wide participation of residents has

become the direction and goal for governments at all levels. Shanghai Greening Bureau has adopted a slogan of ‘Resident Greening Self-Governances’. Against such a backdrop, the current related beneficial practice of social organizations has earned opportunities and support for expansion in different communities in urban Shanghai.

‘Green Self-Governance Map’ is an innovative practice with a green focus. It is organized by professional social organizations, and supported by the government, with the participation of residents. Its purpose is to promote residential participation in the public affairs of the community, to increase social exchanges, break barriers among neighbors, and, to improve the vitality of streets and explore the multi-governing model of social governance. With a focus on ‘community garden incubation bases,’ the project gradually fosters the ‘community garden led by neighborhood committees with the participation of residents.’ It has developed ‘community gardens organized by residents’ and the activity of ‘urban seed drift’ with wide influence. The community self-governance map with planting as the subject has been formed speedily in urban Shanghai. This practice reflects the change from single urban greening area coverage to comprehensive community self-governance and indicates the changes in urban greening from being led by the government to being controlled by residents themselves and the changes in the

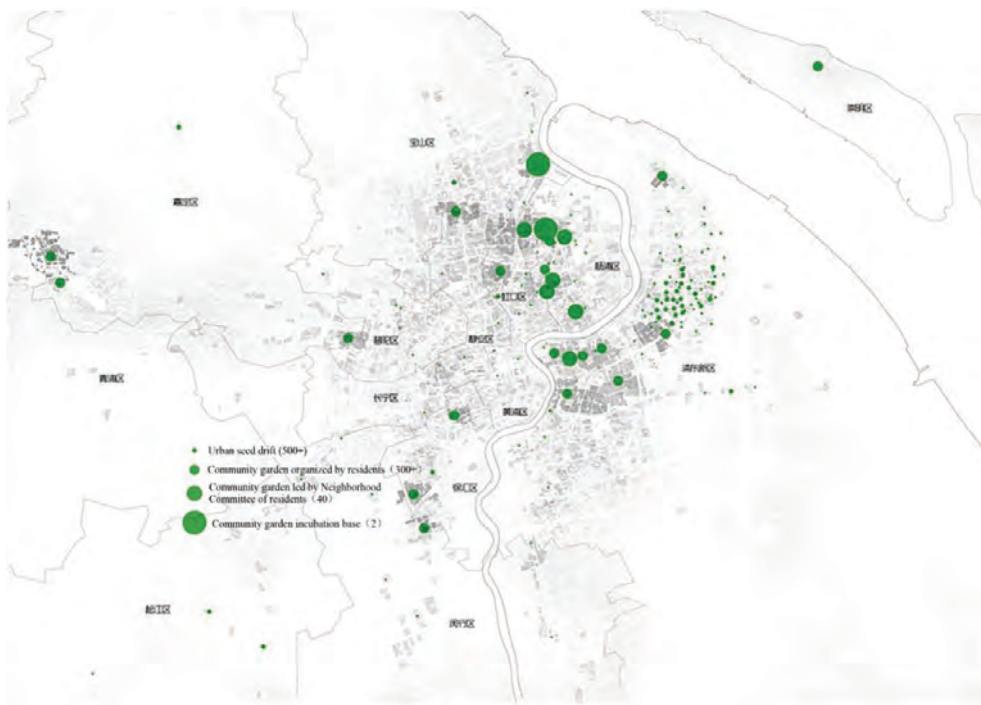


Figure3.13 Shanghai Green Self-Governance Map

maintenance of urban greening from being taken care of by the government alone to being taken care of by willing residents.

### 3.2 Practice Process

In December 2014, Shanghai ‘Clover’ organized residents to build the first ‘Train Vegetable Garden’ in the public space on the side of an abandoned railway. In June 2016, it fostered the first community garden ‘Baicao Garden’ with the participation of the local residents. In July 2016, it built a ‘Creative Agricultural Garden’ in a commercial and residential mixed public area. In 2017, it obtained the support of over 9 districts of Shanghai to build 40 community gardens through government purchase of services from social organizations. By the beginning of 2018, it had gradually formed a Green Self-governance Map with 4 tiers: Tier One is the community garden incubation base; Tier Two is the community garden led by a neighborhood committee with the participation of residents; Tier Three is the community garden organized by residents themselves; and Tier Four is the urban seed drift with the mass participation of the whole society.

#### (1) Community Garden Incubation Base

This refers to the comprehensive community garden represented by ‘Train Vegetable Garden’ and ‘Creative Agricultural Garden’ whose daily operations are taken care of by ‘Clover’ directly. They cover an area of over 2000 square meters, with a high compound degree of functions. They have an advanced operation concept and the efforts of professional people. The compound functions of community planting, children’s nature education, community public living rooms and cultural spaces make these gardens demonstration bases fostered by communities. As a result, the general landscape of Shanghai Green Self-Governance Map has played a role in community building project training and incubating gardens organized by the communities themselves.

#### (2) Community Gardens Led by Neighborhood Committees with the Participation of Residents

These community gardens are led and partially funded by neighborhood committees with the residents’ participation and training by professional organizations. They each cover an area of over 100 square meters. Their purpose is to encourage interaction among residents and increase their initiative and their participation in community public affairs . There are currently over 40 such community gardens. They are mostly in old residential areas. The facilities are old, and the residents are mostly seniors. The community gardens are a platform for community participation. The neighborhood committee mobilizes party members

and team leaders of buildings to lead other residents in taking daily care of the gardens and organizing activities. The communities that social organizations foster for a long time have the capacity for self-management, but the self-governance in communities with newly-built gardens is weak.

### (3) Residents Organize Community Gardens Themselves

Under the guidance and demonstration of professional organizations, local residents design, construct and manage community gardens. Currently there over 300 such gardens. Such community gardens usually cover a small area with low cost. But the local residents are willing and proactive in building and maintaining the gardens, so the results of maintenance and operation are good. Specifically, gardening lovers in the community team carry out projects under the guidance of professional organizations and with the authorization of the neighborhood government, which may allocate an area for them. Or they just build the garden in front of their homes and continue to draw other residents in. Through such means, not only the living environment of the communities improved, but the sense of belonging and pride of the residents also strengthened because they put time and effort into maintaining and monitoring the garden. On the basis of interpersonal interactions, conflicts among neighbors are reduced and the spirit of communication in the community increases.

### (4) ‘Urban Seed Drift’ Activities

Residents obtain seeds and instruments through on-line or off-line interactions with professional organizations and participate in the activities of planting these



Figure 3.14 A Scene of Daily Life in Community Garden

seeds in public spaces. Many people participate in the ‘urban seed drift’ activities, influencing a wide area. The purpose of this activity is to communicate the concept of community self-governance and public participation to future supporters in an attempt to strengthen bonds and warmth among people in an unfamiliar city. For example, in September 2017, ‘Clover’ initiated the adoption of 5000 tulip bulbs given by the Netherlands Embassy, and conducted an exhibition and charity sale of children’s art works around the theme of tulips. This activity receives 500 feedback pictures of planting, among which (from 3 to 50 bulbs) 80 pictures were of bulbs planted in public spaces. A total of over 1160 people including autistic children directly took part in the activity.

### 3.3 Problem Analysis

#### (1) The Issue of Homogenization Brought by Swift Action

The popularization of community gardens is recognized and approved by many neighborhood committees. In order to see results in a short time, it was required that community gardens should be built in many neighborhoods simultaneously, leading to the issue of homogenization. Good community gardens should be a good tool for changing the homogenized environment of a residential area, fostering community uniqueness, and increasing residents’ sense of belonging. Focusing on development speed and lack of in-depth early-stage investigation and research leads to the failure to grasp the culture and life of the community, affecting the expression of the character of the communities with community gardens.

#### (2) The Public Policies and Issues in the ‘Public’ and ‘Private’ Domains under the Proposition of Planting Edible Plants

The planting of edible plants is an important part of developing a green lifestyle with mass social participation. And the green spaces created with edible plants should be an organic component of urban greening. But, currently, the main plants in the Green Self-governance Map of Shanghai are ornamental plants. Planting vegetables in urban public space and community public space is prohibited by current Chinese urban greening policies. It is illegal and will be dealt with by city inspectors. Residents growing vegetables in their community is private use of public space and runs contrary to the community garden principle of joint construction and sharing.

#### (3) Cognitive and Evaluation Deviations of Grass-roots Government Staff

Government plays a vital part in community development in China. First, the perception and understanding of resident greening self-governance by grass-

roots government staff often affect the depth and effectiveness of stimulating the vitality of the people and the community through greening. Against the backdrop of a grass-roots social governance model transformation, the roles of government and the attitudes of government staff are gradually changing, but they need to understand the content and substance of community building further. In addition, the assessment of the outcome of purchasing services from social organizations by basic-level government to a large degree retains the habit of traditional landscape engineering projects. They focus on the time limit of the project and landscaping effect, whereas do not value the participation of residents in self-governance.



Figure 3.15 Autonomous Maintenance by Residents

### 3.4 Experience Summary

#### (1) Adopt the Multi-governing Development Strategy

Factors affecting the development strategy of community gardens include concepts and actions of professional organizations, attitudes of the government, the initiative of the grass-root cadres, conditions for overall community self-governance. Professional organizations have clear concepts and practical approaches to restoring the self-governance capacity of residents. They are the

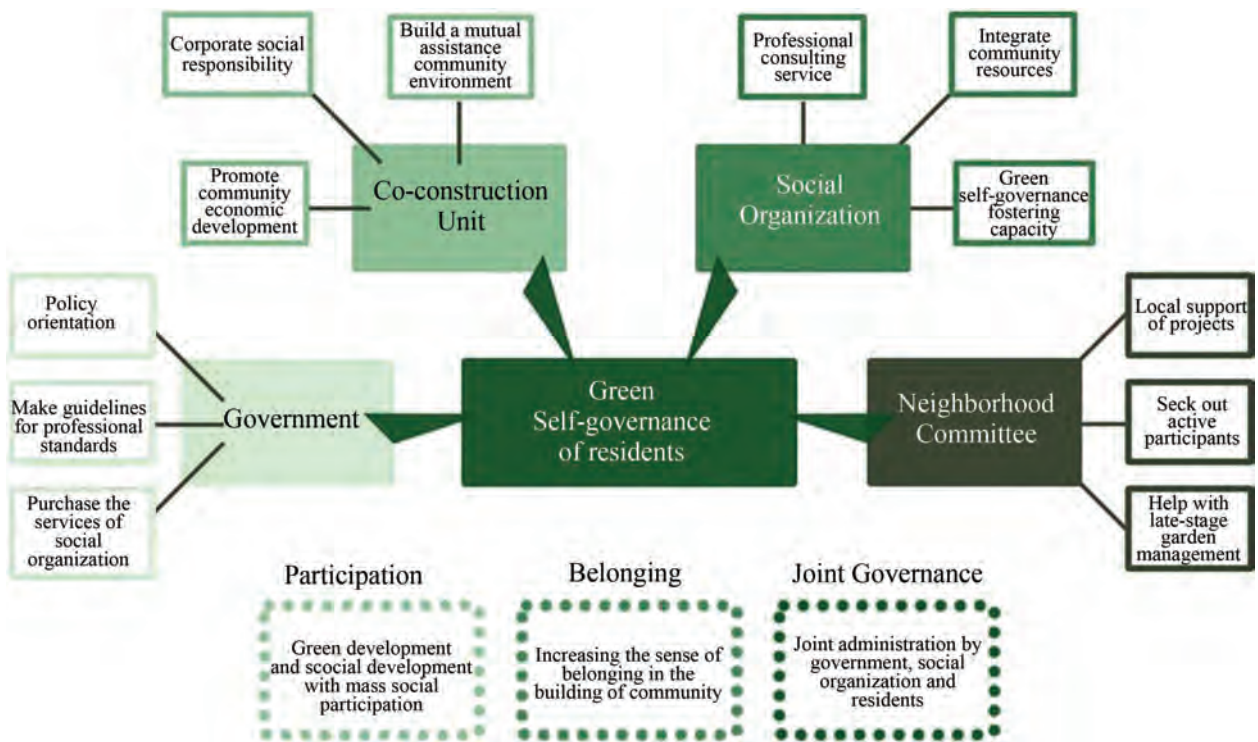


Figure 3.16 Urban Green Development with a Multi-governance Approach

key to the development of community gardens in the direction of the social and natural environment. The recognition on the part of the government of the role of a community garden in community governance and the initiatives of grass-roots cadres legitimize community gardens and provide funding for them to develop systematically at the regional level. Areas with good self-governance conditions can quickly discover community leaders and form a networking effect. The community garden projects led by the government are more systematic and of a larger scale. But it takes a long time to foster a self-governance group. Community gardens launched by residents themselves are just the opposite.

### (2) Participatory Design and Late Stage Operation

Community gardens not only pay attention to the improvement of the hardware of living spaces but also improve the daily life of residents through community building. Therefore the success of community gardens depends on the participatory design and late-stage operation. First, regionally: community gardens should be rooted in local culture and combine history and culture with community memory and space so that users can develop a sense of belonging and acknowledgment. Second, locally: we need to draw on community



activities and training to activate the community and foster the inherent power of the community. Third, neighborhood: we need to maintain an atmosphere of openness and present an open interface with logos, tour-guiding systems, and management facilities. We need to guide community members to join the maintenance and operation teams of community gardens through the proper means.

### (3) The Self-building of Green Living Scenarios

Community gardens are not only an inroad for self-governance and participation, but also the best scenario for mobilizing grass-roots governments, social organizations and residents of the community to create a green life. The innovative green lifestyle driven by self-planning and self-building of green spaces, management, operation and maintenance of local self-governance societies, degradation and recycling of local resources makes the community garden system play an important role in the organic renewal of cities.

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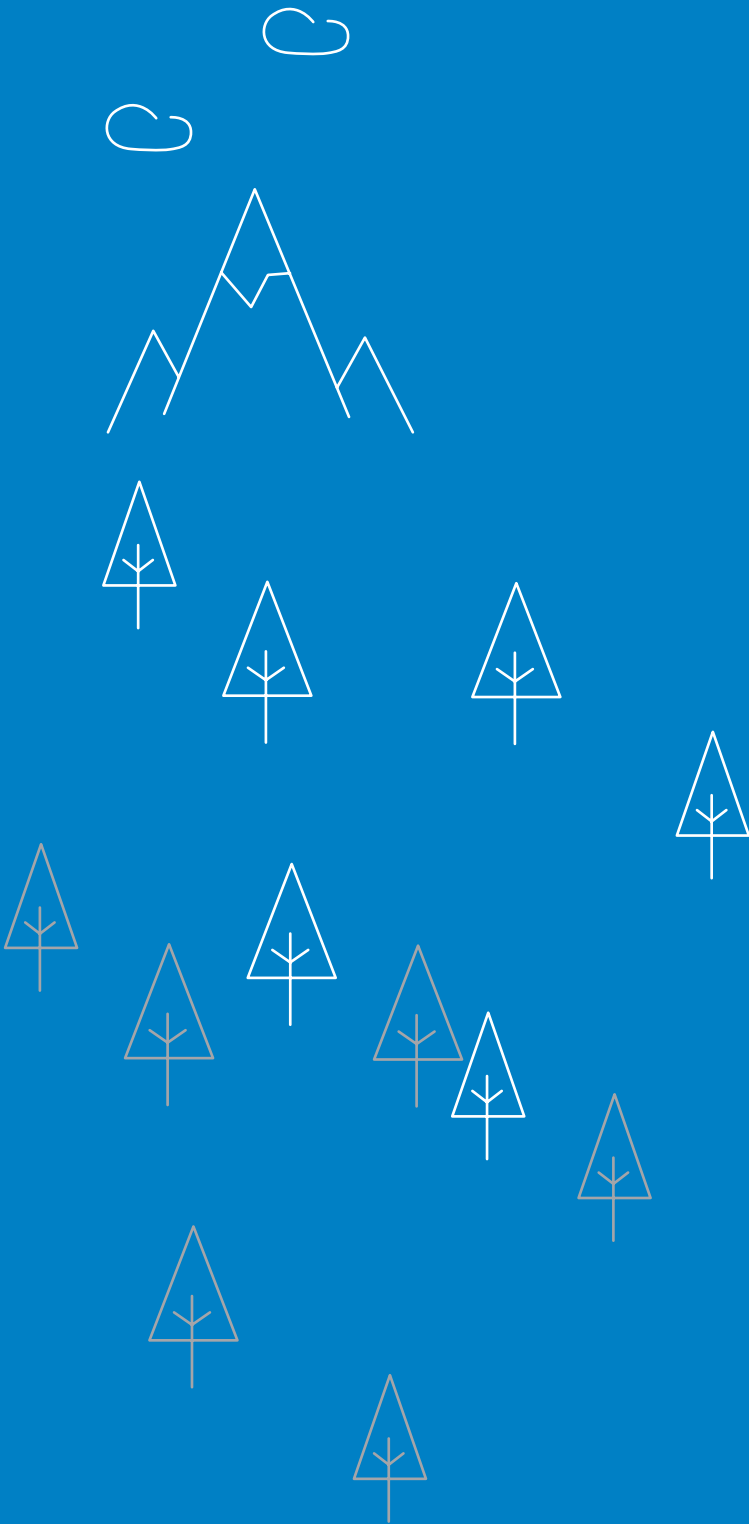
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# Chapter IV

## Culture





## Introduction\*

Culture and nature are two sides of the same coin. The birth of the concept ‘cultural landscape’ made people examine human beings and nature from the perspective of a ‘global approach.’ Culture is not only closely connected with the environment, but also promotes the sustainable development of a city environment on many levels.

According to the 2001 UNESCO *Universal Declaration on Cultural Diversity*, culture is defined as ‘the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and that it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs.’ Based on this, the interaction between culture and urban environment can be divided into three levels: spiritual, material and practical.

### 1. The Guidance of Cultural Concepts Contributes to Promoting Ecological Cities to Shape a City’s Inclusiveness and Identity

Culture includes lifestyles, value systems, traditions and beliefs and it affects the relationships between people in cities as well as those between people and the world, and restricts human behavior. It also covers the human cognizance of nature and environment. First of all, urban residents need to immerse themselves into a type of culture that respects ecology. They need to understand and recognize that, as different components of one system, culture and environment are closely related. On this basis, it is more effective to enhance the emotional ties of the public for supporting the protection of the ecological environment and encourage them to actively participate in the construction of an ecological city through cultural, artistic and creative publicity, promotion and guidance.

### 2. The Passing Down of Cultural Heritage Contributes to Strengthening the Compactness and Resilience of Ecological Cities

‘Traditional ecological knowledge, local residents’ knowledge, the knowledge of local animals and plants, traditional recipes, etiquette and customs, beliefs, various initiation ceremonies, cosmic legends, shamanistic teachings, rituals for obtaining

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\* Chapter 4 is compiled by Shanghai Library (Institute of Scientific and Technical Information of Shanghai), written by Shi Wen, Hua Ziyi and Yang Rongbin.

property, and social organizations all often presuppose the existence of local languages or environment-related vocabularies. These vocabularies are important communication tools to inform people about traditional knowledge relating to the sustainable management of the environment and its constituents.’ The protection of urban heritage is conducive to developing the compactness of the city. Older buildings are mostly constructed by materials taken from nature and are relatively energy-conserving; the main materials used in newly built buildings are plastic, steel, ethylene and aluminum, which consume more energy. More importantly, most of their heritage is accumulated through the experience and skills of local people over many generations, the protection of which conforms to natural law, promotes disaster-resistance, and improves the resilience of a city.

### 3. The Development of Cultural Industries Contributes to Realizing Sustainable Consumption and Production in an Eco-city

Activities related to cultural production are essentially environmentally-friendly. They embody patterns of land use, consumption and production that are more sustainable than most modern methods. It is feasible to employ creative economy and sustainable tourism because they requires less investment and has a lower threshold. Their core is culture which is a strategic tool for income generation and poverty relief. In addition, culture-related economic opportunities cannot be conveniently outsourced. Thus, the culture administrations can provide local resource-dependent employment opportunities for locals, which will establish a link with and cultivate respect for the environment.

Based on the framework mentioned above, this article follows the logic below to select three related cases for urban administrators to learn from:

**First, how the means of displaying culture attract more people to participate in publicizing the eco-city concept and its practices.** An analysis of Melbourne’s ‘Refuge Exercise’ project serves to indicate how cultural practitioners and related organizations use artistic methods to attract the wider public and guide their involvement in publicity of the eco-city concept and its practices.

**Second, how the cultural and creative industries can help cities achieve environmentally friendly consumption and production.** An analysis of the initiatives of Edinburgh’s ‘Creative Carbon Scotland’ will examine how the cultural administrations build a green economy based on respect for environment and encourage consumers to form environmentally friendly consumption habits.

**Lastly, showing how the inheritance and inclusiveness of culture can promote the construction and development of eco-cities by taking the eco-city of Johannesburg, South Africa, as a comprehensive case.** These cases offer examples of how to apply traditional knowledge to build eco-cities, adopt cultural means to guide people to participate in ecological protection, and promote decent employment by local culture.

## Reference Cases

### 1. Melbourne, Australia: Art and City Resilience

#### 1.1 Background

Global climate change has posed increasingly complex challenges for the construction of eco-cities. In order to comprehensively consider the risks of extreme weather events and climate change as well as their relevant sustained impact, the new model for global urban development is to construct ‘resilient cities’. Although many urban strategies and policies emphasize the importance of communities and their interconnectedness, ‘culture’ and ‘art’ have not been treated with enough concern in the process of building such resilient cities. Taking Melbourne’s Emergency Services Preparation Guide as an example, ‘culture’ and ‘art’ are only mentioned after the occurrence of an emergency, for example, in the context of community reconstruction. Some social or cultural research on city resilience also focuses on the conditions ‘after a certain point in time,’ that means the role of culture and art in the recovery phase after a certain climate event. However, in many plan-oriented texts related to resilience, the concept of culture is mostly associated with ‘risk-affected people,’ that is to say it is associated with ‘vulnerability.’

In this context, Melbourne launched an exercise project called ‘Refuge’ in 2016. The project was designed by local artists, and advice and assistance for the project was provided by the City Emergency Services Department. It particularly emphasized the preemptive role of culture and art, namely, through immersion in real interactions and experiences before extreme weather events and the occurrence of associated risks, and making efforts to instil the public with an intuitive understanding of, and to cause them to reflect on, the strategies and policies related to building a resilient city. The project will continue until 2020, focusing on a specific topic each year to explore how cultural means can help improve urban resilience.



## 1.2 Practice Process

As shown in Figure 4.1, the flood disaster simulation exercise refuge was held on July 8 and 9, 2016. Refuge was a 24-hour artist-led disaster preparedness drill that turned the North Melbourne Town Hall into an actual Emergency Relief Center, as well as a collaborative investigation into the role of art and culture in preparedness and resilience through introduction of artists into and integrating artistic works with refuge sites.

The preparations and design for the Refuge project lasted for several months. The project was commissioned by six artists from Arts House (a core program of the City of Melbourne for contemporary and experimental performance) as art directors and producers. They created five interactive art works themed on ‘wayfinding and communication’, ‘light and warmth’, ‘food’, ‘wellbeing’ and ‘sleep.’ They consulted stakeholders from emergency management services, aid agencies, local government and urban planning as well as academics from The University of Melbourne.

Before the official initiation of the project, these artists engaged in detailed discussions. Within about a week, a range of emergency management agencies, local planners, indigenous elders, residents, and academics got involved in the project and provided them with a range of professional advice related to climate change, local community engagement, and the ethical issues involved in the exercise. After detailed discussions, the artist team completed a 24-hour exercise plan and its venue arrangement, which was constantly improved during later discussion and arrangement. After that, the artists created specific art works for the sections for which they were respectively responsible.

