UNIVERSITY OF HULL

Adaptation of Ecological Modernisation in China: A Case Study of Eco-transformation of Industrial Areas in Changsha-Zhuzhou-Xiangtan Urban Agglomeration

being a thesis for the Degree of PhD in Human Geography

in the University of Hull

by

Bingni Deng

2020

Acknowledgements

This thesis is the result of inspiration and guidance of many talented people. I would like to express my gratitude to everyone who has contributed to the thesis and my personal life. Without you, the life in the last four years in the U. K. could not be wonderful as it was.

First and foremost, it is my great pleasure to have two distinguished promoters, Dr Pauline Deutz and Dr Julia Affolderbach. You two have made a great team to supervise me from different perspectives.

I would like to express my deepest thanks to Dr Pauline Deutz for giving me the opportunity to study at University of Hull. I give thanks for her trust and scientific insights that have enhanced the level of my research. She also guided me to learn from other outstanding scholars in communications, which opened my mind and led me entered a professional academic circle.

My heartfelt gratitude also goes to Dr Julia Affolderbach. I am grateful for her efforts for helping me to develop the thesis. Her sharp and constructive advice enlightened me always. Her tender care and house parties you hold for me and other Chinese students made us feel warm and transformed our experiences in the U. K. into beautiful memories.

I am also sincerely grateful to Professor Andy Jonas. As an expert of Chinese context, his advice and concerns were always timely helps.

Thanks to the Department of Geography, Geology and Environment at University of Hull and thanks to all the friends and lovely faces in the department.

I am thankful to China Scholarship Council and University of Hull who sponsored my PhD study. Special thanks to my previous supervisor, Li Zhu, in Central South University, who guided my