As is shown in Table 4.1, six artists designed five works of art to intersperse throughout the whole project. Climate change itself is an abstract concept that is quite difficult to define and understand. The artists tried to express it in styles as specific as possible, so that



Figure 4.1 Project Site of the Refuge Exercise

Table 4.1 Five On-site Immersive Art Works

Description	Interactive Process	Artistic Theme
<p>Theme: Wayfinding and Communication</p> <p>Author: LEE Shang Lun</p>	<p>The work is divided into 4 parts distributed throughout the hall. ‘Information Flood’ was an interactive audio installation set up above the back entrance of the hall. The installation was activated by people moving past it. Sensing movement, the installation set off a sound or series of sounds, in turn encouraging people to stop, walk back, and further explore the installation. ‘Exodus’ was a digital board game repurposed for Refuge. People played three rounds at a time. ‘Air’ was constructed to offer venues for the participants to write messages to express their wishes. ‘Fire’ was an iPad designed to resemble a small fire hearth. It intended to demonstrate that people are encouraged to communicate more after the emergency.</p>	<p>The work intends to turn abstract things into something more concrete through art and vice-versa, thus helping the public understand the climate problems faced by cities and encouraging them to experiment with different test solutions.</p>
<p>Theme: Light and Warmth</p> <p>Works: Human Generator 57</p> <p>Author: Latai TAUMOEPEAU</p>	<p>It consisted of two segments. The installation consisted of a ‘track’ with lanes in a spiral shape. Over the course of the track, people were instructed to do a range of tasks designed to produce energy, for example, walk five laps while holding two calico shopping bags full of potatoes (as in Figure 4.2). This provocation was further enhanced by the audio that was playing in the hall: a loop of sound effects that included thunder, heavy rain, and ominous music. Additionally, a video reel containing news footage of a previous Melbourne flood had been edited to seem as if it was about Refuge’s imaginary flooding scenario.</p>	<p>While attracting people to participate in the games, the work encouraged people to think about the role of individuals when tackling the problems of climate change, sustainable development and urban resilience. The spontaneous acquaintance and dialogue between people during the games is also worth thinking about.</p>
<p>Theme: Food</p> <p>Works: Fair Shair Fair</p> <p>Author: Lawn WELESKI, Jen RAE</p>	<p>It consisted of two segments. Cooking demonstration of ‘rabbit stew’: The first segment was a cooking demonstration of a rabbit stew. The artist, who is assisted by a volunteer, acted as the chef. While cooking, the artist introduced the historical treatment of rabbits as a food source: the rabbit pervaded the rural and urban landscape of Australia during the colonial period and farmers regarded them as a form of food; recent healthy eating practices have seen the renewed prominence of rabbit meat as a healthy food source due to its nutritional value. The segment demonstrated this history in two ways. First, the artist acting as chef provided factual information through her role and voice as the expert chef. Second, the artist showed her hipster side through enacting the ritual of skinning the rabbit, cutting up its carcass, and cooking it. Simulated food ration system: The second segment of Fair Share Fare enacted a food distribution and rationing system. Participants were asked to collect food for the flood simulation refugees. Part of the food was contributed by the participants through donations. The food collected was arranged and stored in paper bags designed by the artist, and distributed to the refugees for dinner and breakfast the next day. These rations were distributed unevenly. Facilitated by the artist, the “refugees” disclosed their ration contents enabling them to trade food rations.</p>	<p>The work focused on the distribution and management of food when extreme weather events occur. Through this work, participants could better understand the history of food, its availability, and the purpose and significance of obtaining food in critical situations. The social connectedness produced in this process is regarded as the key element of ‘community resilience.’</p>

Description	Interactive Process	Artistic Theme
<p>Theme: Wellbeing Works: Nest Author: Kate SULAN</p>	<p>The work ‘Nest’ invited children to build cubby houses through cardboard boxes, blankets and clips. There were three main components to the project.</p> <p>Shelters/Cubbies: A combination of prebuilt cubbies and the opportunity for visitors and children to construct their own cubbies.</p> <p>Music for a Disaster: The artist worked with a number of community groups in North Melbourne such as North Melbourne Primary School and the local Scouts to collect and curate music that inspired a sense of safety, calm and hope. These were played through headphones in the prebuilt cubbies and anyone could listen to the music through headphones.</p> <p>Messages of Hope: During the 24 hour period, the cubbies served as message boards, collecting messages and stories of hope. A mail system was also set up, so people could send messages between cubbies.</p>	<p>In the process of building cubbies or delivering a message, the children learned how to adapt to a changing environment and keep looking for new solutions. While cultivating their ‘resilience’, the children not only activated immediate social connections with their peers, but also enabled a new layer of connection to take place between other participants who were in the periphery or not directly engaging in the cubby program. This social connection also contributed to the development of ‘community resilience.’</p>
<p>Theme: Sleep Works: Dungin (The aboriginal language of Australia) Author: Hannah DONNELLY</p>	<p>The work was divided into 6 segments.</p> <p>Country check in: participants (refugees) identified where they called hometown and checked in under the aboriginal country of that area. The artist encouraged the participants to reflect on the concepts including community resilience in the aboriginal areas.</p> <p>Sleep area: after checking-in, participants were directed to a ‘female’, ‘male’, or ‘non-binary’ sleep area. This approach motivated the participants to feel a cultural inclusiveness and notion of belonging.</p> <p>Writing reflection activity: Participants were given the opportunity to reflect and write about their past and look to the future, while feeling connected to aboriginal culture and country.</p> <p>Fire circle: at least six people remained around fire as a group throughout the evening while at some points many more gathered. They sat around the fire to talk or rest in silence and solitude. The experience of gathering around a fire induced comfort, calmness, and gregariousness.</p> <p>Fair Share Fare: the experience of distributing and exchanging food as described above.</p>	<p>The work hoped to strengthen city resilience by encouraging people to build social connections and acquire a sense of community belonging.</p>



Figure 4.2 The Site for the Work 'Human Generator 57'

the public could participate in the project and respond and reflect accordingly.

### 1.3 Problem Analysis

Since the outset of designing the project, a team of researchers from the University of Melbourne participated as the evaluating party through observation and interviews. Their comments are below.

#### (1) How to Give the Audience a More Intuitive Understanding of the Challenges that Climate Change Poses to Cities by Offering a Delicate Artistic Experience

As an immersive cultural experience, 'Refuge' deliberately created an atmosphere that 'felt' like an emergency relief center might for participants ('the audience' in the ordinary sense). Therefore it was planned to emphasize this theme and to observe how the participants would react and think accordingly under these circumstances. But some participants said that they felt a little confused and overwhelmed when they first entered the scene.

#### (2) How to Promote Dialogues among Multiple Cultures during Activities

Each art work in the project took into account the diversified cultural background of the participants as far as possible. For example, in the modern context, the work 'Dungin' activated reflection on the traditions and culture of the Aboriginal people of Melbourne. As for the work 'Nest', its background music was a compilation of the music of different ethnic groups, thus providing spiritual comfort for people from different cultural backgrounds. In order to inspire diversified solutions for people of

multiple cultures trapped in the same space to respond to the same emergency, various possibilities and options were also provided for the participants throughout the entire center. Within the whole space of ‘Refuge’, all the art works provided the participants with alternatives to choose from in terms of activity routes, interactions, interpersonal communications or reflecting in solitude. For example, the work ‘Nest’ enabled the participants to either participate in building the cubbies or listen to music through headphones in a quiet corner. According to the evaluation, it was found that the total number of participants in the project exceeded 650, but the actual participants could not fully reflect the diverse social composition of Australia. The lack of ethnic diversity restricted the exchange of personal experience and the establishment of social connections, which needs to be continuously improved in follow-up activities.

### (3) How to Further Promote Communication between the Artists

Although the artists and the commissioning party ‘The Arts House’ did a lot of brainstorming in the early stages, scenarios to communicate and exchange views were not designed in the formal phase of the project. These artists also expressed the hope that their work be more closely aligned with the whole exercise of ‘Refuge,’ and that they learn more about the progress and perspectives of other artists.

## 1.4 Experience Summary

### (1) Improve the Ability of Eco-cities to Cope with Climate Change through Integrating Cultural Means

Most urban residents lack awareness and intuitive understanding of climate change challenges. Through cultural and artistic means, it is possible to make people think about their environment and behavior through creative activities, thus building the resilience of a group and even a city. When designing similar activities, it is recommended taking following factors into account:

- Increase access through multilingual signage, Auslan and language translators; provision of means to meet specific cultural or religious needs (e.g. prayer rooms), etc.
- Provide marginalized communities (including displaced persons, refugees, elders, etc.) with an opportunity to share what would be useful for them at such an exercise, rather than simply inviting them to participate.
- Learning from the model of ‘Arts Lab,’ allow artists to work together in a short but intensive period, so as to create works themed on how to face the challenges of climate change.
- After the project is designed, carried out and completed, allow the evaluation team greater participant engagement to get broader access to data and materials, so that more comprehensive evaluation can be done.

### (2) Carry out Training Projects to Enhance the Resilience of an Eco-city by Immersive Art Approaches

Similar activities can be transformed into education and training projects to attract more people to get involved. During the activity, simulate scenes of certain extreme weather to train the public to cope with these challenges through various visual, auditory, sensory and other artistic approaches as well as environmental simulation, signs, clothing, stage props, etc. In this way, the artistic and emotional elements of these projects can motivate people to reflect their understandings more profoundly.

### (3) Bridge Cross-field Cooperation to Create Excellent Eco-cities Through a Cultural and Artistic Approach

When planning similar activities, artists must initiate two-way and equal communication with urban administrators, ecological city experts and professionals in the field of climate change research. All stakeholders need to contribute to the project the knowledge and experience of their respective fields. For example, as for that of artistic creation, climate change research, or disaster management, an ‘anti-disciplinary’ effect can inspire the decision-makers to break through fixed thought patterns and extract a practical solution for an extreme climate crisis. Even after the project is completed, the mechanism of cooperation should be kept and promoted.

## 2. Edinburgh, England: Sustainable Production and Consumption

### 2.1 Background

According to the *New Urban Agenda*, it is pointed out that ‘cultural factors should be taken into account when promoting and implementing new sustainable patterns of consumption and production to responsibly use resources and respond to the negative impacts of climate change.’ The consumption and production pattern based on culture and creativity is characteristic of low energy consumption, low pollution and high added value.

Edinburgh, as a British tourist destination ranked only after London, attracts more than 4 million visitors from the world every year with more than 3,000 events for 12 cultural festivals and has become a city full of creativity and attraction. Local cultural and creative organizations and related practitioners wanted to build a sustainable pattern of consumption and production using the power of culture and art. In 2011, a number of cultural and artistic institutions in Edinburgh including Festivals Edinburgh that manages the 12 festivals, the Federation of Scottish Theatre and Scottish Contemporary Art Network, joined efforts to establish a charity organization called Creative Carbon Scotland. Trusting the social influence and penetration

generated by the medium of culture and art, 'Creative Carbon Scotland' aims to integrate cultural and artistic perspectives into solutions to environmental issues, and to guide the producers and consumers using cultural and artistic approaches to reduce the negative impact on the environment caused by cultural industries and art production. This advanced mechanism is one among pioneering efforts globally to get artists and cultural institutions involved in environmental improvement.

## 2.2 Practice Process

In the past few years, 'Creative Carbon Scotland' formed a relatively complete mechanism. On one hand, its official website listed the universal 'carbon management' recommendations for art institutions, art practitioners and culture consumers, the examples of which included how to guide cultural and art organizations to record water, travel energy and daily energy consumption, waste, etc., and to provide a customized form for them to record these data. On the other hand, 'Creative Carbon Scotland' also launched the 'Green Arts Portal' to guide the viewer to engage in environmentally friendly actions, providing the art-dominated companies with green management guidance for buildings and offices, offering a list of recommended green suppliers, and outlining valid Internet links of solution providers that provide energy efficient services.

In addition to these common recommendations, Creative Carbon Scotland continued to roll out a string of original initiatives and projects. For example, the 'Green Arts Initiative' for cultural and artistic organizations and the 'Green Crafts Initiative' for individual artists expanded as more and more organizations and artists got involved. According to the Carbon Reporting by Creative Scotland's Regularly Funded Organizations (RFOs) released in the middle of 2017, the number of organizations that actively tackled environmental issues in the local cultural industry in 2016 was three times that of 2014.

Throughout this practice, as the most famous among Edinburgh's 12 festivals and globally the largest art festival, the Edinburgh Festival Fringe has become a model for the green cultural and creative industry. Its organizers made detailed suggestions for venue suppliers, performance teams and audiences respectively to carry out cultural activities and appreciate cultural performances in a more environmentally friendly and low-carbon way.

## 2.3 Problem Analysis

### (1) How to Encourage Cultural and Arts Institutions to Develop Lower-Carbon Creative Industries

'Creative Carbon Scotland' launched the 'Green Arts Initiative' in 2013, guiding

local art organizations to join the Green Art Network and share the knowledge, creativity and experience of low-carbon operations. Meanwhile, a unique ‘Green Operation Proposal’ was tailored for each participating institution. As of now, more than 180 art institutions have joined the network, which has constructed the most essential ecological environment for low-carbon development of local cultural and creative industries.

### (2) How to Support Cultural and Arts Practitioners to Present Products and Services in a More Environmentally Friendly Way

‘Creative Carbon Scotland’ advocates that all local cultural and artistic practitioners in Edinburgh work in low carbon way. It was recommended that adverse effects on the environment should be considered during the process of holding art festivals, creating products and presenting performances. For example, the Edinburgh Festival Fringe required venue suppliers to focus on reducing environmental impact in four key areas during the festival: energy, water, waste and travel. Meanwhile, environmentally friendly publicity is recommended to reduce the amount of printed leaflets by means of social networks, stamps, and QR-codes. With the assistance of ‘Creative Carbon Scotland’, local producers of creative products obtained a list of manufacturers that could supply environmentally friendly materials, thus facilitating design and production of handicrafts with sustainable materials to the greatest possible extent.

### (3) How to Guide Cultural Consumers to Take a More Environmentally Friendly Attitude Toward Actively Participating in Cultural and Artistic Interaction and Initiating Green ‘Consumption’

As shown in the Edinburgh Festival Fringe, the organizers encouraged viewers to come to the festival venue by low carbon travel methods. In particular, Fringe Swap Shop was held every year after the festival ended. The performance team and the audience could leave useful items that they didn’t need at the venue. Some of them were bought by those who needed them. After the Fringe Swap Shop was closed, the items that were still useful would be donated and those damaged or unusable items were recycled.

## 2.4 Experience Summary

‘Creative Carbon Scotland’ and the Edinburgh Festival Fringe, as cited above, leveraged the approaches of culture and art to advocate public protection of the environment and call for environmentally friendly behavior which is consistent with the philosophy of the New Urban Agenda. Considering the supply side of culture and art consumption, the largest carbon consumption is generated during





Figure 4.3 A Corner of Fringe Swap Shop

global travel and local travel, which is the step most difficult to control in the entire ‘industry chain’. Therefore, the following policy recommendations focus on the supply side, namely, to promote more sustainable production in cultural industries and, more broadly, in an even wider scope.

(1) Make efforts to motivate the practitioners and institutions in the cultural and creative industries to improve their awareness and consciousness of sustainable environment development and understand clearly the specific impact of their daily operations on the environment

In particular, at this stage, it is necessary to provide knowledge, approaches and tools for enterprises to document and monitor their energy consumption, water consumption and waste disposal that are required for daily operations as well as carbon emissions during business travels. Once this is done properly, it is possible to effectively identify where carbon consumption can be reduced. The above-mentioned customized table provided by ‘Creative Carbon Scotland’ is a useful reference for culture organizations.

(2) Mobilize practitioners and institutions in the cultural and creative industries to develop low carbon development plans based on their actual industrial behavior (such as daily operations, art practices, cultural manufacturing, services, etc.)

Specific reform plans are formulated according to the monitoring of carbon consumption done by enterprises or artists. Some changes are behavioral and cost the least with minimum limitations, but some changes may require more money

and time. City management practitioners can refer to ‘Creative Carbon Scotland’ while formulating different carbon-saving policies, projects, tools and cases for different groups of people. Moreover, they can even integrate this content and carry out some workshops and seminars for the participants to communicate with each other and discuss the problems encountered during actual operation.

(3) Encourage the practitioners and institutions in the cultural and creative industries to disseminate low carbon operating schemes in a cultural and artistic way and spread green consumption guidelines to the public

Through promoting a low carbon philosophy among suppliers and consumers, demonstrating the daily efforts to practise this philosophy, offering them good cases, and even designing some low carbon behaviors that are practicable at the time of consumption (such as providing low carbon traffic information for consumers), it is possible to achieve the goals of indirect education.

### 3. Johannesburg, South Africa: Cultural Inclusiveness and Livable Homes

#### 3.1 Background

How to make an eco-city more livable is the biggest challenge for all ecological cities. Essentially, as a concept that emphasizes coordination and stable development among social, economic, ecological and living environments, ecological city espouses a philosophy of building human settlement areas through ‘constructing excellent human settlements in which natural ecology and social psychology are leveraged to promote human activities that can fully integrate technology and nature, motivate human creativity and productivity, satisfy more material needs and provide a higher level of lifestyle.’ From this perspective, cultural inclusiveness can become the ‘secret key’ to coordinate relevant factors. Using people-oriented, inclusiveness-dominated, and local condition-tailored development principles, it can directly or indirectly build a more livable city.

Since the beginning of the 21st century, many African cities also have tried to build sustainable eco-cities using local solutions that emphasize a combination of Western technology and indigenous African culture and knowledge. Different from the strategy to ‘make a new city’ in a new place, whether in reviving or transforming an original urban area or building a new ecological city, African cities always face dual challenges in fulfilling a vision of building a green and livable environment—to improve environmental quality under the conditions of underdeveloped infrastructure and to develop a low-carbon and climate-adapted

economy to alleviate poverty. Based on this premise, the pursuit of home livability requires the cohesive force that cultural inclusiveness can give to the people. Moreover, an atmosphere of sustainable development can be created by the inner motivation and participation of all parties.

The Ivory Park EcoCity in Johannesburg, South Africa, is a pioneer among eco-city builders and a typical case of building a livable home by cultural inclusiveness, which is embodied in the fact that it integrates ecological wisdom both native and external, traditional and modern, and creatively builds inclusive and diversified urban public spaces, advocates young people to participate widely and eventually forms an inherent driving force to build an eco-city.

### 3.2 Practice Process

The Ivory Park EcoCity, located in the town of Midland, on the outskirts of Johannesburg, South Africa, used to be a shanty slum. Up to 50% of the adults in this area were unemployed. In 1999, a non-governmental organization called Earthlife Africa came to initiate a local poverty reduction experiment. The first construction funding of \$1.7 million was invested by the Danish Agency for Environment and Development. Subsequently, the Johannesburg municipal government took the leading role in the project and more overseas funding was invested for the follow-up development. The Ivory Park EcoCity Project aimed to introduce modern ecological concept of the Beddington Ecological Community (BedZED) in the UK while using traditional African knowledge to build a fair, poverty-alleviated, self-reliant and environmental-friendly habitat. During the construction process, the Ivory Park EcoCity specially considered the positive impact of cultural inclusiveness on sustainable development.

First, the Ivory Park EcoCity fully respected and used indigenous traditional knowledge to 'create a city.' Diversified environmentally friendly ecological housing was built in the city. Among which was a community hall (Figure 4.4), in which meetings and training were held. The main building material of this red building was locally discarded polystyrene material. After the polystyrene was crushed, it was pressed into blocks before mixing with cement paste to make bricks. No air conditioning was installed inside the building, but it was warm in winter and cool in summer with a suitable temperature within the building throughout the year, since the roof was made of mud and ventilation ducts were buried in the ground using traditional craftsmanship. Green plants were planted on the slopes on both sides of the building. It was open to children as an important public space for recreation. As a green construction company that was created and promoted in the EcoCity, the



Source: <http://era-architects.co.za/jhbEcoCity.html>.

**Figure 4.4** The Community Hall of the Ivory Park EcoCity

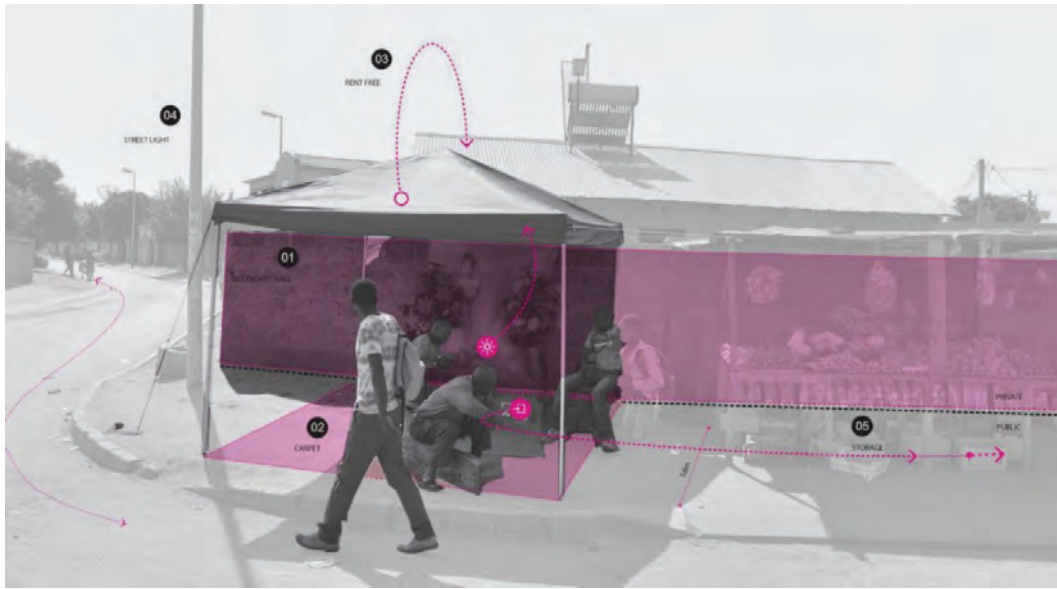
Ubuhle Bemvelo Eco-construction Co-op dedicated to building ecological housing adapted to local climate and economic conditions by selecting local materials and using environmentally friendly traditional construction techniques. For example, the traditional experience in Africa is that thick clay walls can absorb heat during the day and release heat during the cold winter nights. Such ecological construction projects frequently employed local residents who often had no building experience and needed to be trained before they could work. Women were also employed for these projects.

In the early stages of planning, the Ivory Park EcoCity actively designed public cultural facilities to demonstrate diversified cultures. Two libraries, two community centers, one school for all people, and a shopping complex were built. There was also a cultural center (Uri Cultural Centre) that regularly hosted cultural and artistic exhibitions to showcase the literary and artistic works of different ethnic groups. The events took diverse cultural forms including African dance, oral history, and specialty foods. Opportunities could thereby be given to even some highly marginalized cultures to show their unique features. For example, the San bushmen in the Ivory Park EcoCity are less socialized and still follow a traditional hunter-gatherer lifestyle. However, they have excellent ecological wisdom and know how to ‘maximize the use of plants and animals in the surrounding environment to meet their demands and control their use of plants and animals to the degree that the ecological balance remains undamaged’. They specialize in rock murals. They can blend various mineral pigments, lime, soot and animal oils to make special materials for coloring, so that the color of the murals lasts for a long time without fading. This mural art was fully demonstrated in local cultural fairs or art exhibitions.

### 3.3 Problem Analysis

#### (1) How to Create a Culturally Inclusive Public Place to Improve the Suitability and Attractiveness of Walking in the Eco-city

The Ivory Park EcoCity often uses open streets as a ‘stage’ to hold cultural events. For example, in June 2013, it held an interactive exhibition on the main



Source: <http://emergentcity.co.za/sitec.html>.

**Figure 4.5** A Local Street Photography Studio in the Ivory Park EcoCity

street, the content of which included street visits, photography exhibitions, and open discussions. The exhibited photos were offered by six certified street photographers and two local photojournalists who recorded the local rich and diverse street life. Figure 7 is one of the works and it shows a local street photography studio. These activities improved the livability and attractiveness of public spaces.

### (2) How to Guide Local Residents to Create Self-sufficient Green Livelihoods Using Their Unique Cultural Endowments

The informal business activities were quite active in the region, which mainly included street vendors, spazas and so on. Some residents planted mixed crops on both sides of the city streets and sold them along the street. Some people painted on the external facade of the building to collect payment from advertising companies. Some local women made featured braids for the visitors. For the eco-city residents and foreign visitors, these urban scenes were both a driving force for economic development and an important platform for mutual exchange among diverse cultures.

### (3) How to Attract Citizens to get involved in the Construction of Eco-cities Using Cultural, Education and Training Approaches

In the Ivory Park EcoCity, young people were recruited as tourist guides to introduce the history and characteristics of the city to foreign tourists and potential builders. Efforts were made to open study groups or workshops themed on ecological wisdom in the schools or communities so as to teach the participants various knowledge and skills, including the construction process of ecological buildings, the use of clay bricks,

landscape design and organic farming techniques and the passive energy consumption dominated design strategy—to strengthen the heat preservation, insulation, ventilation, and lighting of the building itself and use less energy-consuming equipment. As a result of the long-term influence of the ecological culture, more young people were naturally inspired to be volunteers, thus working as creators, implementers and participants to create sustainable development of the eco-city. For example, local young people established the ‘Shova Lula’, which imported used bicycles and spare parts from the UK, Germany and Switzerland. ‘Shova Lula’ provided bicycle rental and repairing services and promoted cycling culture. Moreover, a waste recycling cooperative was established by young people to hire local people and call on all urban residents to collect glass, paper, plastic, tin cans, etc., and bring them back to the recycling center for sale to recycling companies after being sorted.

### 3.4 Experience Summary

#### (1) Based on the Premise of Respecting Multi-culturalism, an Eco-city can be Made as a ‘Home Land’

In the Ivory Park EcoCity, it is promoted that cultural diversity should be given human rights based respect and local art, oral history, religious customs, and food culture that are inherited by different ethnic groups are cherished and treated properly. Around the year 2008, approximately 20% of the population in the Ivory Park EcoCity came from countries outside Africa, and their daily language was a mixture of Zulu, Sepedi, Xhosa, South Sotho, and others. However, the local residents were highly spiritually harmonious, and loved the EcoCity as their shared home land. The locals respect the spirit of ‘Ubuntu’. ‘Ubuntu’ means ‘willing to share’ in the Bantu language, which gives the connotation that ‘I am closely connected with and inseparable from others in the same life.’ This reflects the important role played by eco-cities through protecting culture, cultural diversity and social cohesion.

#### (2) Through the Approaches of Nurturing ‘volunteer culture,’ an Eco-city can be Built as a ‘Wisdom-inspiring Classroom’

The sustainable development of an eco-city can not be made without cultivating ‘volunteer culture’ for local people. Inspired by this culture, they can spontaneously and consciously participate in the local ecological construction projects, the outcomes of which indicate that the ecological culture and wisdom are truly recognized by the beneficiaries from the community and the eco-city, thus motivating them to work together for a higher standard of living. In this sense, an eco city can become a nursery for cultivating ecological culture and it can not only cultivate a young local generation, but also refine the local ecological culture and wisdom.

### (3) The Sustainability of an Eco-city Injects Creative Culture into the Informal Economy

In the African eco-city, its informal economic activities, including street peddling, are comparatively dynamic. Correctly guiding the informal economy will help reduce poverty and increase employment in developing cities as well as enhance the sustainability and resilience of local economies. In order to provide this kind of guidance, more efforts need to be made to extract more creative connotations for such economic activities. For instance, it is interesting to recognize the role of intangible cultural heritage including handicrafts, music, dance, visual art, traditional cuisine, drama and others; to promote the development of traditional professions and crafts through leveraging the knowledge of local ecosystem management, natural resource exploitation and local materials. Among them, many industries do not need too much technology, energy and investment, so culture can help create sustainable livelihoods and promote development of a green economy. Finally, through designing a ‘work stage’ that is suitable for cultural and creative practitioners, especially the individual practitioners, not only livelihood can be created, but also crises of urban governance can be avoided.

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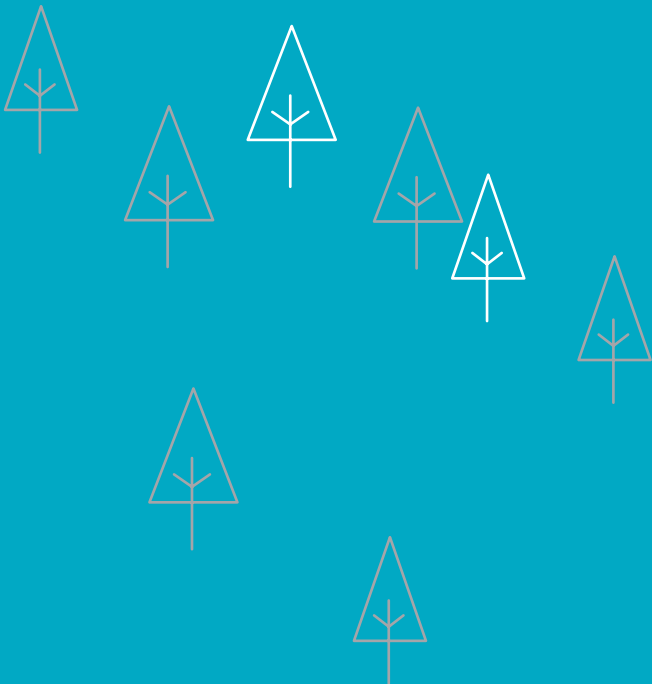
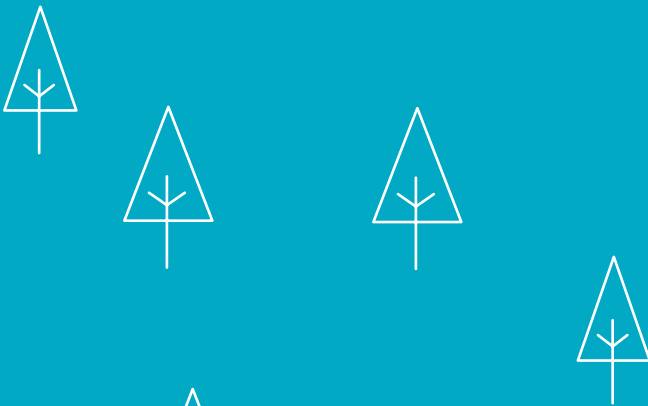
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# Chapter V

## Economics







## Introduction\*

Green economic development is an important support for sustainable eco-cities. Therefore, we have to figure out ways to cooperate with nature, effectively integrating ecological properties of nature with green and low-carbon economic development, in order to realize mutual infiltration and impact between ecological properties of economy and economic properties of ecology, during the management of natural resources and protection and restoration of ecological environment. River ‘Renaissance’ in Liverpool is an outstanding case of the process. Eco-cities have to face up to and settle issues like realizing innovation in green industries through adjustment, optimization and upgrading of economic structure, as well as supplying and replacing non-renewable energy resources with energy economy, especially green energy. For example, geothermal resources in Iceland allow the energy supply and application to become more diversified and cost effective. While saving a great deal of petroleum and coal, the eco-city successfully realizes green and low-carbon energy economy. Investment in natural capital, especially the development and promotion of green finance and green bonds, enables us to find new economic investment direction and growth driver. Therefore, how to avail the opportunity of natural capital economy becomes the key for future green development of eco-cities.

## Reference Cases

### 1. Liverpool, England: The Renaissance of Mersey River

#### 1.1 Background

The City of Liverpool covers an area of 113 km<sup>2</sup> and has a population of 491,500 (ONS, 2017). The city lies at the heart of the urban metropolitan area of Merseyside (population 1.5 million) in the Northwest of the UK. For over 810 years the growth of the city has been interlinked with the River Mersey. The development of the city’s port in the early 1700s led to the city’s rapid growth and by 1900 it was one of the world’s busiest ports and most important mercantile centres. In the second

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\* Chapter 5 is compiled by the School of Urban and Regional Science of Shanghai University of Finance and Economics, written by Zhang Xueliang, Liu Jianghua, Hong Qianwen, Zhang Shiqi, etc.



Figure 5.1 Liverpool Waterfront

half of the 20<sup>th</sup> Century the city underwent a rapid economic decline and lost half of its population.

By the 1980s the city was at rock bottom, beset with riots, mass unemployment, industrial strife and vast swathes of post-industrial derelict land. The UK Government considered whether to adopt a policy of ‘managed decline’ but opted to try and regenerate the city through a new public-private approach to urban renewal. One of the subsequent initiatives was the Mersey Basin Campaign—a 25 year plan to clean up the city’s polluted river.

The city managed to reverse its seemingly terminal decline by the late 1990s and has undergone a remarkable physical and economic renaissance over the past few decades. Liverpool’s population has increased by almost 60,000 (12%) since 2000 and its economy has returned to growth year on year since 1996. In 2018 Liverpool is a leading European visitor destination and the UK’s fifth most visited location for overseas tourists. The city gained Unesco World Heritage Status in 2004, was European Capital of Culture in 2008 and recently gained Unesco City of Music status.

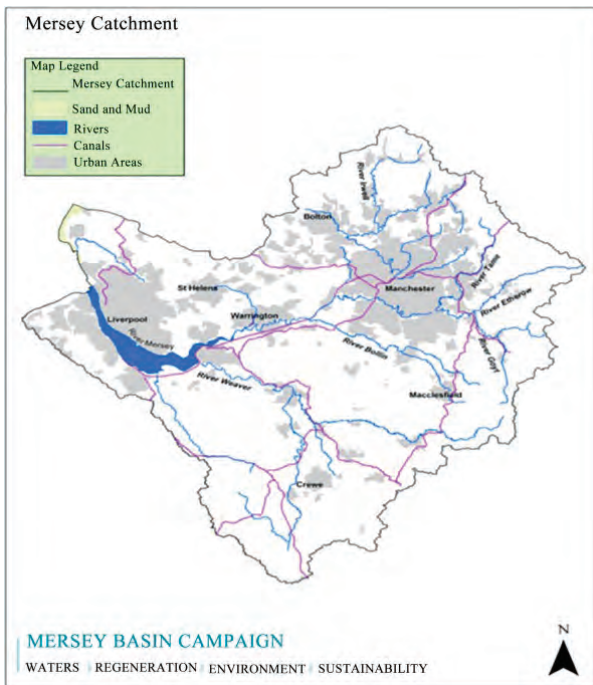


Figure 5.2 Map Showing the Catchment of the River Mersey in North West England



Figure 5.3 The MERPAS Scheme on the River Mersey

### 1.2 Practice Process—The Mersey Basin Campaign

The Mersey Basin Campaign began in 1985 as a 25-year, government-backed movement to clean up the entire Mersey river system. Michael Heseltine, then Environment Minister was the driving force and insight behind its creation when he recognized the relationship between environmental improvement and economic regeneration. As a result of Heseltine’s initial idea to ‘make good the degradation of centuries’ the Mersey Basin Campaign (MBC) was established, with government backing to address the problems of water quality and associated landward dereliction on the Mersey and its tributaries. The MBC covered an area of 4,680 km<sup>2</sup> with over 2,000 km of watercourses, (Figure 5.1).

A key water quality issue was the low levels of oxygen in the main river as a direct result of the ongoing sewage discharge. In response one key programme of works involved replacing the 28 crude sewage discharges into the Estuary with a new primary sewage works at Sandon Dock which diverted wastewater to a new treatment works under a Mersey Estuary Pollution Alleviation Scheme (MERPAS), (Figure 5.2).

### 1.3 Problem Analysis

#### (1) Pollution of the River Mersey

In 1760 over 40 species of fish including Atlantic Salmon were found in the

River Mersey. A hundred years later during the industrial revolution Liverpool became home to the great port of the British Empire. The River Mersey and its wider catchment played an important role in the new mechanised spinning and weaving mills which were located along the watercourses within the region. Associated with the textile industry was an increase in the bleaching, dying, finishing trades as well as chemical works. Similar growth took place in the paper, heavy chemical and glass industries. All of these industries used the waterways as a means for the disposal of industrial waste leaving a legacy of pollutants within the River Mersey. At the same time, the population of the Northwest exploded as people arrived in search of work and by the 1960s up to 60% of the mainland pollution generated by over 5 million people living and working in the catchment was being discharged directly into the River Mersey. Despite some changes and



Figure 5.4 Pollution of the River Mersey

improvements, by the 1980s, the Northwest's waterways were among the most polluted in the world.

### (2) Economic Decline

In 1715 the first ever commercial wet dock was completed in Liverpool on the River Mersey which accommodated up to 100 ships and was accessed directly from the river. Later in 1846 with the construction of the Albert Dock complex with both wet and dry docks Liverpool became a global trading port. By the late 19th century, 40% of the world's trade was passing through Liverpool's docks and the city's growth and prosperity continued, with the city being known as 'the second city of the Empire'. However, from the mid-twentieth century, the advent of containerization made Liverpool's docks obsolete and the docks and traditional manufacturing industries went into sharp decline. From being Britain's largest port in the mid-19th century, the Mersey's share of Britain's trade plunged to just 2.4% in the mid-1980s and the unemployment rate in Liverpool rose to one of the highest in the UK. As a result of these factors by the 1980s the city was struggling with industrial decline, dereliction, poor housing and social problems.



Figure 5.5 Population Loss with Economic Decline

### (3) Population Loss

As the city fell into economic decline the population of the city also fell from

almost a million on the eve of the second world war to around 440,000 by the turn of the century. In the 1960s tens of thousands of Liverpool residents were enticed into ‘new towns’ such as Runcorn and Skelmersdale, with the promise of better housing and better job prospects. The continuing population loss contributed to the sharp economic decline of the city during the 70s and 80s, with population numbers still continuing to fall by about 2,500 a year between 1991-1996. This extended loss of population contributed to the city’s spiral of decline as those who left tended to be those with the best job prospects. Consequently, the population that remained comprised of a higher proportion of welfare recipients which in turn caused the city’s economy to weaken further and increased the pressure on those with marketable skills to move away.

These key problems came to a head in the 1981 when disturbances in Toxteth, an inner-city area of Liverpool, turned into full-blown riots. In the wake of the riots, government policy began to focus on the problems of inner cities, and of post-industrial dereliction.

#### 1.4 Experience Summary

##### (1) New Approach in Governance

The scale and complexity of the clean-up programme required to deal effectively with the gross water pollution and waterside dereliction was too great for any one authority or agency and The Mersey Basin Campaign broke new ground in British administrative practice with its uniquely collaborative programme.

Three key organisations were established at the centre.

1) Mersey Basin Campaign Administration Ltd acted as the overall coordinator and administrator of the partnership.

2) The Mersey Basin Trust was formed in 1987 as a registered charity and acted as a focal point for the community and voluntary sector to voice their views on the Campaign.

3) The Mersey Basin Business Foundation, formed in 1991, and acted as a channel for business sponsorship for MBC-related activities.

These organisations promoted, and facilitated action by, the myriad of businesses, local authorities, public agencies and groups involved in the MBC.

The partnership changed over the life span of the Campaign, building from its government roots to recognise the interdependence of economic prosperity and quality of the environment and the need for a sustainable development approach. Key to its success was ensuring that opportunities existed to build relationships with partners and connections at all organizational levels.

## (2) Partnership Working

A successful clean up required the engagement and participation of myriad different organisations, authorities and communities. The Mersey Basin Campaign set up a network of over 20 Action Partnerships, and between 1989 and 1992, the Mersey Basin Trust provided over £100,000 in grants and enjoyed a membership of over 400 community groups, voluntary organisations and schools.

During the first few years, much time was spent spreading awareness of the MBC vision and persuading organisations to work towards its objectives. As a result a significant number of large-scale improvement projects in line with the MBC's objectives were carried out by the major public and private sector agencies which were aimed at improving the sewerage network in the Mersey Basin and regeneration of land through north-west urban development corporations.

Working closely together and co-ordinating activity was critical to the success of the MBC in the longer term and collaborating on a project basis over many years allowed trust to develop between the partners through working together, producing positive results and partners obtaining benefits from working together rather than individually. This innovative approach at the time was recognized in 1999, when the Mersey Basin Campaign won the inaugural World River Prize.

## (3) Consistent, Simple Messaging

The Campaign's work was based on three clear aims which remained unchanged throughout its 25 years of activity:

- **improving river basin quality across the Mersey Basin** to at least a 'fair' standard by 2010 so that all rivers and streams were clean enough to support fish;
- **encouraging sustainable waterside regeneration** to stimulate attractive waterside developments for business, recreation, housing, tourism and heritage; and
- **engaging individuals, businesses and communities** in the process to encourage people living and working in the Mersey Basin to value and cherish their watercourses and waterfront environments.

## (4) The River Valley Initiative

Eight years into its life the MBC developed its River Valley Initiatives (RVIs). RVIs were in effect seen as 'mini campaigns'. Through the RVIs it was envisaged that the successful partnership approach of the MBC at the strategic Mersey Basin level, could be developed to encourage local stewardship of individual watercourses. The RVIs built on the joint working, targeting specific watercourses





Figure 5.6 Evolution of New River Economies

using a project officer to stimulate and maintain local involvement. The RVIs formed a direct link between the Campaign and the Local Environment Agency Plans (LEAPs) being published by the Environment Agency.

#### (5) Evolution of New River Economies

Today the city has one of the fastest growing city populations in the UK and river water quality improvements mean the Mersey supports a wide range of fish species, as well as porpoises, grey seals and even octopus. The Mersey Estuary has been designated as both a Special Protection Area (SPA) and a Ramsar Site in recognition of its conservation value, especially for birds, as well as a Site of Special Scientific Interest (SSSI).

The new River Mersey Task Force (a collective of professional individuals from a range of sectors who share an interest in the role the river plays in the sustainable economic development of the City Region and beyond) are exploring '*the feasibility of the River Mersey becoming the cleanest and most ecologically diverse river in an urban setting by 2045*'. Working together they are drawing on work and foundations of the Mersey Basin Campaign to:

- **unlock barriers to growth at key locations;**
- **unlock economic potential**(by creating opportunities to use the River Mersey to drive innovation, collaboration and development across key sectors including renewable energy, water innovation, water resource management and the visitor economy); and
- **deliver a long term sustainable economic growth plan** for the River Mersey.

Together these actions will maximise the River’s potential contribution to the Liverpool City Region; enabling Liverpool to make a major contribution to the country as a pioneer of greener, more sustainable and more prosperous urban living and helping to rebalance the economy between the north and south of the country.

Our regional economy is now worth more than £149 billion and supports over 266,000 businesses. The city is already using the natural assets of the River to harness and create energy solutions to help drive future growth. Today Liverpool Bay has over 270 offshore turbines installed including the first deployment of the world’s biggest offshore turbines and a further 330 installed and 174 consented in the neighbouring Southern Irish Sea. This represents one of the largest offshore wind clusters in the world and the first commercial deployment sites for next generation technology from Mitsubishi Vestas and Siemens and is host to pioneering projects. The UK headquarters for leading offshore wind suppliers ABB, Siemens and Vestas are located within a 60 km radius of Liverpool and DONG Energy, the global leader in offshore wind, will complete a new Combined Operations Centre facility on the Mersey at Birkenhead to control and support its Southern Irish Sea windfarms. In addition there is a vibrant offshore wind supply chain-over 160 companies active in the sector across a spectrum from finance and insurance through manufacturing and assembly to operations and maintenance. Using the Mersey to generate renewable energy is also being explored and The



Figure 5.7 The Museum of Liverpool by the Riverside, Which Opened to the Public in 2011, is the Largest Newly-built National Museum in the UK for More than a Century.

Mersey Tidal Power project has reached full technical and environmental appraisal level.

Building on its maritime past the city is once more a major port and logistics hub for the North of England, with highly developed transport and logistics infrastructure and expertise in ship building, fabrication, manufacturing and engineering employing 28,000 people across 1,700 businesses and contributing £ 3.4 bn to the city regions GDP. Furthermore, LCR is one of the UK's six dedicated centres for offshore renewable engineering and home to the Institute for Renewable Energy and The National Oceanography Centre (NOC). Going forward a recent report from The Mersey Natural Capital Project has identified that the River now contributes £ 400 m+ per year within the Liverpool City Region with the potential to contribute over £ 3 billion per year across the wider catchment and detailed feasibility work is underway to explore the potential to use water sourced heat pumps in the Mersey to heat the waterfront municipal buildings.

Liverpool has reinvented itself with its River once more at the heart of its economic growth and sustainable development.

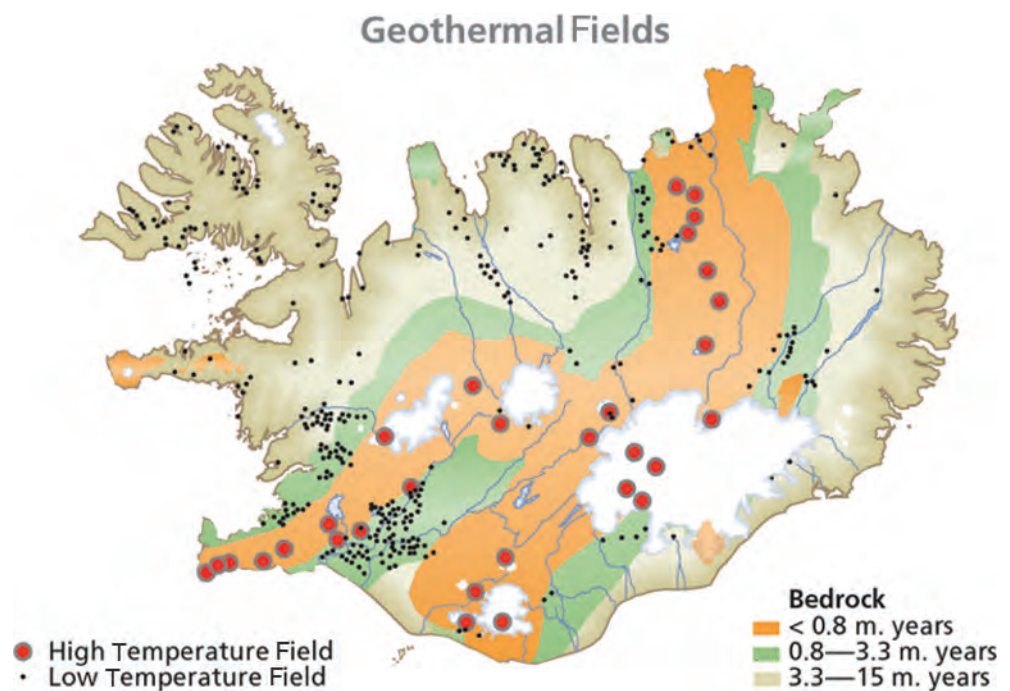
## 2. Iceland: Country of Ice and Fire, Driven by Geothermal Energy

### 2.1 Background

Iceland is an island country in the North Atlantic with an area of 103,000 km<sup>2</sup> and a population of about 0.35 million. It is located at the junction of the North Atlantic and the Arctic Ocean. Reykjavik is its capital and the largest city. Situated on the mid-Atlantic ridge between the North American Plate and the Eurasian Plate, Iceland possesses numerous volcanoes and frequent geological activities, bringing it abundant geothermal resources. In the uppermost 1,000 m below ground in Iceland, 250 separate 'low-temperature' (<150°C) geothermal areas exist. And in addition to these, the top 1,000 m contains twenty 'high-temperature' (reaching 250°C) areas. High-temperature areas are mainly distributed in active volcanic areas or adjacent to active volcanoes; low-temperature areas are distributed outside active volcanic areas, or scattered throughout Iceland. Geothermal resources in high-temperature areas are mainly used for electricity generation; geothermal resources in low-temperature areas are mainly used for heating or bathing. With the development of technology, geothermal resources in low-temperature areas can be used to generate electricity gradually.

Furthermore, 11% of Iceland's territory is covered by seasonal glaciers. As these

melt into rivers that run down from the mountains into the sea, they also provide Iceland with abundant hydroelectric resources. Thus Iceland's energy consumption can mainly be supplied by hydroelectric and geothermal resources, as evidenced by usage of these resources in the contemporary Icelandic economy in areas ranging from household heating and lighting to energy-intensive industries. Only the transport sector continues to rely on fossil fuels as its major energy source. In 2014, 85% of Iceland's primary energy came from renewable energy sources, with geothermal resources accounting for 66%. Renewable energy generation supplies 100% of the nation's electricity consumption.



Source: <https://nea.is/geothermal/the-resource/>.

**Figure 5.8** Distribution of Geothermal Resources in Iceland

### 2.2 Practice Process

At the beginning of the 20th century, a farmer designed a geothermal system that provided heat for his farm extracted from geothermal water. Based on this, Reykjavik's municipal government began development of Iceland's geothermal resources, using oil-drilling technology to provide heat for more areas. The gradual maturation and commercialization of related technologies has permitted development of large geothermal heating systems. Thus, Reykjavik currently has 10 automatic heating stations, with over 400 kilometers of heat pipes, benefiting nearly 200,000 residents in the capital area. In Iceland, in addition to 26 municipal-run heating systems, there are some 200 smaller heating companies situated in villages.

Many rural communities near hot springs in Iceland have also built heating/power distribution systems or geothermal wells, yielding stable geothermal water. Siting community schools near geothermal supplies provides them with energy for heating and swimming. 87% of all Icelandic households now benefit from geothermal heating.

Apart from geothermal heating, Iceland also has geothermal power generation. Currently capacity of geothermal power stations exceeds 600 MW, accounting for nearly 30% of the country's total power generation. With the remaining 70% coming from hydropower, the country has supplied 100% of its electricity consumption with clean energy—a major achievement. Power production has also driven the development of energy-intensive industries led by aluminum industry, which has turned Iceland into one of the world's largest aluminum producers. Three energy-intensive enterprises have been built in southwest Iceland: Icelandic Aluminium Co., Ltd, Nordic Aluminum Plant Co., Ltd, Ferrosilicon Smelter Co., Ltd. Based on geothermal power generation, the Icelandic government has built a metal smelting industry, whose products include aluminum, ferroalloy, magnesium, ferrosilicon, abrasive materials, steel, zinc and other metals. Geothermal resources have also stimulated the growth of a chemical industry, which includes production of polyols, alcohol (ethanol), oil refineries, paper, pigments, oxygen, special chemicals and other industries.

Other than heating and power generation, Iceland has also successfully established geothermal greenhouses and developed ecological agriculture. With



Source: <https://nea.is/geothermal/direct-utilization/greenhouses/>.

**Figure 5.9** Geothermal Greenhouses in Iceland

a history going back as far as 1924, geothermal greenhouse cultivation has allowed Iceland to become the largest exporter of bananas in Europe. Tomatoes and cucumbers cultivated in geothermal greenhouses also meet 70% of domestic demand. In addition to development of geothermal-greenhouse-based ecological agriculture, Iceland has developed methods for speeding up crop growth by heating soilbeds directly from geothermal springs, thus bringing crops to market earlier. An estimated 120,000 m<sup>2</sup> of agricultural land adopts this method. From the mid-80s, Iceland began to develop geothermal aquaculture, greatly accelerating the development of Icelandic fisheries, and increasing production by shortening the incubation/maturation cycle of fish fry.

These geothermal energy utilization achievements could not have come about without the support of the Icelandic government, which established Orkustofnun (the National Energy Authority) in 1967 with the aim of obtaining information on geothermal resources to promote economic growth. In 2003, the National Institute of Iceland Geological Survey was established, independent from Orkustofnun, to study geothermal resource exploration technologies. The resulting new technologies revealed many previously undiscovered geothermal resources, allowing these to be exploited. As geothermal exploration and development technologies have matured, the government gradually faded out of the field, leaving power companies to become the mainstay of the market. Once technical problems concerning geothermal exploration and development had been resolved, the Icelandic government set up an Energy Fund to address other issues facing the industrialization of geothermal resource utilization, such as insufficient funding and maturity mismatch. Thus, the Icelandic government has played an important role not only in the research and development of geothermal resource technologies, but also in the development of the country's geothermal industry itself. Moreover, the Icelandic government has legislated to guarantee incentives for the use of renewable energy. Ownership of resources is attached to the land from which they are discovered, with the State of Iceland enjoying ownership of resources found on public land, unless a private individual can prove his/her right of ownership. Although resource ownership is based on land ownership, development and utilization is subject to licensing, according to the *Act on Survey and Utilization of Ground Resources*, No.57/1998 and the *Electricity Act*, No.65/2003. The former of these covers resources underground, in rivers and lakes and on the sea bed within fishing limits. The Act also covers surveys of hydropower electricity generation. The right to use and exploit resources is limited and regulated by the *Natural*

*Resources Protection Act, the Planning and Building Act and the Environmental Impact Assessment Act.*

In short, the Icelandic government has played a very important role in the use and sustainable development of geothermal resources in Iceland. Before the resource is developed and utilized, the Icelandic government first evaluates the project to be developed, not only from the perspective of energy efficiency and economy, but also on the environmental impact. Second, the government always pays attention to and supports the development of the geothermal industry. Initially, the government directly participated in the exploitation of geothermal resources and technological upgrading, and then gradually gave way to market players. At the beginning, due to the high cost of geothermal resources compared with water resources, the government subsidized the development and utilization of geothermal resources. However, with the advancement of technology and the emergence of scale effect, the Icelandic government has gradually eliminated widespread subsidies for geothermal resources. Third, the Icelandic government has enacted a comprehensive set of laws to ensure the sustainable development and utilization of geothermal resources. Finally, the Icelandic government is actively working with research institutions, energy companies and the public to make the development of geothermal resources not only environmentally friendly but also socially friendly, as is the case with Iceland's famous Blue Lagoon.

### 2.3 Problem Analysis

#### (1) Inappropriate Exploitation of Geothermal Resources can Cause Ecological Destruction and Environmental Pollution

Extraction of geothermal water during exploitation of geothermal resources leads to a drop in underground water levels, and can thus exacerbate land subsidence. Therefore, after exploitation of geothermal resources, geothermal water should be reinjected into the geothermal reservoir. This process, known as geothermal reinjection, by making geothermal reserves dynamic, also converts geothermal resources into truly renewable resources. Meanwhile, geothermal reinjection can also effectively extend the production lives of geothermal fields while avoiding thermal and soil pollution caused by tail water discharge. Separately, during the development and utilization of geothermal resources, greenhouse gas buried underground will be directly discharged into the atmosphere unless treatment processes are put into place. The relatively high sulfur dioxide and silicon dioxide content of these gases can cause air pollution. Geothermal water also contains

toxic heavy metals such as mercury, arsenic and boron, which can cause soil pollution.

### (2) Geothermal Resources may not be Renewable

Geothermal reinjection needs to be carried out to ensure the reproducibility of geothermal resource. On the one hand, inadequate geothermal reinjection technology may lead to reinjection of less geothermal water than has been extracted, and gradual resource depletion. On the other, geothermal resources may be non-renewable because they will eventually disappear due to natural changes in the internal structure of the Earth. The only way to ensure that geothermal resources will not be exhausted is to exploit them directly from the magma layer, but technology capable of this remains developmental, and is not yet ready for commercialization.

### (3) Iceland's Unique Energy Resources Make its Energy Transition Difficult to be Replicated Elsewhere

Iceland is a special case, uniquely endowed with geothermal resources. Located on the mid-Atlantic ridge between the North American Plate and the Eurasian Plate, the country is covered with volcanoes and geologically active sites, delivering abundant geothermal resources. Meanwhile, the glaciers provide the nation with abundant hydroelectric power resources in the form of the rivers that these glaciers supply. Hydroelectric power resources are widespread, and can be replicated wherever suitable resources occur. However, geothermal resource utilization needs to consider the reinjection issue: it is precisely because Iceland has abundant water resources that it can utilize geothermal resources in a sustainable and ecologically-friendly manner.

## 2.4 Experience Summary

(1) As one of the major countries engaged in development and utilization of geothermal resources, Iceland has issued a series of laws to ensure the sustainable, reasonable and orderly exploration, development and utilization of geothermal resources.

While ownership of resources is based on ownership of land, resource development and utilization is subject to licensing according to the *Act on Survey and Utilization of Ground Resources*, No.57/1998 and the *Electricity Act*, No.65/2003. The *Act on Survey and Utilization of Ground Resources*, No.57/1998, covers resources underground, in rivers and lakes and on sea beds within fishing limits. The Act also covers surveys for hydroelectric power. The right to use and exploit resources is limited and regulated by the *Nature Conservation Act*, the



*Planning and Building Act and the Environmental Impact Assessment Act.*

(2) The Icelandic government has played an important role in exploration for and utilization of geothermal resources

The Icelandic government established Orkustofnun (the National Energy Authority) in 1967 with the aim of obtaining information on geothermal resources to promote economic growth. In 2003, the National Institute of Iceland Geological Survey was established independently from Orkustofnun to study technologies for exploration for geothermal resources. New technologies have allowed discovery and exploitation of many previously undiscovered geothermal resources. As geothermal exploration and development technologies have matured, the government has gradually departed from the field, leaving power companies to become the mainstay of the market. Once the major technical problems concerning geothermal exploration and development had been resolved, the Icelandic government set up an Energy Fund to address other issues facing the industrialization of geothermal resources utilization, such as insufficient funding and maturity mismatch. Thus, the Icelandic government has played an important role not only in geothermal resource technology research and development, but also in the development of the country's geothermal industry itself.

(3) Iceland's all-round, high-efficiency development and utilization of geothermal resources, covering all sectors (household heating, power generation and industrial utilization etc) is a true realization of the green economy

Iceland makes excellent use of its geothermal resources for heating, power generation, greenhouse heating, animal farming, etc, in all aspects of the national economy and peoples' daily lives. This has eliminated Iceland's dependence on imported foreign fossil fuels, allowed the country to become energy independent. Over 30 years of replacing fossil fuels with geothermal resources, Iceland has saved about \$8.2 billion on energy imports; geothermal heating alone saves \$100 million a year. Through its development and utilization of geothermal and hydropower resources, Iceland has become one of the cleanest, most environmentally friendly and greenest countries in the world.

### 3. Paris, France etc: Ecological Investment and Green Bonds

#### 3.1 Background

The potential threat of climate change and resource depletion is leading to a transition—whose inevitability is widely acknowledged—of energy use from high-carbon fossil fuels towards low-carbon renewable energy. Meanwhile, it is

recognized that the transition will be long and slow, and, requires the avoidance of price distortions in economic activities (subsidies for fossil fuels, negative externalities of fossil fuel combustion etc). Instead, the transition demands appropriate management of natural resource emissions, emphasis on the scarcity of environmental space and public policies designed to reduce climate risks. Many experts have estimated the funds required to complete this transition. Although the results were inconsistent, they were in agreement in one respect: that public resources alone would not be sufficient to meet the transition's funding needs. Therefore, green bonds were introduced to help fill this funding gap, and bring about the low-carbon transition. This section examines the green bonds issued by Gothenburg, Sweden and Paris, France, taking these as examples illustrating the role of green bonds in the adaptation to climate change and the promotion of green economic development. In order to mitigate climate change and protect the natural environment, Goteborg in Sweden and Paris in France set goals for climate change, sustainable transport, waste and emission management, pollution control and the health impact of pollution, and for improvements in environmental protection and bio-diversity. The goals of Gothenburg's 2050 climate strategy include the following: reducing energy consumption in industries, public buildings and houses by 10% between 2011 and 2030; reducing carbon dioxide emissions by 80% between 2010 and 2030; and near-complete transitioning of heating to renewable energy, waste incineration and industrial waste heat by 2030. Paris pledged to reduce greenhouse gas emissions by 80% by 2050, and shift energy consumption to 100% reliance on green sources by that date, thereby enhancing the city's flexibility *vis-a-vis* climate risks and inspiring new patterns of economic growth.

### 3.2 Practice Process

The issuance of green bond shall be subject to The Green Bond Principles, (GBP). The GBP was jointly launched by the GBP Initial Executive Committee (composed by Green Bond Issuers, Investment Institutions and Underwriters) and International Capital Market Association (ICMA) in January 2014, with the purpose of providing suggestions on the transparency and information disclosure for the development of green bond market and improving the projects with capital beneficial to environmental protection. The GBP preliminarily defines the investment scope of green bond and standardizes the basic principles of the management of funds raised and information disclosure of green bonds. Up till now, there are almost 200 green bond issuers, underwriters and investors worldwide following the GBP. The GBP

provides the guidance on the disclosure and transparency for green bond issuers depending on its five core pillars: 1) definition (the projects to use fund raised), 2) selection (project evaluation process), 3) traceability (management of fund raised), 4) transparency (supervision and reporting), 5) verification (provide assurance through external audit).

As a member of the Global Green Bonds Alliance, Sweden’s Gothenburg became the first city in the world to issue climate bonds, closing a SEK 500 million deal to issue a six-year green bond, funding public transport, water management, energy and waste management projects, and carrying Gothenburg’s AA+ (S&P) and Aaa (Moody’s) ratings. In 2014-2016, additional green bonds were issued each year. In 2014, the second batch of green bonds worth SEK 1.8 billion was issued; in 2015, the third batch of green bonds worth SEK 1 billion was issued; in 2016, the fourth batch of green bonds worth SEK 1 billion was issued (UNFCCC). The use-of-proceeds green bond modelled on those from the World Bank, where proceeds are earmarked for environmental projects but returns and risk are backed by the issuer’s full balance sheet. To ensure information transparency of investment projects, a green bond disclosure framework was developed for the bond, including information on the issue date, eligible investors, and the use for which capital is being raised. The bond is underwritten by The Swedish Bank. Between 2013 and 2015, 75% of the green bond yield was used to finance climate change projects designed to establish a low-carbon and climate-resilient city.

In 2015, the COP 21 Conference was held in Paris, France. In order to let

**Table 5.1 Case Study of Green Bond Issuers in Two Cities**

Issuer	Date of Issuance	Amount	Green Project
Municipal government of Gothenburg, Sweden	From September 2013 to September 2019 Duration: 6 years	SEK 4.3 billion	Funds raised earmarked for environmental projects: public transport, water management, energy and waste management etc
Municipal government of Paris, France	From May 2015 to May 2031; Duration: 16 years	€ 300 million	Green bond yield applied in areas such as renewable energy, building energy retrofits, mobility electrification, improved waste collection, water use demand management and reduction of the urban heat island effect, including the construction of 300 charging piles for electric vehicles and of an electric bus line, urban agriculture and urban greening projects etc

citizens and participants understand the diversity of Paris's environmental and ecological protection actions, the City of Paris issued its inaugural Climate bond for € 300 million with a May 2031 maturity to finance climate and energy projects. Aimed at private investors wishing to invest in the sustainability of Paris, the bond offers a 1.75% coupon, and strives to reduce greenhouse gas emissions by 75% by 2050. Paris has applied green bond yield to projects in fields such as renewable energy, building energy retrofits, mobility electrification, improved waste collection, water use demand management and reduction of the urban heat island effect, including construction of 300 charging piles for electric vehicles and an electric bus line, urban agriculture and urban greening projects. The environmental benefit of the bond has been reflected in reductions of carbon dioxide emissions of at least 30%. Social benefits have included the refurbishment of 25,000 family homes. In terms of economic benefits, the progress of the project will be audited and published every year, maintaining investor confidence in green bonds and promoting their understanding of the project's ongoing progress.

### 3.3 Problem Analysis

#### (1) How to Take Net Effect of the Project on All Related Communities and Groups into Consideration When Evaluating Its Green Effect?

CICERO (Center for International Climate and Environmental Research-Oslo) is a research institute that provides second opinions on Goteborg's green bond framework. It intends that issuers should at least be aware of potential negative macro-impacts and aim to minimize them, or green effect might be harmfully influenced. Since climate change can bring about complicated effects, green projects may impact communities or groups that were not originally considered, and which may or may not be climate-friendly. Evaluation of projects' green effects should therefore take into account their other net effects on all related communities and groups.

#### (2) How to Avoid 'Rebound Effects' Introduced by the Increased Energy Efficiency of Energy Use During the Implementation of Green-bond-related Projects, Which Could Offset Beneficial Ecological Effects?

Funds raised via the Paris green bonds will be applied to building energy retrofits and improvement of energy efficiency. But improved energy efficiency may lead to 'rebound effects': increases in energy consumption (and related activities) reflecting lower energy costs, due to the defined increases in energy efficiency. Similarly, adoption of renewable energy will bring down the prices of fossil fuels, eventually

stimulating their consumption. Although rebound effects cannot be eliminated, green bonds related projects should make great efforts to minimize them. For example, implementing green projects based on changes in energy prices, so as to reduce the negative influence of rebound effects.

### (3) How to Mitigate Risks of Diversion of Green Bond Funds into Non-green Projects, Given the Lack of Unified International Green Bond Regulatory Standards?

Since issuance of green bonds is not currently subject to unified standards, cities are free to select whatever standards they favor. Green Bonds Principles and Climate Bonds Standards are two frameworks with worldwide recognition, but compliance with one of these is not compulsory when issuing green bonds. And some countries, including China, have established their own issuance standards for green bonds. According to the World Wide Fund for Nature, risk that green bond funds are potentially channelled into non-green projects might rise up. Therefore, it called upon issuers to demonstrate that their targeted projects can produce measurable environmental benefits-certifiable by an independent third party to intentionally-recognized standards-before issuing green bonds.

#### 3.4 Experience Summary

### (1) Successful Green Bond Issuance can Satisfy Financing Demands Related to Infrastructure Construction, and Development of Low-carbon and Environmentally-friendly Industries, and Address Maturity Mismatch

Successful green bond issuance has the following benefits. First, it enriches bond markets, promoting the development of corporate bond market and improving bond markets in different countries. As a result of that, up-to-date bond markets can meet green financing needs. Second, it proves that financial market supports issuers to devote them into clean energy industry, which will attract an increasing number of investors to pay attention to and participate in the building of low-carbon, environmentally-friendly industries, and , will stimulate private sector (& households) to participate in sustainable urban development & resilience building. Furthermore, green bonds can address the maturity mismatch stemming from banks' short financing maturity and green infrastructure's long construction periods. In the cases of Goteborg and Paris, green bonds were issued with maturities of 6 years and 16 years respectively, satisfying diversified funding demands. Between 2013 and 2015, 75% of the green bond yield was used to finance climate change projects, enabling Goteborg to establish a low-carbon and resilient climate. Paris, on the other hand, applied its green bond yield to projects in fields like

renewable energy, building energy retrofits, mobility electrification, improved waste collection, water use demand management and reduction of the urban heat island effect. The city strives to reduce its greenhouse gas emissions by 75% by 2050.

### (2) Successful Green Bonds Issuance in Goteborg and Paris has Acted as a Role Model for Increased Exploitation of Financial Support by the Renewable Energy Industry, and Other Low-carbon, Environmentally-friendly Industries

Other cities can draw lessons from these examples, imitate them to conduct innovative exploration in renewable energy industries, including wind power, solar power and hydropower; promote improvements in the financing structures of clean energy enterprises; reduce financing costs, shorten realization period of gains from greenhouse gas emissions; stimulate more rapid growth of clean energy enterprises and expedite the transition of enterprises from traditional to clean energy usage. Reflecting this, environment-friendly projects will be able to achieve greater results. Proceeds from the green bonds issued by Goteborg and Paris have been applied to a great variety of low-carbon environmentally-friendly industries, including renewable energy, building energy retrofits, mobility electrification, improved waste collection, water use demand management, reduction of urban heat island effects, improved energy efficiency at sewage treatment facilities and support for construction and maintenance of parks. Utilization of green bonds could be expanded to promote development of all low-carbon environment-friendly industries, in fact.

### (3) Third-party Agency Certification of Green Bond Issuance Promotes Investor Confidence

Green bonds provide a new source of funding, separate from credit and equity financing and, widen the range of funding possibilities available for long-term projects where matching long-term funding is difficult to obtain, so as to promote construction of green infrastructure. However, since low-carbon environment-friendly industries are emerging ones with unpredictable future returns and benefits, investors will tend to remain prudent. Given this, in order to bolster investor confidence, green bonds issuers should invite third parties to carry out elaborate and transparent information disclosure and certification. In the case of Goteborg, not only were credit ratings of AA+ (S&P) and Aaa (Moody's) obtained, but reliance was also placed upon the World Bank, where proceeds are earmarked for environmental projects.

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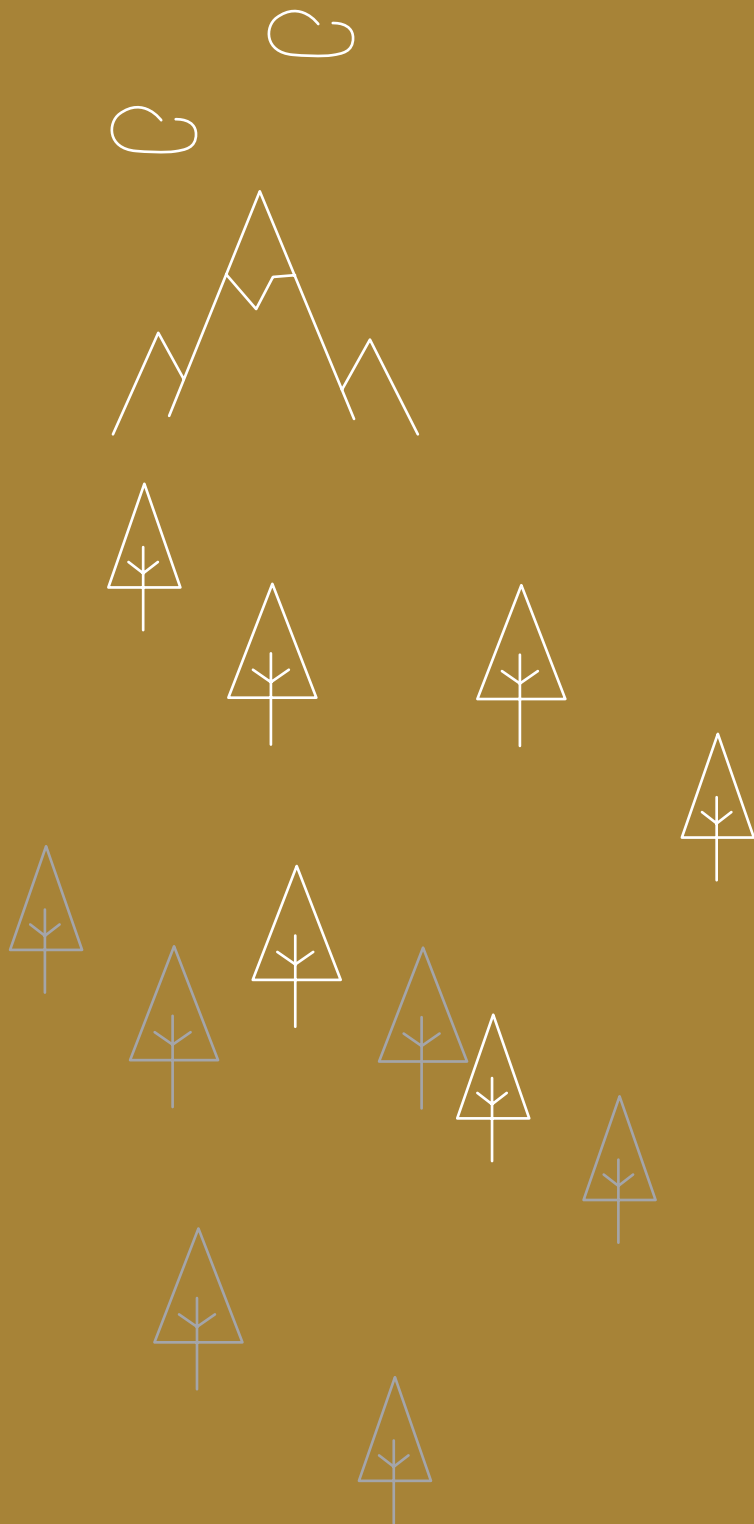
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# Chapter VI

## Governance





'Shining Glow over Fan-yu Memorial Bridge', photographed by Ji Yongdong (Wuxi Water Conservancy Bureau).

## Introduction\*

Governance is the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken. The traditional urban management model attaches great importance to the top-down role of government in administrating, controlling and dominating urban construction and development. However, urban governance mainly focuses on inviting more shareholders to participate in developing cities, striving for urban growth and competitiveness improvement with joint efforts. The latter also advocates that unilateral decision-making led by the government be replaced with a multilateral governance system consisting of both government and non-government sectors, working together for urban construction and development.

With the development of urbanization and improvement of people's living standards in recent years, urban eco-environmental issues, as a matter of public administration, have raised concerns all over the world. Meanwhile, cities worldwide are working on building themselves into eco-cities and pursuing green development. Faced with a string of problems like a deteriorating ecology and environmental pollution, previous experience in urban ecological governance becomes less practical. Instead, varied interest groups including the government, citizens and the public must rethink their judgments about eco-cities and green development, sharing the responsibility of urban governance and striving for transformation and innovation of the governance model.

### Selection of Cases

Cases concerning the following three subjects of urban ecological governance were selected: breakthroughs and innovation in policies and systems, upgrades and application of technologies, and diversity and cooperation among leading players. As a result, the three selected cases are the river chief system in Wuxi City, construction of a smart eco-city in Copenhagen and a community land trust system on Denman Island, providing a frame of reference for urban governors.

First, focus on breakthroughs and innovation in ecological governance systems.

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\* Chapter 6 is compiled by Shanghai Urban Planning and Design Institute, written by Lu Ke, Zong Minli, Du Fengjiao and Wang Zhouyang.

The ‘River chief system’ and community land trust system are both significant attempts carried out by local governments to address urgent problems. Innovation of systems and mechanisms as well as utilization of administrative means for urban governing bodies can have a positive impact on the creation of eco-cities and green development. Nevertheless, protection of achievements needs ongoing improvement of systems, encouragement and regulation on executors and acquisition of understanding and support from the public.

Second, stay attentive to upgrades and application of ecological governance methods. Application of cutting-edge technologies to urban governance aims at greater results that cannot be achieved by traditional means. Borrowing experience from cities like Copenhagen and utilizing big data, IoT and Internet+ and so forth, urban governance has seen significant improvements in terms of publicizing information, and facilitating intelligent governance and public participation. In addition, they equip eco-cities and green development with more efficacious methods.

Third, emphasize diversity and cooperation among leading players in ecological governance. Active participation from diversified players builds the best urban governance. Government still plays a leading role in creating eco-cities and green development according to these three cases. However, urban governance is a complicated systematic project, demanding a sound governance atmosphere jointly created by all government departments, society (including markets and organizations) and the public.

## Reference Cases

### 1. Wuxi, China: Institutional Innovation in Waters Governance<sup>1</sup>

#### 1.1 Background

The 17 development goals are set out in *Transforming Our World: the 2030 Agenda for Sustainable Development*, of which the sixth is ‘ensuring availability and sustainable management of water and sanitation for all’. Throughout the world, most cities in both developed and developing countries have experienced or are experiencing the conflict of urban development and the waters ecological environment. However, waters management is a complex systematic project, often

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<sup>1</sup> Thanks to Zou Yongming, Li Xihua, Xue Luyang and Xu Chengjun of Wuxi Water Conservancy Bureau for their support of this case.

involving a wide range of elements such as those upstream and downstream, those on the left or right bank, those in different administrative regions and industries. Its complexity also determines its time-consuming and overwhelming nature.

As a developing country with continuous industrialization, China is facing a serious situation of water pollution prevention and water resources protection. In order to carry out waters management, China has made investments and guarantees in various areas such as policy, funding, human resources and technology. However, due to cooperation barriers between departments, lack of overall coordination in management, and insufficient water management concepts, the overall governance does not goes well.

Wuxi City in Jiangsu Province lies between the Yangtze River in the north and Taihu Lake in the south. Hailed as Pearl of Taihu Lake, the city is the home to ‘Wu Culture’ and the cradle of modern China’s national industry and commerce. In 2017, Wuxi first stepped into the club of cities with over 1 trillion GDP in Chinese mainland. Wuxi enjoys a permanent population of 6.5 million and is the one with features of cities situated in the Yangtze River Delta since its water area accounts for 26% of the total area of 4,627 square kilometers.

In May 2007, because of an outbreak of cyanobacteria in Taihu Lake, a water with severe eutrophication made it impossible to guarantee the potable water for part of Wuxi citizens living in the north of Taihu Lake in Jiangsu Province. This incident attracted the attention of the state and local governments. In order to solve the dilemma of water governance under the, traditional economic growth model, the CPC Wuxi Municipal Committee and the Wuxi Municipal People’s Government issued the Control Targets and Assessment Measures for Water Quality of River Sections (Lakes, Reservoirs, Marshes, Springs) in Wuxi (Trial) in August 2007. The results of monitoring the water quality of 79 river sections are clearly included in the performance appraisal of the principals of the cities (counties) and districts. The promulgation of the document represents the beginning of the implementation of the ‘River Chief System’ in Wuxi as well as in China.

The ‘River Chief System’, in short, refers to the principals of the Communist Party and governments at all levels in China assuming the office of the ‘River Chief,’ and taking charge of the management of rivers and lakes and pollution control, as well as the coordination and integration of various forces. It is an innovative system in China’s promotion of waters management. In the River Chief System’s more than 10 years of implementation, all provinces, municipalities and autonomous regions have explored their methods in combination with their respective characteristics, have continuously optimized and improved relevant policies and systems, and have achieved much advancement in waters management.

Since 2008, the trial promotion was carried out in Jiangsu, Zhejiang and other provinces. In December 2016, the General Office of the CPC Central Committee and the General Office of the State Council issued *Opinions on Comprehensively Enacting River Chief System*, which was further written into the *2017 Report on*

	2007	2008	2016	Till Now
Development Stage	Initial Stage	Local Promotion		Full Promotion
Development process	After the outbreak of cyanobacteria in Taihu Lake, Wuxi City took the lead in introducing the River Chief System. In August 2017, Wuxi City issued the <i>Control Targets and Assessment Measures for Water Quality of River Sections (Lakes, Reservoirs, Marshes, Springs) in Wuxi (Trial)</i> .	Beginning in 2008, the trial promotion was carried out first in Jiangsu, Zhejiang and other provinces. In 2014, the Ministry of Water Resources promoted the River Chief System on the basis of local experience and practices. Until the introduction of the Central Document, the River Chief System was explored in 25 provinces, cities and districts across the country. Among them, Beijing, Tianjin, Jiangsu, Zhejiang, Fujian, Jiangxi, Anhui, and Hainan issued special documents, and the other 16 provinces, cities and districts experimented the River Chief System to varying degrees.		On December 11, 2016, the General Office of the CPC Central Committee and the General Office of the State Council issued <i>Opinions on Comprehensively Enacting River Chief System</i> . And since then, the River Chief System is required to be fully implemented across the country. In 2017, the River Chief System was written into the <i>2017 Report on the Work of the Government</i> .

Figure 6.1 Practice Process of the River Chief System

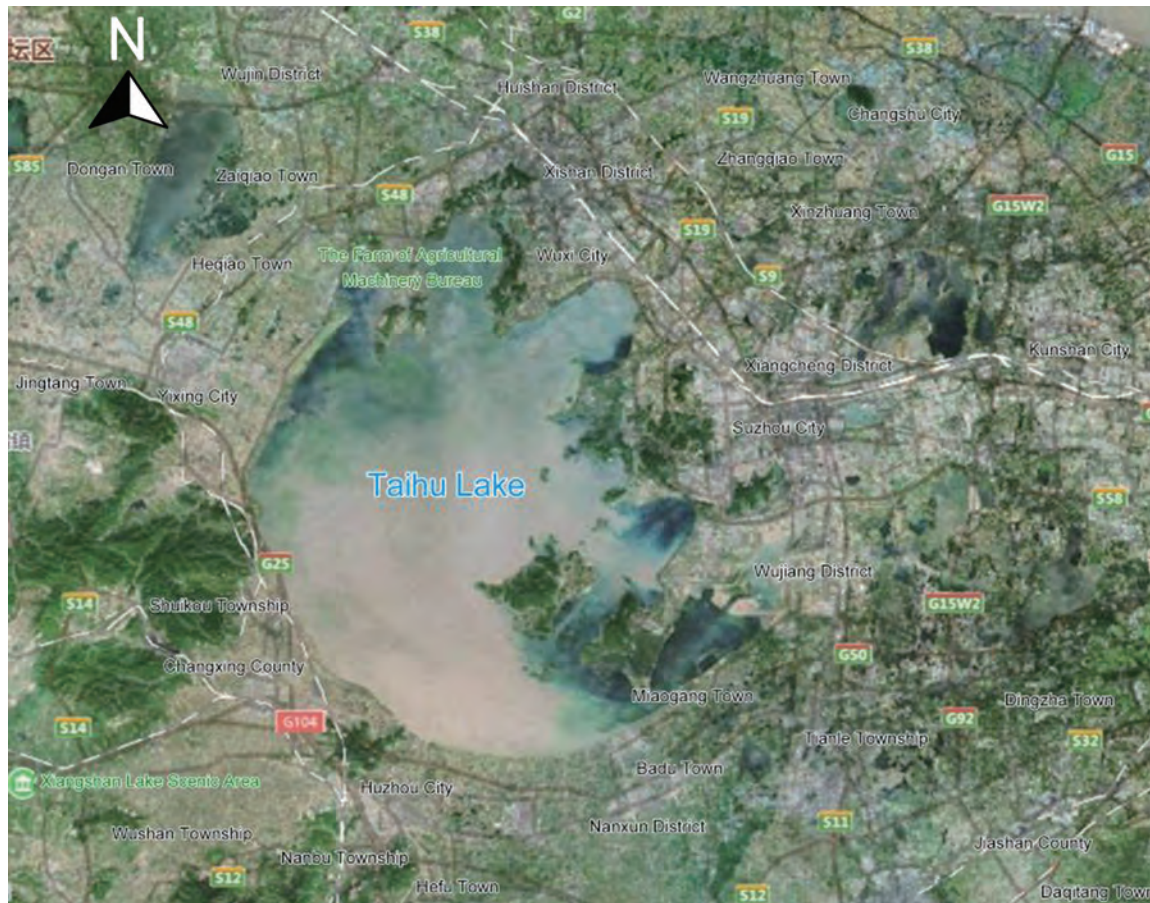


Figure 6.2 Areas around the Taihu Basin

*the Work of the Government.* Upgrading from the Wuxi City's emergency strategy dealing with the water crisis to the national strategy, the River Chief System became an important step of comprehensively deepening reform.

As the birthplace of 'River Chief System,' Wuxi has successively won awards of the Model City of National Eco-conceptualization, the Best Livable City in China, National Model City for Environmental Protection, National Water-Efficient City, National Demonstration City for Water Ecosystem Protection and Restoration, and National Demonstration Area for Construction of A Water-Efficient Society, etc. The process, measures and effects of the waters governance in Wuxi have typical and representative significance. In this case, it is expected that the Wuxi model can provide reference and experience for other cities in the world to jointly create a resilient, sustainable eco-city.

## 1.2 Practice Process

After more than ten years of continuous exploration and practice, Wuxi has gradually formed a management mechanism characterized by 'Leadership of the CPC Committee, Management of river chiefs, Interactive Systems, Shared Governance of Departments and Long-Term Effective Management and Protection' and a working mechanism characterized by 'Full Coverage, Joint Participation, True Implementation, Strict Supervision, and Major Rewards and Penalties' of the 'River Chief System'. Wuxi City has explored a new and distinctive way for waters governance.

### (1) To Realize the Full Coverage of the 'River Chief System' and Form an Interactive System of Multiple Departments

In September 2008, Wuxi City comprehensively established 'River Chief System', and its implementation scope gradually extended from the original 79 sections to all river channels within the city. In 2009, in the Regulations of the River Channels in Wuxi, the duties of River Chief and related work requirements were fixed in the form of local regulations, which provided a strong legal support for the 'River Chief System' within the city. In 2010, the 5,635 river channels above the village level (of which 815 are river channels above the town level) all have a river chief appointed to them. The goal of 'realizing the full coverage of the River Chief System by the end of 2010' of Wuxi City was completed and the River Chief System at municipal, county (district), township (street) and village (community) levels was established. Among them, 4 province-managed river channels, 2 province-managed lakes and 13 main river channels flowing into the lake are led by provincial and municipal leaders, implementing the Dual River



Chiefs System. In addition, Wuxi City has established a lead team for the work of the River Chief System, which consists of multiple departments including water conservancy, development and reform, environmental protection, municipal administration, housing construction, transportation, agriculture and forestry, and urban management. At the same time, the River Chief System Office was established as a permanent component of the water conservancy department.

### (2) To Enact ‘One River, One Policy’ and Highlight Systematic and Precise Governance

The implementation of ‘One River, One Policy’ is an important safeguard measure for the development and enhancement of the ‘River Chief System.’ The river chiefs carry out pollution source analysis for the rivers in their jurisdiction, formulate a comprehensive plan for improvement of the water environment, and conduct precise management of ‘One River, One Policy.’ Among them, the Implementation Plan for the Comprehensive Environment Improvement of the Main Rivers Flowing into the Lake targeting 13 major rivers flowing into the lake in Wuxi City was formulated, and the ‘One River, One Policy’ and ‘One River, One Record’ were established for other river channels at district and township (street) levels. It is also necessary to optimize the improvement plans for rivers and lakes and implement them by grade and year. In the process of waters governance, Wuxi City has persisted in controlling the pollution source, implementing a strict environmental access system for the industry, and has eliminated a number of overly polluting enterprises, high energy consumption, high input, low level and low efficiency. As of April 2017, a total of 2,819 companies were shut down and more than 3,200 companies were moved into industrial parks. At the same time, a series of comprehensive measures such as source control and pollution interception, non-point source pollution treatment, ecological dredging, water diversion and conduction, and connectivity of water system have also brought remarkable results.

### (3) To Clarify Duties and Tasks, Strictly Supervise and Assess, and Consolidate the Effectiveness of Waters Management

In accordance with China and Jiangsu Province’s working plans on River Chief System, Wuxi promulgated, the Implementation Plan for Comprehensive Deepening the River Chief System in Wuxi in 2017 in which the responsibilities of the river chief were upgraded to include water resources management, water pollution prevention, water environment management, water ecology restoration, rivers and lakes resource protection, supervision of law enforcement for rivers and lakes, long-term effective management and protection of rivers and lakes, comprehensive

One Chief Manages One River for Different Sceneries in Different Rivers						
Name of the River:	Qingshui River	District-Level River Chief:	Ni Shouhong	Unit:	People's Government of Binhu District, Wuxi City	
Beginning and End:	Daxi Port to Zhoutan Port	Department-Level River Chief:	Han Zhizhong	Unit:	Commerce Bureau of Binhu District, Wuxi City	
Length of the River:	4.8 kilometers	Sub-District-Level River Chief:	Qin Wenrong	Unit:	Wuxi Taihu City (Huazhuang Sub-District)	
Level of the River:	Third-level	Community-Level River Chief:	Du Guoxiong	Unit:	Zhoutan Community, Huazhuang Sub-District	
Water Quality Target:	Grade III	Supervisory Telephone: 85601157 (Office of Sub-District-Level River Chief); 81173303 (Office of District-Level River Chief)				
Notice Board of River Chief System	<p>With the primary missions of protecting water resources, preventing water pollution, controlling water environment, and renovating water ecological environment, the River Chief is responsible for organizing and leading the management, protection and governance of related rivers, lakes and reservoirs, and takes charge of the section's water quality reaching standard. The main responsibilities include:</p> <ol style="list-style-type: none"> <li>I. Grasping the basic situation of river water environment, to form 'One River, One File';</li> <li>II. Studying and formulating controlling measures of river water environment, to form 'One River, One Strategy';</li> <li>III. Coordinating major problems such as the management of river water environment;</li> <li>IV. Promoting the implementation of key projects, and supervising and guiding relevant responsible parties and departments to fulfill their responsibilities;</li> <li>V. Facilitating the transformation and upgrading, as well as the governance of water environment, such as the sewage interception and pipe collection and ecological restoration.</li> </ol>					
	Introduction to the River	The east-west Qingshui River starts from Daxi Port to Zhoutan Port, with a length of 4.8 kilometers and an estuary width of 18 meters, covering an area of 86,400 square meters. With a river bank length of 9,600 meters, it flows through four communities, including Nonglian, Taihu, Sangnan and Zhoutan.	Management Target of River Chief System	In the river, there is no direct discharging of sewage, barrier-free water, no damage to the embankment, no siltation at the river bottom, no rubbish on the river, no destruction of greening, and no illegal buildings along the bank, so as to significantly improve the appearance of water environment, the water ecological environment and water landscape, and basically realize an 'Ecological River with Clear Water, Green Banks, Barrier Free and Beautiful Scenery'.		

Figure 6.3 River Chief System Signboard (Qingshui River)

functions of rivers and lakes and other aspects. At the same time, Wuxi City's strict assessment mechanism includes the staged and year-end assessment, and the assessment results are taken as an important basis for the comprehensive evaluation of local leaders. The Accountability Measures for the Governance and Protection of Taihu Lake Water Resources in Wuxi and the 'One-vote Veto' Opinion of Organization Department of the CPC Wuxi Municipal Committee on the Poor Implementation of Major Decisions of Municipal Government and CPC Committee were also issued as supports to carry out strict accountability on those who fail to control pollution, and form a strong internal driving force for waters governance, which is conducive to actively consolidating the effectiveness of water management over the years. In addition, a 'River Chief Management Signboard' is erected at each river, which displays the basic information of river channels and river chiefs subject to wide supervision, complaints and reports from the public, so that waters governance becomes a common activity of the whole society.

#### (4) To Encourage Engagement of the Public and Actively Carry Out Volunteering to Protect River Channels

Wuxi enjoys over 5,000 volunteers working on this project and invites an array of people to take on 'Enterprise River Chief,' 'Nongovernmental River Chief' and 'Public River Chief,' working together on management and protection of rivers and lakes. With activities themed with 'Protecting and Being Young Guards of the Mother Rivers,' Wuxi welcomes several model volunteers including 'Xiaoshuidi Team' from Wuxi Yangming Central Elementary School, 'Hexiaoqing' Volunteers from Nanchang Street Primary School and Volunteering Supervision Team of River Channels from Wuxi Aviation Industry Park. Additionally, a series of special reports, such as 'River Chiefs' Stories on River Governance,' 'Stories of River Chiefs' and 'Journals of River Chiefs,' and special promotion themed with 'My River Chief and My River' have been developed to tell community-level river chiefs' stories about river governance, which further expand the influence of River Chief System.

#### (5) To Actively Innovate the River Chief System and Build Highlights of It

Wuxi City has been proactively exploring new working modes of River Chief System based on actual experience during the exercise of it. It strives to build a rating system for river channel protection and create a mechanism of model river channels, evaluating the results of governance and long-term management and protection and leading follow-up work; to prepare *Evaluation System on Fulfillment of Duties in Integrated Governance of River Channels for River Chiefs in Counties*

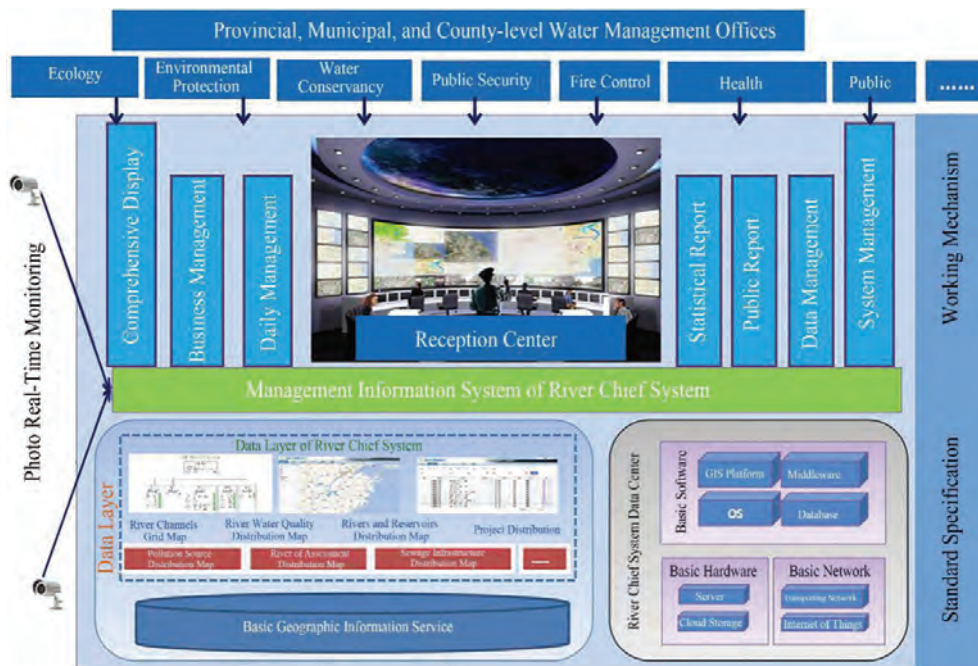
*and Districts of Wuxi City*, supervising and evaluating river chiefs' fulfillment of duties in integrated governance of river channels and calling on them to play a significant role in corresponding works; to establish the 'River Section Chief System' and 'River Basin Chief System' based on the original River Chief System, asking major leaders from governments to assume the office of 'River Section Chief' or 'River Basin Chief' to systematically carry out integrated governance on rivers and lakes according to areas and river systems; to implement Security Deposit Mechanism of River Chiefs on trial, demanding river chiefs at all levels to sign a performance bond that integrates improvement of water quality and effects of governance with their performance evaluation. The mechanism plays a significant role in supervision since it can leverage the deduction of security deposit and rectification against river chiefs with poor performance to create a big change.

### 1.3 Problem Analysis

The 'River Chief System' work lasted for more than 10 years. It has made some breakthroughs in management structure, system and mechanism and governance effectiveness, and accumulated a lot of experience. At the same time, there are also some problems and difficulties.

(1) **There Are still Barriers in the Governance of Inter-provincial Water Areas.** The 'River Chief System' is mainly implemented by each province in their respective administrative regions, and there is no river chief setting for the rivers and lakes across provincial administrative regions. Although the subject of administrative management of the inter-provincial rivers and lakes is often clearly defined, due to their connectivity, pollution control and industry access, integrated and comprehensive treatment of the river basin is required. At present, at the junction of Zhejiang Province and Jiangsu Province, the position of 'Joint River Chief' was initially explored, trying to break administrative barriers, but no promotional trend has yet been formed.

(2) **There Is an Imbalance in the Management of the River Chief System.** Waters governance is a long-term and arduous task related to people's livelihood. It is not a one-time task, nor is it a task for managerial supervision and inspection. However, due to imbalances in awareness, ability level, institutional construction and local promotion efforts, there are still some problems such as individual river chiefs failing to perform their duties properly and a decline in their enforcement capacity. At the same time, the water quality monitoring system mainly aims at primary river channels, while covering less small river channels, creating a weakness in water governance.



Source: <http://www.uhope.com>.

Figure 6.4 Suggestions on the Organization Structure of Management Information System of the River Chief System

(3) Water Quality Improvement is Difficult and the Rebound Risk is High. Whether in Wuxi or other cities, some rivers can get polluted again after treatment. In the case of water treatment in various places, it is still difficult to control the pollution sources such as direct discharge of sewage, mixed pipe network and agricultural non-point source pollution. In addition, due to the lack of effective management on old urban underground sewage pipe network, the effectiveness of governance cannot be intensified and maintained and water quality in some river basins decreases again.

#### 1.4 Experience Summary

Originated from Wuxi, 'River Chief System' was replicated and promoted throughout China, and continued to innovate and improve. It has achieved good results in pollution source control, river water quality improvement, drinking water safety improvement, ecological restoration, and environmental awareness. This is of great significance to cities in other countries, especially those in developing countries such as Asia and Africa, in aspects of dealing with water pollution hazards, enhance pollution control capacity, and improve water resources management capacity in the process of rapid urbanization.

(1) Carry out Systematic and Precise Waters Management. Wuxi City insists

on formulating and perfecting ‘One River, One Policy’ and coordinating upstream and downstream, left and right banks and mainstream and tributaries specific to different rivers and lakes in different regions, with different grades and functions. Wuxi City regards waters management as a systematic project and implements different policies for different rivers. At the same time, Wuxi City also reinforces precise, comprehensive, legal, long-term and source governance to explore and form a new model of ‘Five Joint Methods of Waters Management,’ highlighting the management of both phenomena and root causes.

**(2) Unite Multiple Departments into a Tightly Connected Web of Responsibilities.**

In the vertical direction, from the municipal level, through district (county) and town (street) to village (community) level, a series of ‘ecological responsibility chains’ has been formed. In the horizontal direction, various departments such as the development and reform, economy and trade, finance, planning, construction, land, engineering and public security gather their forces to give full play to the functions of various departments in areas like policy, fund, technology and law enforcement. In this way, it not only are the problems of shirking responsibilities, and unclear responsibilities and powers between departments avoided, but cross-regional governance is also promoted.

**(3) Establish Clear Management, Assessment and Accountability Mechanisms.**

By issuing local laws and regulations, government documents and regulations, the main duties of river chiefs at provincial, municipal, county, township and village levels are clearly defined at the national, provincial, and municipal levels. At the same time, it is necessary to improve assessment of River Chief System implementation and of the duty performance of the river chiefs, as well as clarify the reward and penalty system.

**(4) Harness the Power of Society and Public to Achieve Shared Governance.**

The ideal waters governance structure should be led by the government, comprised of corporate entities, and involve public participation. Although the River Chief System is promoted by the government’s administrative powers, it attaches great importance to the utilization of the power of the public and society in the Practice Process. Wuxi City employs ‘Civil River Chiefs,’ the ‘Chiefs of River Channel Sections’ and volunteer river patrols to supervise and assist relevant departments in dealing with river channel problems in a timely manner through WeChat groups and the River Chief App. In addition, in other cities in China, there are also civil river chiefs such as ‘Enterprise River Chiefs,’ ‘Farmer River Chiefs’ and ‘Civilian River Chiefs,’ which have enhanced the society’s attention and participation in

water management. In addition, Environmental publicity and awareness training in schools, communities, and media platforms are important for river protection and water management.

(5) **Innovate System Management and Improve the Effectiveness of Waters Management.** It is necessary to constantly optimize and improve the ‘River Chief System’ and rework ideas and measures to seek breakthroughs. The ‘River Section Chief System’ is derived from the foundational ‘River Chief System’ in Wuxi City. According to the characteristics of the water system, rivers are divided into districts and sections to establish a mode of sectional management. Compared with the previous mode where river chiefs managed their own districts and hardly cooperated with each other, the river section chiefs can now coordinate the provincial, municipal and district relations between upstream and downstream, as well as the left and right shore for the rivers that flow through multiple districts, which is helpful in forming joint forces and settling the problem of shirking responsibility.

In addition, Wuxi City strengthens scientific and technological innovation and continuously explores water ecological restoration technologies and water pollution control technologies that are safe and effective, with relatively low capital investment, such as breeding ‘indigenous flora’ to improve the self-purification capacity of waters. Wuxi City also focuses on cooperation with research institutes and universities, and makes greater efforts to promote the utilization of new materials and new technologies.

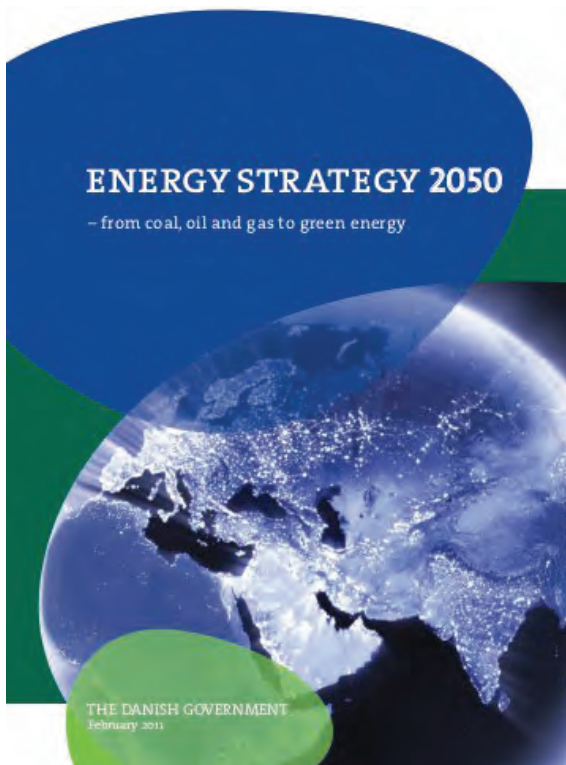
## 2. Copenhagen, Denmark: Ecological Governance Innovation

### 2.1 Background

The concept of the ‘smart city’ is being increasingly incorporated in the construction of eco-cities, as the next generation of information technologies including big data, IoT, and artificial intelligence evolve. These technologies are significant for urban ecological governance and green development. Based on experience gained from developed cities in Europe and the United States, construction of smart eco-cities must pay greater attention to building an open innovation space that is person-based, citizen-involved and society-oriented as well as creating public values. The construction should focus on addressing the needs of the public, take advantage of new information technologies and social media to invite more users to participate, and pool everybody’s wisdom to consistently drive innovation on governance models. Consequently, smart cities are able to achieve

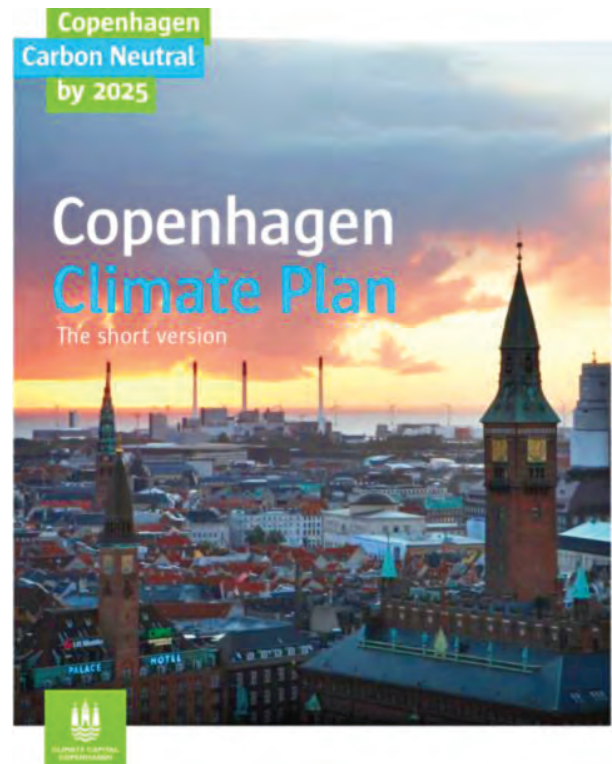
a reasonable utilization of urban spaces and resources and advance sustainable development in an urban economy, society and environment.

Copenhagen is an outstanding model for ecological and sustainable cities, which was selected by the European Union as a European Green Capital for 2014. In 2012, Denmark issued Energy Strategy 2050, confirming a string of energy saving and transitional goals. The country works on leveraging energy transition to encourage green growth, create green employment and competition, and wean itself off of fossil fuels like coal, oil and natural gas. Copenhagen proposed in the CPH 2025 Climate Plan that it would be the first carbon neutral city across the world by focusing on four areas—energy consumption, energy production, green mobility and the City Administration. The 2025 Plan will be accomplished through two stages: 1) cut CO<sub>2</sub> emissions by 20% between 2005 and 2015; and 2) reduce CO<sub>2</sub> emissions in Copenhagen to zero by 2025. Hence, the Copenhagen Municipality makes the utmost of information technologies like big data and IoT, consolidates cooperation between the public and private sectors and drives collaboration between the government, enterprises, universities and non-profit organizations, aiming at promoting green growth of the city and ultimately achieving the goals



Source: <http://denmark.dk/>.

Figure 6.5 Energy Strategy 2050



Source: <http://en.klimatilpasning.dk/>.

Figure 6.6 Copenhagen Climate Plan



proposed. According to relevant data, Copenhagen’s carbon emissions in 2014 decreased by 31% compared with 2005, and the first phase of carbon reduction targets has been exceeded.

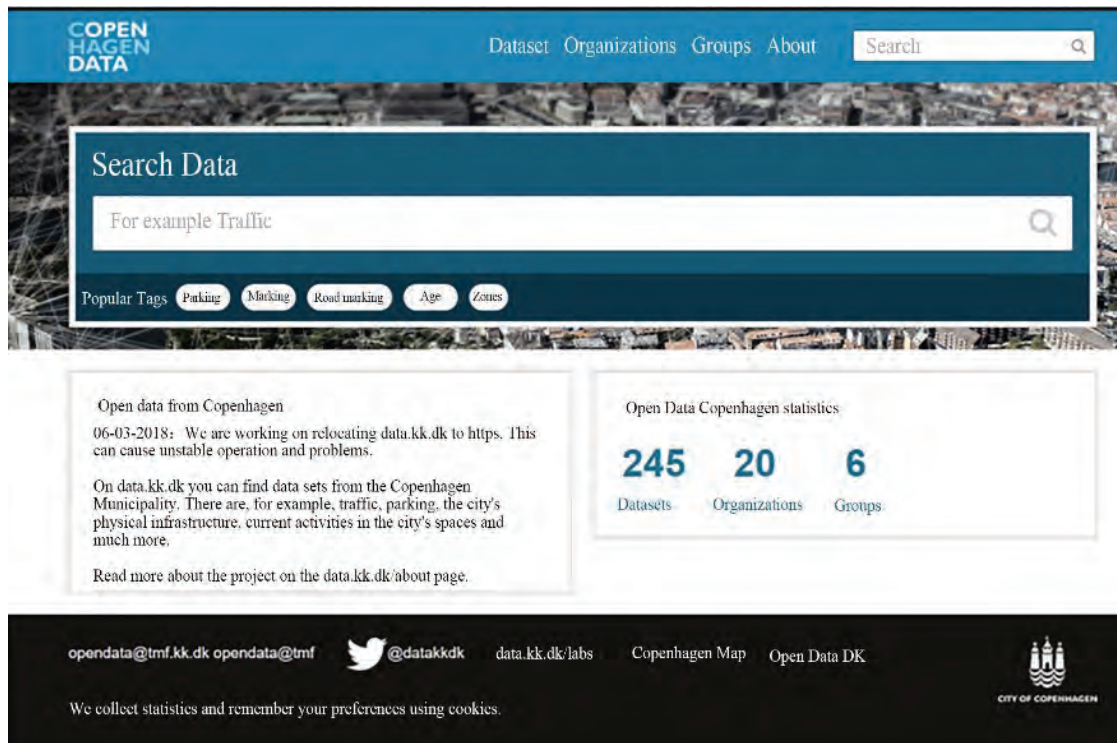
## 2.2 Practice Process

Staying focused on realizing a sustainable environment development and improving citizens’ living standards, Copenhagen Municipality has figured out a smart eco-city solution covering various fields with data collection platforms, intelligent infrastructure construction, multi-participation systems, and so on during its eco-city governance.

### (1) Building Big Data Platforms

Building of big data platforms is an important measure for advancing the construction of a smart eco-city. Copenhagen built three significant big data platforms, including Open Data, IoT Platform for Cities and City Data Exchange, to facilitate acquisition and utilization of data.

Open Data aims to build an open platform of basic urban data, which incorporates diversified functions, to deal with various data like transportation and parking facilities. Data sets concerning urban ecological governance on Open Data



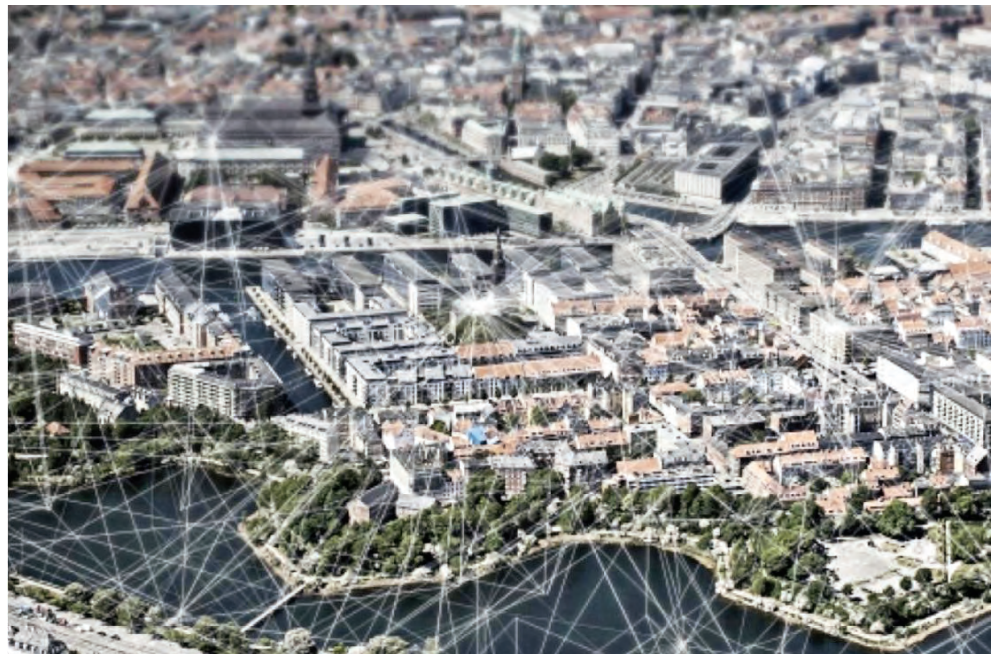
Source: <https://www.data.kk.dk/>.

Figure 6.7 Open Data

include quality of the natural environment, energy consumption, water quality and solid waste. The platform is open to all citizens and enterprises, which can get access to data for free for analysis and research, development and application, trend evaluation, etc.

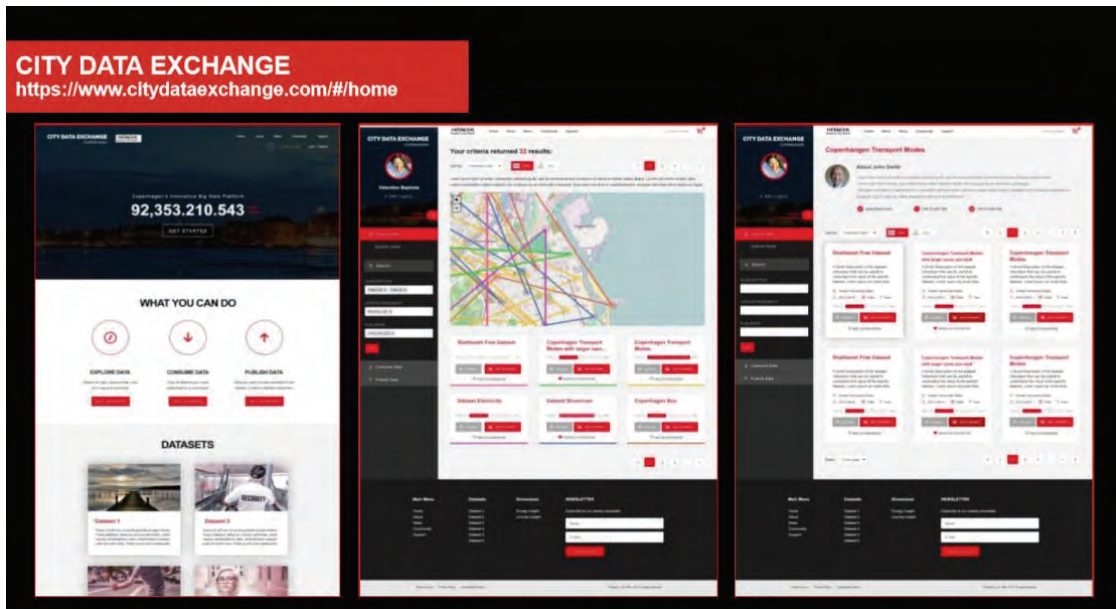
IoT Platform for Cities is a program launched by Copenhagen, Antwerp and Helsinki, which is an EU Horizon 2020 innovation project. Complex data from different sources can be standardized through the interconnected platforms, facilitating data utilization among cities and jointly creating the next generation IoT platform for cities.

City Data Exchange is an integrated data service jointly provided by Copenhagen Municipality and Hitachi, aiming to establish a data sharing center for the government and enterprises. The program strives to advance innovation and inspire new ideas, improve living standards in Copenhagen, and assist the city in becoming a carbon neutral city by 2050. The platform is sponsored by Copenhagen Municipality, CLEAN (a cleantech cluster), the Capital region around Copenhagen and other partners. City Data Exchange can be used for integrating data from various sources, such as the census, criminal statistics, energy consumption, air quality sensors and traffic sensors, enabling the sale and purchase of data. It will further surpass the current Open Data, building a more intelligent, more sustainable, greener Copenhagen.



Source: <https://cphsolutionslab.dk>.

Figure 6.8 IoT Platform for Cities



Source: <http://www.hitachi.eu>.

Figure 6.9 City Data Exchange

## (2) Creating Copenhagen Solutions Lab

Copenhagen Solutions Lab is an incubator for the government to create a smart eco-city. It includes five main themes: people and flows, digital services, data-driven operation and supervision, environment and climate, and lighting and urban life. Copenhagen Municipality, in partnership with private enterprises including Cisco and Citelum, provides products and solutions for traffic, parking, outdoor lighting, climate protection, energy supply and many other areas. They take advantage of information technologies to formulate data-driven solutions, in order to optimize and empower urban operations and finally realize Copenhagen's ambitious goals.

First is the Street Lab. Areas around Copenhagen City Hall were selected as a test field for smart eco-city solutions, further developing the whole city into a large laboratory. Since Copenhagen Municipality established the Street Lab test areas in 2016, the project on HC Andersens Boulevard has been monitoring dynamic data such as smart parking, waste management, air quality, noise, water management, movement monitoring and tourist WiFi. The project makes use of sensors installed in street lamps, dustbins and drains as well as real-time data that is collected by Internet technologies and transmitted to a smart grid, for readjusting transportation and energy consumption, and improving the city's environment, and security and emergency response abilities. Street Lab helps researchers test the feasibility of



Source: <https://cphsolutionslab.dk>.

**Figure 6.10** Street Lab

solutions, enabling Copenhagen Municipality to offer better services for citizens during operation of the smart eco-city and assess what can be scaled to larger areas of the city.

Measurement of air quality is a typical case of Street Lab, which mainly relied on expensive equipment located in official measuring stations in the old days. However, Street Lab can successfully measure contaminant particles, noise and weather on urban streets in a more flexible manner with smaller and cheaper sensors. Infrastructures within the one-square kilometer test area are equipped with diversified wireless technologies and employ sensors to connect to each other and share information. As a result, researchers can get a critical mass of measured data. For instance, data collected by sensors can be used for analyzing significant differences of air quality when planning to build schools or kindergartens. Copenhagen Municipality also is able to prioritize matters for local authorities based on more data analyses.

Second is Danish Outdoor Lighting Laboratory. Danish Outdoor Lighting Laboratory (DOLL) is situated in the center of Copenhagen involving over 40 competing outdoor light solutions as well as multiple parking, waste and environmental sensing solutions. DOLL is strengthened by Cisco's Smart+Connected Digital Platform. This technology connects city infrastructure over a common network and data layer, which improves operational effectiveness



Source: <http://www.lightinglab.dk/Living-Lab/>.

Figure 6.11 Danish Outdoor Lighting Laboratory

by allowing them to monitor, control and optimize each solution, in real time, to meet what their citizens' needs faster and easier while enhancing productivity, cost-efficiency and overall citizen quality of life. Meanwhile, Copenhagen Municipality has entered into a partnership with Silver Spring Network, Citelum and SELC to launch an enhanced urban lighting system, which is expected to network 20,000 street lights in Copenhagen and establish a remote lighting management and control network. The project strives to improve energy efficiency and lower operating costs. Replacement of high pressure sodium lamps (HPSL) with LED ones will reduce energy consumption by 65%, while providing better lighting.

### 2.3 Problem Analysis

Although Copenhagen has applied the next generation technologies like big data and IoT to governance of an eco-city, it still faces some problems and challenges.

(1) **Open Data Has Not Been Perfected yet.** Since sources of data have not been soundly integrated, users cannot conveniently find all the data they need. Furthermore, the government plays a leading role in building the data platform. Since horizontal communication and integration skills are not well developed among cooperators and fields, and some valuable data is not open to the public, research institutes and enterprises have not been able to extract new value from existing data or develop possible solutions.

(2) **City Data Exchange Has Not Been Soundly Developed.** Many organizations and enterprises are hesitant to buy and sell data on City Data Exchange because the marketplace is still in the early stage of development. On one hand, buyers

are accustomed to turning to traditional data providers when necessary and are not familiar with the open City Data Exchange. On the other hand, providers are reluctant to upload their data because they are afraid that competitors could easily get access to their resources.

(3) **Citizens are Concerned about Private Data Security.** Actually, a quantity of data gained by mobile phone signaling or GPS is related to private personal activities, the security of which citizens are sensitive about. For example, a telecommunication company once sold data to a government-run tourism website, which aroused a hot debate. Similarly, ecological governance is faced with the same problem. In particular, the General Data Protection Regulations (GDPR) promulgated by the European Union in 2018 has become more stringent in the collection and use of personal data which will ultimately challenge data analysis-based urban experimental projects.

(4) **Mechanism of Collaboration among Enterprises, Universities and Research Institutes still Needs Improvement.** Universities, research institutes and enterprises are diversified in technological capabilities, so that a mechanism of collaboration favoring cooperation and communication needs to be built for implementation of new projects and industrialization of new technologies. Enterprises also need financial support from the government to invest new technologies and projects, so that they can strengthen their development, test new projects and determine more successful urban solutions.

## 2.4 Experience Summary

Copenhagen closely integrates the construction of an eco-city with that of a smart city, which attracts multiple parties including the government, enterprises, universities, research institutes, citizens and non-government organizations to take on their full roles. As a result of that, it is a role model for the utilization of new technologies in eco-city governance.

(1) **Apply the Next Generation Information Technologies Like Big Data and IoT to Governance of Smart Eco-cities.** Acquisition and integration of basic data is the premise of smart eco-city governance. Construction of Open Data can build an important bridge between data providers and users, creating an environment for testing urban solutions.

(2) **Enterprises and Research Institutes can Launch Flexible Operations to Implement Related Plans When They Cooperate with the Government rather than Be Led by It in Building Smart Eco-cities.** During project implementation, integration of top-down policies with bottom-up solutions has effectively helped

enterprises, investors and public organizations learn about green economic growth from each other, so as to more efficiently realize public interest related goals.

(3) **Build Big Data Platforms to Advance Data Exchanges between Public and Private Sectors as well as Improve the Frequency and Value of Information Utilization.** Government departments and enterprises are capable of capturing more data for analysis and study of urban issues. SMEs and start-ups are able to propose innovative urban solutions with data analysis. Citizens can directly participate in the construction of big data platforms, thus promoting smart eco-city governance.

(4) **Projects Including Street Lab Enable Cities to Become a Large Laboratory for Ecological Governance, in Which All Players Test Various Solutions Based on Free and Open Big Data Platforms.** The city, as a smart and open test field, attracts research institutes, enterprises and the public to address challenges in urban life with technological innovation and constantly explore new models for sustainable urban development in the future.

### 3. Denman Island, Canada: Community Land Trust System

#### 3.1 Background

Since the 1980s, with faster urbanization and growing populations globally, housing prices have remained stubbornly high, and more and more families need to rely on indemnificatory housing to solve such problems. Thus, it's vital to build indemnificatory housing. However, the construction of indemnificatory housing is inseparable from the support of land resources. Those cities that are developing rapidly always hope to exploit the value of land resources as much as possible-the government releases land at the highest prices possible, developers monopolize development and pricing, and each party pursues maximum benefits, resulting in an inverse proportion of land profitability and housing affordability, and a lack of indemnificatory housing. Meanwhile, in the construction of indemnificatory housing, in addition to the power of the market and the government, the power of society which is usually ignored also plays an important role. Developed countries and regions such as the United States and Canada are trying to explore more effective governance models. Housing experts and communities gradually are aware that Community Land Trust (CLT) is one of the best ways of land governance.

The severe housing crisis in British Columbia, Canada ('BC' for short) where household incomes couldn't keep pace with sharp rises in land and housing prices, has severely affected their affordability for renters and potential homebuyers.

According to the BC Non-Profit Housing Association (BCNPHA) 2016 census results, 21.3% of households spend half or more of their income on rent, which is the highest among all provinces in Canada. In recent years, BC has resorted to the continuous development of CLTs to solve the housing problem.

Denman Island is a small island in BC near Vancouver Island with a population of approximately 800 households. It is known for its marine environment on the west coast. In the 1990s, inadequate affordability of land and housing became an important factor in reducing the quality of life of the residents on the island. The influx of an array of relatively affluent new people led to an increase in housing prices, which in turn resulted in a shortage of affordable and rental housing on the island. Besides, many rental homes were previously provided by local homeowners and the availability of this type of rental housing has declined significantly as fewer and fewer owners buy properties on Denman Island.

In response to these pressures, the residents of Denman Island who wanted to address their needs for affordable housing jointly established the Denman Community Land Trust Association (DCLTA) in 2008. DCLTA sells or leases affordable housings to eligible low-income earners by retaining land ownership and selling only home ownership.

The Denman Island affordable housing program gained official support from the government. As a community within a fragile island ecosystem, the land use planning on Denman Island is hosted by the Island Trust Foundation, which is a federation of local island governments with a mandate (Islands Trust Act) to make land use decisions that will ‘preserve and protect’ the islands. The DCLTA, with the support of the government and the Island Trust Foundation, can therefore develop and build affordable housing in an environmentally responsible manner consistent with the ecological roots of Denman Island.

### 3.2 Practice Process

#### (1) The Land Trust Is Committed to Providing Safe, Economical and Stable Housing for Low-income Residents.

The DCLTA obtains land on Denman Island from donations, bequests or low-cost purchases by local landowners, minimizing the transfer of costs to low-income tenants. The DCLTA then assesses whether the land is suitable for development in terms of affordability for low-income individuals and families. For example, the DCLTA gives priority to single-family houses with access to garden space, and the opportunity to develop a home industry.

Taking responsibility for land, projects and follow-up management, the DCLTA



will consider leasing land to non-profit organizations such as cooperatives and farm collectives before developing affordable housing. This model allows the organization to retain control over the land to ensure the interests of the community. Efficient land and housing asset management ensure that rents do not rise with operating costs (The commitment of DCLTA is to maintain rental rates at no greater than 30% of tenant’s income and reduce them year on year.). Meanwhile, all the income is reinvested in trusts to provide affordable housing in more non-profit ways and reduce the burden on everyone.

**(2) Public-private Partnership Promotes the Landing and Operation of Multiple Affordable Housing Projects.**

In July 2010, the DCLTA received its first land donation and launched the first affordable housing project—the DCLTA’s Ridge Project. Since May 2014, DCLTA has signed Lease Agreements with tenants one after the other. In April 2015, the Ridge Project was completed and the first low-income tenant moved in.

In November 2013, the affordable housing project for seniors was launched. Partners in the project from the private and public sectors include the Canada Mortgage and Housing Corporation (CMHC), the Comox Valley Housing Task Force (CVHTF), the Comox Valley Regional District (CVRD), Forests, Lands, Natural Resource Operations & Rural Development (FLNRO), the Ministry of Transportation and Infrastructure (MOTI), the Real Estate Foundation of British

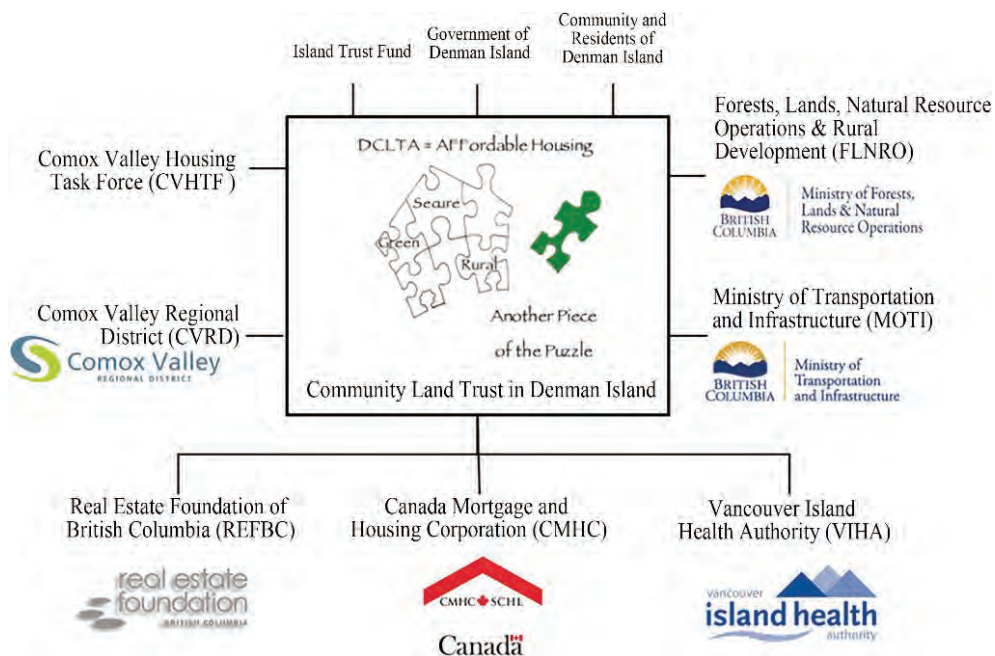


Figure 6.12 Community Land Trust Model in Denman Island

Columbia (REFBC), and the Vancouver Island Health Authority (VIHA). As of March 2018, the DCLTA had completed the preliminary work of the affordable housing project for seniors and reached a development consensus with its partners.

The DCLTA is currently engaged in the following activities: 1) Working to raise fund to purchase the land, achieve the requisite approvals, and invite the community engagement necessary for its Seniors' Affordable Housing Project; 2) Continuing to involve the Denman Island community, support affordable housing-mandated organizations (some as far away as the Maritimes) and add a voice to developing housing strategies (Islands Trust Housing Forum, Canada's 'Let's Talk Housing'); and 3) Conduct real estate data research projects to provide land status inquiries for all of Denman Island's housing and assist in assessing potential donations or land purchases.

### (3) Getting Along with the Island's Ecology.

Considering the beautiful marine and island ecological environment of Denman Island, how to deal with the relationship between housing construction and ecological protection is a key issue for affordable housing projects. Although there are many difficulties in the process of implementation, the DCLTA has slowly and progressively protected the land for indemnificatory housing on Denman Island through various measures.

**The residential buildings suit the terrain of the island.** Building different types and sizes of dwellings in various areas of the island (without consideration for the development of multi-storey buildings) by designing a variety of affordable housing, fits with the overall style and features of the island's ecology and maintains a balance between housing, environmental and social goals. This flexibility is necessary in view of the availability of donated land.

**Innovative residential density transfer method.** The policy on housing density in Denman Island reads 'The overall residential density on Denman Island should generally not increase beyond that permitted by existing zoning on January 12,000 except that a modest increase may be permitted to accommodate zoning amendments for special needs and affordable housing.' Also, via Bylaw 185 (May 2009), the Denman Island Local Trust Committee has established an innovative 'Density Bank' that enables the transfer of residential densities (potential dwellings) to create affordable housing. Thus, in addition to directly acquiring ownership of land, the DCLTA may acquire extinguished densities from land designated Conservation or unused densities from parcels with more than one permitted density for use on leased, donated or purchased land.



Figure 6.13 Affordable Housing under Construction



Source: <http://www.denmanaffordablehousing.org/DCLTA/Photos.html>.

Figure 6.14 Affordable Housing Integrated with the Environment

**Address climate change and sustainable development of the island.** The DCLTA focuses on the island and its lifestyle, and is devoted to protecting the environment. Based on current energy-efficient building practices, taking into account climate change adaptation and cost-effectiveness, and focusing on island sustainability and community integration, the DCLTA continues to explore the application of advanced technologies such as solar energy in the community. It also studies septic tank and waste water recycling systems to comply with provincial regulations and creates sustainable management templates for affordable housing.

### 3.3 Problem Analysis

The Denman Island Community Land Trust System has made significant progress in providing affordable housing to low-income groups. However, there are still some problems unsolved. In the future, it is necessary to continuously study how to provide affordable housing to meet the needs of a community with limited land resources and ecological environment of an island.

#### (1) The Project Cycle Is Long.

Considering the protection of the fragile island ecosystem, affordable housing project of Denman needs to go through a much longer preliminary process than the general housing project, including site selection, development application, environmental impact assessment, planning and adjusting, site formation, consultation with partners and signing of memos, as well as organizing community information meetings and public hearings. After the launch of Seniors' Affordable Housing in 2013, the basic preliminary work was completed within 5 years. However, the design and construction have not yet been initiated, so people in urgent need of affordable housing cannot be settled in time.

#### (2) Difficulties in Continuing Land Donations and Investment Attraction.

Due to land resource constraints and the high cost of land on the island, the DCLTA is challenged with continuously attracting land donations and social investments. Despite support from all parties, the DCLTA still needs to strengthen cooperation with the government and continuously raise funds to purchase land at low cost in some cases to support project construction and ensure the continued success of the model. The participation of non-profit organizations is still welcomed in order to bring together small non-profit organizations with a shared vision and mission to join existing projects and in turn creating new projects.

#### (3) Public Confidence in Community Land Trust Needs to Be Improved.

Although more and more countries have begun to introduce this model to alleviate the housing crisis, Community Land Trusts have not been widely accepted



Source: <http://www.denmanaffordablehousing.org/DCLTA/Photos.html>.

Figure 6.15 Flower Activity at an Affordable Housing Community

compared to other established housing security models. The DCLTA has adopted a variety of methods to show how Community Land Trusts can be of social benefit to all the public, and enhance the interaction of community residents such as hosting community food and flower activities. However, in the course of the project, the resistance and indifference caused by the public's lack of understanding will still be encountered, which hinders the smooth progress of the project.

### 3.4 Experience Summary

#### (1) Provide Sustainable and Versatile Housing Security Tools

A CLT can be regarded as an innovative system in which multi-subjects participate in land governance and can be used as a participatory method for land development, as a model for asset management and redevelopment and/or rehabilitation, and as a valuable tool for providing affordable housing across the housing spectrum. While retaining land ownership, it is committed to building new housing, especially for vulnerable populations and protecting existing affordable housing. CLTs are a hub for a diversity of stakeholders to redevelop housing assets and create a broader, more diversified portfolio that allows cross-site subsidies on capital and operating costs. Therefore, the Community Land Trust System is flexible and suitable for a wide range of applications.

### (2) Establish Uniform Management Organization

Community Land Trusts conduct uniform management of land acquisition, development, construction, sale and lease, post-maintenance management and community construction, which is more open and transparent with a simple procedural system. They can effectively allocate housing resources to protect the interests of community members. Since the Community Land Trust is owned by the residents, it is supervised by all residents.

### (3) Coordinate the Protection and Utilization of Natural Resources and Ecological Environment

Since the Community Land Trust System has high dependence on donations or low-cost land, it is more effective in rural areas where land is more likely to be donated. CLTs need to work with local land use planning agencies to develop appropriate policy mechanisms for the project. The housing built needs to respond flexibly to land availability and sustainable development, and develop affordable housing without damaging local ecological environment.

### (4) Fully Understand the Needs of All Parties and Provide Benefits for All Parties

As an innovative housing problem governance model can benefit multi-parties. For local governments, a CLT is a place for municipalities to deploy public land assets without risking loss to the market and where social and financial returns can continue in perpetuity. For community, a CLT stewards assets for the community, providing affordable housing in perpetuity as well as strong security of tenure, and can improve the quality of community living, such as parkland, gardens, day care, community centers, renewable energy facilities, etc. For buyers and renters, CLTs offer strong security of tenure, including financial education, legal consulting, etc.. The CLT includes more than one tenure type, it can allow members to move between housing types dependent upon their needs and abilities, and reduce rental costs over time. For investors, investing in a CLT allows investors to achieve a social impact while earning a safe return on investment. The CLT can also monitor homebuyers and buy back the home if the homeowner is at risk of default, ensuring the home stays within the trust



Figure 6.16 Community Land Trust Provides Benefits to All Parties

and preventing the homeowner from defaulting on their mortgage. For non-profit organizations, CLTs allow non-profit organizations to grow and build capacity.

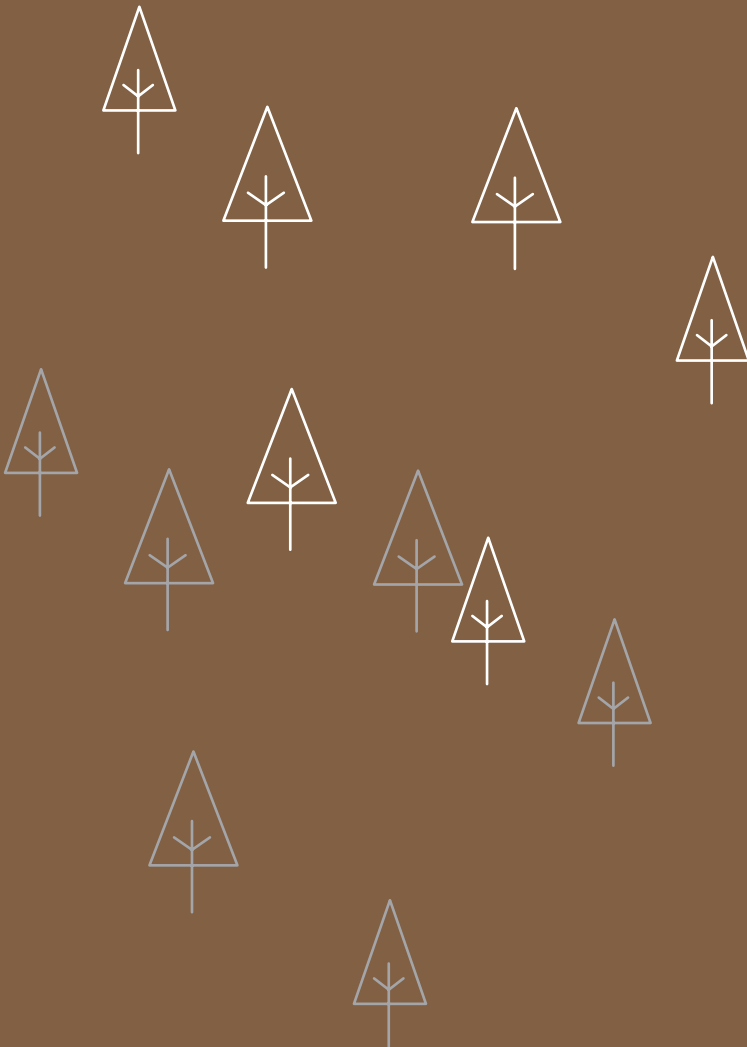
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Chapter VII  
International Cooperation







## Introduction\*

This chapter mainly analyzes cases including global climate governance in the context of: 1) cooperation and communication among global cities; 2) efforts and achievements of international organizations concerning urban ecological civilization construction and sustainable development. The chapter, relying on these cases, tries to emphasize the importance of urban administrators in urban cooperation and the necessity of regulatory and institutional urban cooperation. It also calls on promotion of concepts like ecological civilization and green development, and their integration with urban development strategies during urban cooperation. It finally concludes that application and advancement of science and technologies are the only way to realize green development of eco-cities.

This chapter is meant to offer comprehensive suggestions on urban cooperation in green development of eco-cities to urban leaders. It strives to legalize, institutionalize and normalize participation of cities in global governance, as well as to diversify and improve efficiency of the related implementation.

## Reference Cases

### 1. Global Climate Governance in the Context of Cooperation and Communication among Global Cities

#### 1.1 Background

As limitation of global climate governance led by transnational cooperation is increasingly prominent, sub-state actors, particularly cities, are playing a growing significant role in this field. Cities held Conferences of the Parties, established transnational municipal climate networks and influenced their countries' climate policies. All of these are catalysts for the global climate governance development. It is to explore that breakthrough in multilateral and multi-layer global climate

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governance and diversification of main participants can further improve the role of cities in this governance system, based on diplomatic activities on climate changes held in cities, climate alliances of cities and the carbon market governance. Given to existing practices, cities have distinctive roles in climate governance because conferences of the parties have been held in many representative cities. Transnational municipal climate networks (e.g. C40) as platforms for international communication and joint actions have developed some influential transnational forces for development of global climate governance. A bottom-top carbon market led by cities has become the foundation and motivation of worldwide public private partnerships. Cities, as developers and active practitioners of new governance measures, are vanguards of experimental global climate governance. Although grounded on local realities, their policies are widespread in other parts of the global climate governance system through national and international networks and stimulate the development and transformation of the system.

## 1.2 Case Analysis

### (1) Global Cities as the Nodes of Historical Process of Global Climate Governance

Bonn has an important impact on global climate governance. From March 28 to April 7, 1995, the first Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) was held at the Berlin International Conference Center in Germany, and 116 delegations of the UNFCCC Parties attended the conference. The conference adopted documents including the *Berlin Mandate* and decided to locate the permanent secretariat of the UNFCCC in Bonn, Germany. Geneva also has special significance in environmental governance. The second Conference of the Parties of the UNFCCC adopted the Geneva Declaration, agreeing to the conclusions of the Second Assessment Report of IPCC (Intergovernmental Panel on Climate Change) and calling on developed countries to set legally binding targets for emission limitation and make practical emissions reduction. In addition, after the Conference of the Parties, Switzerland officially implemented the ‘Swiss Activity and Experiment Plans of Joint Implementation of UNFCCC’ in 1997.

The third Conference of the Parties of the UNFCCC was held in Kyoto, Japan in December 1997, which highlighted the role of Kyoto in climate diplomacy. The Kyoto Protocol is the profoundly significant world treaty. Its official entry into force is the first time in human history to restrict greenhouse gas emissions by form of regulation. The 8th Conference of the Parties of the UNFCCC adopted the Delhi

Declaration which clearly stated that climate change should be addressed under the framework of sustainable development. Hence, the role of New Delhi in climate negotiations and environmental governance is highlighted.

The 2009 United Nations Climate Change Summit held in New York laid the foundation for the Copenhagen Climate Change Conference, and New York's response measures of climate change have referential significance. The greenhouse gas emissions in New York City have fallen by 19% since 2005, and New York City has now completed two-thirds of its target set five years ago. The 2009 Copenhagen Climate Conference in Denmark (the 15th Conference of the Parties of the UNFCCC) also promoted the EU to lead the global low-carbon economy. On December 12, 2015, the Paris Agreement was adopted on the 21st Conference of the Parties of the UNFCCC. The Paris Agreement represents a new milestone in the history of human response to the challenges of global climate change. The Paris Agreement is committed to stimulating the power of business and society and encouraging the bottom-top emission reduction effort, while cities began to be officially listed in the stakeholders and responsibilities in climate change.

## (2) Urban Climate Network and Global Climate Governance

The urban network is the most important transnational link between local governments, through which cities can cross multiple layers of global governance. Through urban alliances, urban diplomacy is further developed towards a multi-dimensional cooperation. In recent years, with the increasingly severe global environmental crisis, under the dual background of the diversified main participants of global environmental governance and the prominent position of local authorities, international cities have carried out multi-layer cooperation and established a series of platforms for communication and joint actions. Moreover, the international cities also have established international cooperation organizations or alliances, in which some of the cities participate, and signed international agreements such as the *Green Cities Declaration* and the *World Mayors and Local Governments Climate Protection Agreement*. The idea inter-municipal corporations shaping policy direction and enabling effective decision making in sustainable urbanization.

Although inter-city agreements are not as legally binding as inter-state agreements, the role of urban climate networks cannot be underestimated: on the one hand, urban climate networks are flexible, pragmatic, cooperative and efficient. Since urban cooperation does not require complex negotiation and legal procedures, the construction of a transnational climate network and the launch and implementation of related cooperation projects on city level are much easier to

implement. The urban climate network are more concerned with practice, and its focus often lies in the exchange of policy experiences and mutual support between cities. Therefore, the urban climate network is a loose but effective community of practice. The urban climate network is conducive to the rapid dissemination of information. The role of urban climate network reflects the New Urban Agenda's recognition to significant contribution of voluntary collaborative initiatives, partnerships and coalitions that plan to initiate and enhance the implementation by highlighting best practices and innovative solutions.

1) The International Council for Local Environmental Initiative (or 'ICLEI') is the largest city network in the world with the goal of achieving sustainable low-carbon emission through various projects, actions and local plans. The Council is committed to developing specific measures for greenhouse gas emissions during the implementation of environmental protection plans and methods to measure such emissions. ICLEI is a non-profit, non-government member organization with more than 1,000 member cities from 86 countries and a global secretariat located in Bonn, Germany. Founded in 1990 by 200 local governments from 43 countries at the United Nations Headquarter in New York, its projects and activities are focus on a wide range of sustainable development topics. Cooperators of ICLEI include associations of municipal administration, metropolises, the United Nations, intergovernmental organizations and business sectors, such as the United Cities and Local Governments (UCLG), the World Mayors Council on Climate Change (WMCCC), United Nations Environment Programme (UNEP), the United Nations Human Settlements Programme (UN-Habitat), the United Nations International Strategy for Disaster Reduction (UNISDR), the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (UNCBD), the International Union for Conservation of Nature (IUCN) and the World Economic Forum (WEF).

ICLEI works primarily on the top ten agendas: supporting cities to achieve goals of sustainability, strong resilience, high resource efficiency, biodiversity and low-carbon emissions; building smart infrastructure and developing a green city economy with an ultimate goal of building healthy and happy communities. As an urban network, ICLEI provides a contact platform for cities and local governments to encourage the experience sharing, negotiation and cooperation between members by organizing international conferences and learning networks. At the same time, ICLEI also launches custom-made projects and activities based

on the specific needs of certain cities, autonomous regions and districts. ICLEI provides the participating cities with policy support addressing regional and global environmental challenges through its three international campaigns—the Cities for Climate Protection (CCP), the Local Agenda 21 (LA21) campaign, and the Water Campaign launched in global cities in the 21st century. In the

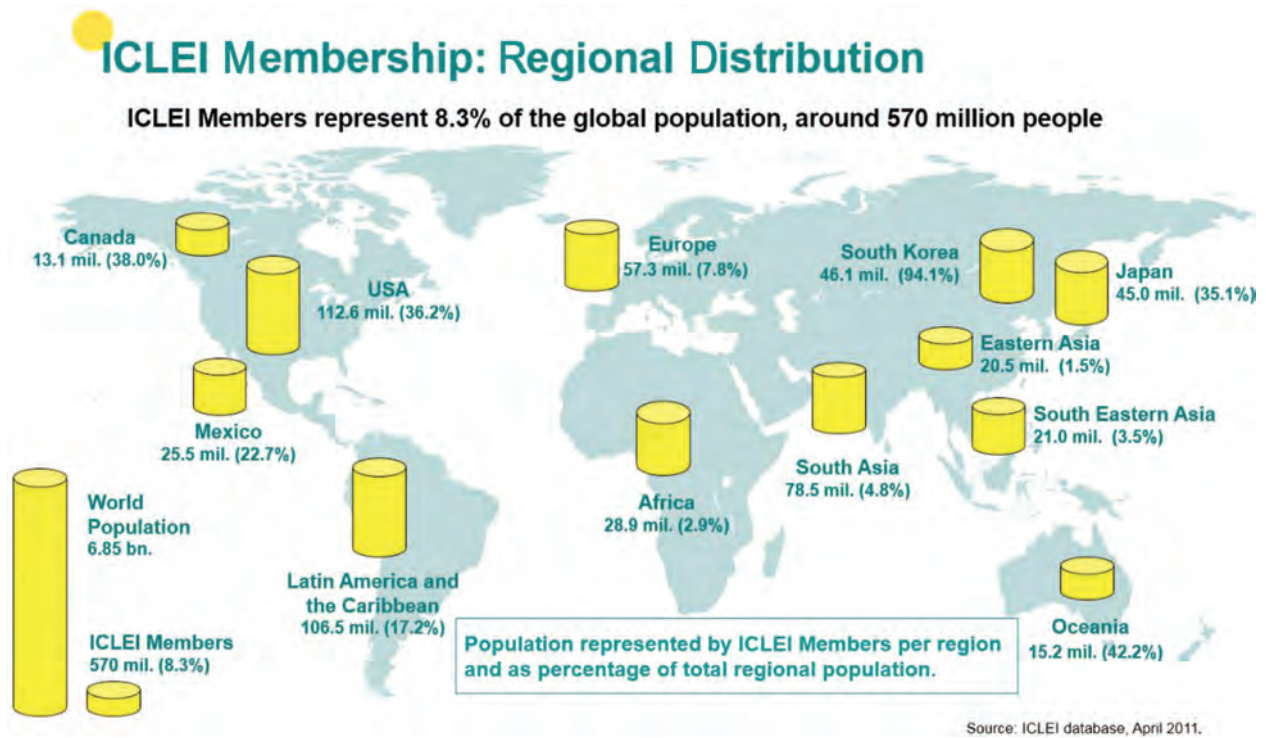


Figure 7.1 Regional Distribution of ICLEI Membership



Figure 7.2 Global offices of ICLEI

process, ICLEI not only serves local governments as an information exchange site for sustainable development, but also provides policy guidance, training and technical assistance, as well as advisory services to enhance the capacity of local governments.

2) Cities for Climate Protection (CCP) is one of the climate protection programs of ICLEI. It was established in 1993 following the success of Urban CO<sub>2</sub> Reduction Project. At first, the program had only 14 local authorities from Europe and North America.<sup>1</sup> And its most well-known mechanism is the 5 milestones-based methodology, including conduct, set targets, develop, implement and monitor,<sup>2</sup> which will be repeatedly carried out successively until the climate change to an appropriate value. It now enjoys over 1,000 members. It is the world's first international initiator for promoting local governments' greenhouse gas emissions.<sup>3</sup> CCP aims to develop campaigns involving worldwide local governments, in order to realize significant reduction in local greenhouse gases, improve air quality and consolidate liveability of cities.

3) The Cities Climate Leadership Group (C40) is an international city association dedicated to addressing climate change. Its members include cities in China, the United States, Canada, the United Kingdom, France, Germany, Japan, South Korea, Australia and other countries. The C40 City Group, formed in 2005 under the proposal of Ken Livingston, the former London mayor, carries out cooperation projects of emission reduction, improves energy efficiency, and reduces greenhouse gas emissions to promote the emission reduction actions and sustainable development of C40 cities. The C40 organization would conduct case studies on adaptation to climate change, select typical departments and regions to conduct case studies of adaptation to climate change, and propose operational adaptation policies and measures.

The C40 member cities are able to quickly achieve the goal of reducing greenhouse gases through sharing information and experience in the fields of construction, transportation, etc., and imitating actions and measures to provide the most rapid and effective urban experience. This reinforces the idea of peer-to-peer learning and subject-matter-related partnerships outlined in the New Urban Agenda. The parties concerned in London City met in Stockholm to exchange experience

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<sup>1</sup> Michele M. Betsill, 'Transnational Networks and Global Environmental Governance: The Cities for Climate Protection Program.' *International Studies Quarterly*, 2004 (48): 471-493.

<sup>2</sup> <http://www.iclei-europe.org/ccp>[accessed 2014-11-23].

<sup>3</sup> <http://archive.iclei.org/index.php?id=10829>[accessed 2014-11-23].

on energy conservation buildings and promote such practices in other cities to reduce energy use of buildings. In February 2003, the Congestion Charging System began to be introduced in central London, has cut 100,000 tons of carbon dioxide emissions. London is able to collect about £122 million congestion charges per year to improve traffic conditions. In August 2007, Stockholm became the second city in Europe after London to adopt the Congestion Charging System. During the experiment, Sweden's carbon dioxide emissions were reduced by 14% and the number of motor vehicles was reduced by 22%. It was found that the urban climate network of the C40 City Group promotes the spread of emission reduction policies including distributed energy supply and Congestion Charging System among its member cities, and achieves global climate governance among cities at sub-national levels with higher efficiency.

4) The World Majors Council on Climate Change is a coalition of local government leaders committed to addressing climate change. It advocates strengthening participation of local governments as the government stakeholders to address related issues of climate change and global sustainability. Currently, the council has more than 80 members, representing a vast network of local governments committed to reducing global greenhouse gas emissions. Its membership is open to mayors and government officials at the same administrative level.

The council aims to strengthen political leadership of global sustainability by cultivating a group of strong local sustainable leaders, and to become the main political publicity force of cities and local governments on global sustainability issues. In order to achieve its organizational goals, the council has taken the following measures: demonstrating the actions of local leaders on climate and sustainable development; supporting its members to improve their leadership on climate and sustainable development; allowing global leaders of various local governments to enact policies on global climate and sustainable development; offering political guidance on developing and implementing mechanisms adapting to local climate and sustainable development initiatives.

### 1.3 Experience Summary

(1) *The Report Thoroughly Introduces Breakthroughs in Multilateral and Multi-layer Global Climate Governance Based on Diplomatic Events at Home on Climate Changes and Climate Network of Cities.* In the context of diversification of main participants in global climate governance, the significance and role of cities in this governance system will be further improved. Urban climate diplomacy and



subsequently achieved consensus might finally result in frameworks with binding force that introduces changes to countries. International cooperation among cities creates a relatively independent global climate governance network that can carry out corresponding governance without being authorized. And cities can acquire miscellaneous suggestions from multilateral and multi-layer global climate governance cases.

(2) **Cities Are Committed to Participating in Decision-making and Influencing Global Climate Multi-layer Governance.** National states cannot control policy-making during global climate governance anymore; instead, supranational actors can exert independent influences. Furthermore, non-state actors, national states and sub-state actors are connected by policy networks. In conclusion, the decision-making capacity is shared by different actors at various governance levels. And cities, under the jurisdiction of national states, are able to get access to global governance. Non-state actors, including non-governmental organizations and cities, are playing an increasingly important role in global environmental governance. They are trying to figure out internal problems, their relationship with state authorities, cooperation between cities and non-city actors, coordination of similarity and diversity among cities and, floor and ceiling for cities to participate in global governance.

(3) **Cities Take Part in the Construction of Related Climate Alliances.** For example, local authorities in the United States mainly propose their initiatives in regional cooperative mechanisms for greenhouse gas emission reduction. Alongside with various urban climate-related action networks, these organizations provide cities with political independence, financial resources and technological support, allowing them to actively reduce greenhouse gas emissions. Additionally, the International Council for Local Environmental Initiatives (ICLEI) invites 1,200 local governments to settle environmental problems. The Cities Climate Leadership Group (C40) connects London, Tokyo, New York, Sydney and other metropolises to address climate pollution. The World Alliance for Low Carbon Cities (WALCC), the Climate Alliance and the Energy Cities Alliance also play significant roles in dealing with climate change.

## 2. Urban Development & Cooperation Driven by Eco Forum Global

### 2.1 Background

An eco-city is a ‘social, economic and natural’ compound system dominated by human behavior, based on the natural environment, and supported by resource



Figure 7.3 Eco Forum Global

flows in social systems, as well as human settlements with efficient resource utilization, liveable environments, high economic efficiency, social harmony and sustainable development. The revelation that a better city and life can be created by the relevance and interaction among the organic systems of the earth, cities and humans against the current background of rapid urbanization and accelerated growth of urban populations is the key.

China has been playing an active and significant role across the world in building eco-conceptualization. The Global Eco Forum (hereinafter referred to as the 'GEF') is China's highest, largest and most international exchange platform in the field of eco-conceptualization and sustainable development. 2018 is the 10th anniversary of the GEF, as well as the forum's fifth anniversary of becoming a national-level international forum. The Global Eco Forum Annual Conference in Guiyang 2018 themed on 'Embracing a New Era of Eco-conceptualization: Green Development with a High Priority on Ecology'.

## 2.2 Case Analysis

Guizhou, the only province without plains in China, is highly dependent on resources due to its abundant historical mineral resources, but its mining industry has also caused great harm to the natural environment. Influenced by high-energy



Figure 7.4 Forest-belt of Guiyang

consumption and highly-polluting industries, the average concentration of  $\text{SO}_2$  of Guiyang (the capital of Guizhou) is twice of the national Grade II standard of  $\text{SO}_2$  concentration. In the 1990s, Guiyang was the China's famous city for acid rain. After over a seven-year management, however, Guiyang has made great achievements in the development of its eco-conceptualization. With the initial formation of the system of an eco-city, Guiyang has become a leader of building eco-conceptualization in Guizhou and a forerunner of eco-conceptualization in China.

Guizhou, in order to popularizeeco-conceptualization, and explore the law of building eco-conceptualization, has drawn on foreign and domestic achievements to promote the implementation of eco-conceptualization, built a platform for foreign communication and cooperation, and planned to hold the GEF, which was convened in 2009 for the first time. In January 2013, approved by the CPC Central Committee and the State Council, the Ministry of Foreign Affairs approved the holding of the GEF, which has now been upgraded to China's only national-level international forum with a theme of eco-conceptualization.

During the past decade, China has become an important participant, contributor and leader in the global development ofeco-conceptualization. During this

period, the GEF has also played a significant role. Guiyang, the host city for the GEF, has taken advantage of its own experiences in the development of eco-conceptualization to spread eco-conceptualization and promote its development. The forum is committed to the exchange and cooperation of university, industry, government and media personnel, as well as all other circles of decision makers. It is also committed to the popularization of eco-conceptualization. Focusing on the development of major national strategies, this annual conference is designed to serve the national strategic policy and exploring new ways of building eco-conceptualization. Since being first proposed at the 17th CPC National Congress, ‘eco-construction’ has played an increasingly important role in the national strategy. As the concept has been upgraded to China’s guiding ideology, the GEF has always adhered to the development of eco-conceptualization, to serve the national strategy, and to explore new ways of building eco-conceptualization.

The forum has been an active participant in the promotion of extensive international and domestic exchange and practical cooperation over eco-conceptualization, forming a powerful response to the international community’s common concern for environmental protection, and providing ‘China’s solution’ for eco-conceptualization with ‘China’s voice’. The GEF, highly consistent with the deployment of national strategies in the 10-year development, has played a role in promoting eco-conceptualization in the world. It is at the 17th CPC National Congress in 2007 that China first put forward ‘eco-conceptualization’. In 2009, the first EFG was held successfully. At the forum, the *Guiyang Consensus*, with an active significance to the development of eco-conceptualization and a green economy, was adopted; the concept of a ‘green economy’ was first put forward in China, laying a foundation for the flourishing of green finance, including green investments, green bonds, green credit and green ratings. As the 18th CPC National Congress was convened in 2012, the Party Central Committee incorporated eco-conceptualization into its ‘Five in One’ overall layout (promoting economic, political, cultural, social, and ecological progress), upgrading eco-conceptualization to a national level. In the same year, the GEF was China’s only representative participating in the United Nations Conference on Sustainable Development-Rio+20, submitting its voluntary commitment to the conference. It also conveyed China’s determination to build eco-conceptualization. There were over 2,000 domestic and overseas guests attending the 2014 GEF, including senior officials of relevant UN agencies, international organizations, and relevant national ministries and commissions, as well as entrepreneurs, renowned experts and university presidents. At the 40 theme forums,

relevant experts and scholars conducted in-depth exchanges and discussions from various perspectives, including the economy, society, humanities and education, and made numerous pioneering, forward-looking and leading achievements. The theme of the GEF 2016 is ‘Embracing a New Era of Eco-conceptualization: Advancing Green Development, Unifying Knowledge and Action’. ‘Embracing a New Era of Eco-conceptualization’, an important concept proposed by General Secretary Xi Jinping, is China’s firm declaration on promoting eco-conceptualization, as well as China’s solution to the world’s economic development and environmental protection. The forum has also adopted a series of action plans, from green banks to green development funds, from the Sustainable Enterprise Alliance to the Marine Conservation Alliance, and from eco-environmental protection of the ‘Belt and Road’ Initiative to cooperation on climate change. Therefore, when attending the opening ceremony, Yu Zhengsheng (Chairman of the Chinese People’s Political Consultative Conference) remarked, ‘The GEF has discussed a series of problems in the development of eco-conceptualization, and made positive contributions to promoting China’s sustainable development and safeguarding global ecological security’.

### 2.3 Experience Summary

The development of eco-cities promotes the harmony between society and nature. From the multiple perspectives of developing circular economies, creating low-carbon economies, expanding green economies, forming ecological industrial systems and developing ecological economics, we should pay great attention to the applications of low-carbon development, green and ecological technologies, enabling ‘ecologicalization’ to cover aspects including education, technology, culture, morality, laws and systems. Open systems closely connected with surrounding suburbs and related areas, involve not only natural ecosystems such as the air, water, land, greenery, forests, animal life, energy and other mineral resources, but also artificial environmental systems, economic systems and social systems in the city.

Secondly, we should build eco-cities and develop low-carbon economies. On the basis of promoting eco-conceptualization, we should correctly handle the relationships between economic development, resource conservation and environmental protection so as to build a new city with picturesque scenery, beautiful environment, ecological safety, and harmony between man and nature. We should give priority to economic development and ecological construction. We should implement national strategies on climate change in order to develop a low-

carbon economy and promote energy conservation and emissions reductions. The development of eco-conceptualization concerns the well-being and future of human beings.

In addition, we should enhance urban inclusiveness and promote the development of the sharing economy. Inclusiveness means the sharing in the fruits of economic growth, equal social rights, and homogeneous public services. Inclusive development is a key to eliminate poverty, improve the disadvantaged and integrate them into mainstream society. An inclusive city means an extensive community-based participation that makes development become social improvement and community renewal achieved by the government, companies, social organizations and the public. Extensive participation is important to build a broad consensus on development from planning to implementation, along with all-party mobilization to achieve results that benefit all.

Publicity and education over environmental protection to raise citizen awareness of eco-conceptualization should be strengthened. The establishment of the ‘World Environment Day’ is a reflection of the awareness and attitudes of people worldwide towards environmental issues, as well as an expression of people’s aspiration for a beautiful environment. We should improve environmental quality, strengthen the promotion of ecological culture, and advocate a lifestyle and consumption model that is green and low-carbon, as well as civilized and healthy, so as to promote the eco-conceptualization of the society. Through good management of the relationship between economic development and ecological environment protection, urban development has protected the ecological environment, promoted green, circular and low-carbon development, and improved the quality of the ecological environment.

There is the need to launch theme activities related to the ecological environment, to improve the environmental practices of various actors such as enterprises, families and individuals. A large amount of the earth’s resources will be consumed by us and our activities. People worldwide have paid increasing attention to green travel and a low-carbon life. A growing number of people have used fewer vehicles such as airplanes, trains, taxis and cars in order to reduce carbon emissions. Enterprises and institutions are considering how to reasonably allocate funds and reduce their operating costs, thereby contributing to the protection of environmental.

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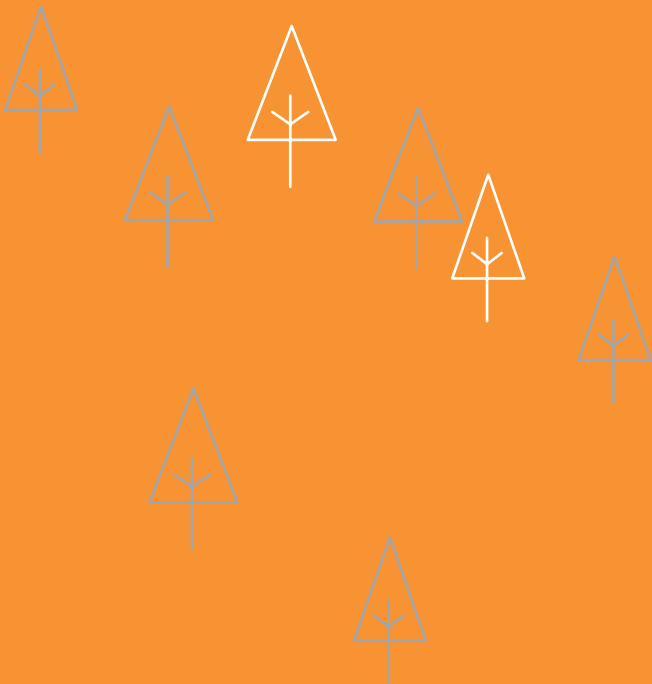
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# Chapter VIII

## Policy Suggestions







Adhering to the new development goals and ideas of SDGs and NUA and drawing on lessons from the cases proposed in the Annual Report 2018, we will summarize 30 policy suggestions from six aspects as references in decision-making and practice of different interest groups like government, enterprise and social organization. Although some policy suggestions are multi-dimensional and multi-perspective, all policy suggestions will be classified into six categories to easily learn about cases related to corresponding policy suggestions.

## Ecology

### Strategy 1: Improve the Resilience Capacity of Coastal Cities through Decision-making Actions-Innovative Technologies-Multiple Participations.

Establish a government organization framework for coastal urban resilience actions, integrate resilience urban goal into entire urban management and decision-making processes, and propose a roadmap for coastal urban resilience action.

### Strategy 2: Adopt Structural and Non-structural Resilience Strategies and Innovative Technologies, and Issue Corresponding Supporting Policies at Each Stage.

Propose a sustaining urban resilience action plan, continuously track and evaluate the implementation of key projects, and implement adaptive management and decision-making.

### Strategy 3: Take Waterfront Space of Coastal City as an Important Carrier for Urban Ecological Restoration

Excavate flood control facilities more potential social benefits by creating diverse waterfront space of coastal city, exploring its cultural connotation and increasing its accessibility and tourism value. Preserve the rare and fragile aquatic marginal ecosystem through the ecological restoration of urban waterfront space.

### Strategy 4: Historical Culture and Human Elements Needs to Be Valued in Urban Ecological Restoration Process.

Constitute basic elements of the urban spatial form, enhance urban environmental quality, and promote the development of the surrounding ecological industry relying on the related facilities and historical sites of the waterfront space, and the main historical streets connecting the piers and historical sites.

### Strategy 5: Realize the Utilization of ‘Three Wastes’ through Technological Innovation.

Realizing the dynamic monitoring and real-time tracking of the reuse of the ‘three wastes’, and, the recycling and low carbon utilization of resource through the application of digital technology.

## Society

### Strategy 6: Advocacy of and Incentives for Green Life

- (1) Stimulate social creativity, increase social benefits, and optimize the related supply of relevant public services, market products and public welfare projects through policy guidance, enterprise initiation and public participation;
- (2) Encourage multiple subjects to affect users' consumption behavior via the Internet, and stimulate green consumption;
- (3) Conduct emission-reduction trade in accordance with the international Voluntary Emission Reduction Trade Mechanism, perfect green financial mechanisms for individual consumers, encourage responsible enterprises and individuals to get involved in purchases, and enable individuals to participate in sales and investment in the future carbon market.

### Strategy 7: Policy and Implementation Strategy of Social Participation

- (1) Fully stimulate the sense of participation of the basic-level governments, enterprises, professional organizations and the public by optimizing superior policies, and establish more multimedia platform tools for public mobilization and participation;
- (2) Encourage universities, colleges, research institutes, and professors to provide education and training service to the public, and cultivate environmental awareness and participation capabilities of individuals, communities and social organizations;
- (3) Improve the policy and market environment of green consumption, and optimize the social ecology of material recovery and utilization, effective use of energy, protection of living environment and species, etc.

### Strategy 8: Omni-beneficial and Unique Ways to Promote Inclusive Development

- (1) The inclusive ecological development concept encourages everyone to live a low-carbon lifestyle and thus share in progress;
- (2) Provide targeted green-life service projects to vulnerable groups, and enable them to share safe food, clean air and water in a fair way;
- (3) Realize well-established green ecology and social ecology by promoting diversified and individualized practices of global environmental governance, adjusting measures to local conditions, and innovating the green lifestyle.

## Culture

### Strategy 9: Draw on Traditional Culture and Wisdom to Improve the Resilience and Recuperability of the City

Promote and protect local culture and traditional knowledge, especially people's knowledge about the nature, languages, faiths and practice to provide new methods to adapt to and respond to environment changes.

### Strategy 10: Protect cultural legacy and Promote Compact Development of the City

Properly manage historic cities and archaeological sites, and make them important source of restoring force of local society after natural disasters. This helps to establish more compact, inclusive and adaptive environment-friendly city.

#### Strategy 11: Develop Cultural Creative Industry in Order and Create Green Economy of the City

The development of traditional profession and craftsmanship rooted in cultural diversity should be creatively promoted. Since most creative industries are less dependent on technologies, resources and investments, they help to protect the environment and create sustainable livelihood and decent jobs.

#### Strategy 12: Use Cultural and Artistic Means to Conduct Eco-education

Through the means of culture and art, proactively promote eco-education for the public, create wider public awareness, get more citizens involved in the exchanges and dialogue among diversified cultures, and therefore increase the sense of belonging and spiritual attachments of citizens to eco-city.

#### Strategy 13: Stimulate Urban Space with Culture and Lift the Dynamism of Eco-city

The spatial form, color, appearance and size of buildings of the urban area should conform to the demand of local urban design and reflect local cultural characteristics. Building in inspiring public space permeated by culture helps to improve the livability and appeal of eco-cities.

## Economy

#### Strategy 14: The Primary Task of Urban Energy Supply Is to Establish Sound Legal Regulations

Relying on its natural endowment and superior resources, the primary task of a city is to build sound legal regulations for its sustainable development and utilization of resources so as to rationally utilize resources and adapt to local conditions.

#### Strategy 15: Making Sure that All Aspects of Energy Development and Supply Are Green and Clean as much as Possible

In the entire industrial chain of clean green energy supply, we must evade the utilization of resources with high pollution, high emissions and high energy consumption in the upstream of the industry to ensure that the entire industrial chain of green energy is low-carbon.

#### Strategy 16: Comprehensive Development and Recycling across Fields Should Be Achieved in Green Energy Economy

The development and utilization of green energy, represented by geothermal resources should be achieved across fields comprehensively, and achieve a workable sustainable development model for green economy while ensuring stable economic growth.

#### Strategy 17: Green Finance can Provide Effective Financing Support for Urban Green Infrastructure Construction and Healthy Development of Low-carbon Environmental Protection Industry

All kinds of green financial products, including green bonds, can provide effective financing channels for the emerging green development industries of urban economy, and promote the healthy development of environmentally friendly economic activities.

#### Strategy 18: In the Early Stage of Becoming a New Growth Point of Inclusive Green Economy, the Primary Task of Green Finance Is to Formulate Institutional Guarantees in Line with Rules of International Game and Domestic Legal Regulation Environment

The green financial market urgently needs institutional guarantee and supervision mechanism that is in line with the actual operation to ensure that green finance has the greatest utility value for the development of urban green economy.

## Governance

### Strategy 19: Innovate Eco-governance System to Introduce ‘New Systems’ to Realize ‘Zero Dead Zone’

In making and implementing new systems, attention should be paid to fairness. The development of eco-city should be linked with the interests of the majority of the public. The institutional design should try to cover the most marginalized and the most vulnerable groups. At the same time, we should try to forestall problems and conflicts that might pop up in the future and effectively implement the new systems in local practice.

### Strategy 20: Coordinate with Regulators of Eco-governance to Carry out ‘New Cooperation’ to Achieve ‘Zero Dottleneck’

Establish coordinated mechanism of trans-departmental, trans-sectorial and trans-regional cooperation to promote the exchanges and cooperation of different parties, build unified eco-city governance platform with reciprocal mechanism of win-win, share experience of success and foster the establishment of regional eco-coordination governance mode.

### Strategy 21: Shift the Eco-governance Mode to Identify ‘New Targets’ and Exercise Multiple Targeted Measures

Shift the extensive eco-governance mode by smart tools including big data to achieve meticulous management of the city, and control and assess all links of eco-governance including its source, process, technology, human resources, capital and results, so as to make the eco-governance more scientific and practical.

### Strategy 22: Break through with Eco-governance Technologies and Use New Technologies to Tackle Key Problems

Enhance technological innovation, proactively encourage basic research of eco-governance to tackle key problems, explore and apply the most cutting-edge, low-carbon and highly efficient eco-governance technologies and new materials, resolve the existing environmental problems and new environmental problems.

### Strategy 23: Improve the Sense of Eco-governance, Practicing ‘New Concepts’ and Achieve ‘Multiple Interactions’

Government is the leading role to promote new eco-governance system, tool and model, and the awareness of green development, encourage all sectors of the society to participate and mobilize the community and citizens to achieve benign interaction among government governance, social participation and citizen self-governance.

## International Cooperation

### Strategy 24: Establish Mechanism and Normalization of City Governance, and Promote the Development of Urban Carbon-emission Market

Promote the legalization, institutionalization and normalization of cities in the global governance, explore diversified and highly efficient avenues of implementation, and scientifically assess the results. A bottom-up carbon-emission market development is an important tool of urban marketization to address climate change.

### Strategy 25: Boost global City Cooperation and Development through the Research, Development and Application of High-tech technologies

Through the research, development and application of modern technologies including AI, block-chain, mobile internet, and new media, provide a platform and handle for global eco-city cooperative governance.

### Strategy 26: Improve Urban Sustainable Governance Review System, and Put in Place a Global Cooperative city Governance Discourse System

Allow cities across the globe to conduct exchanges, dialogue and mutual learning in the same discourse system to promote scientific and systematic city eco-governance through the scientific review of urban sustainable governance.

### Strategy 27: Increase soft Cooperation of Non-governmental Organizations (NGOs), and Promote the Sustainable Development of Cities across the Globe

Recognize the important roles of NGOs in the sustainable growth of cities across the globe and increase the communicative cooperation among NGOs and social organizations for public welfare so that they can monitor and boost one another, and thereby boosting the eco-governance and sustainable growth of cities across the globe.

### Strategy 28: Establish a Stage to Help Cities across the Globe to Discuss and Learn the Success Experiences of Eco-governance

Provide platforms and environment for decision-makers and participants of global city governance through international conferences, forums and symposiums, so that they can discuss and negotiate from different dimensions and perspectives, providing scientific evidence for the innovations of city governance system and mechanism.



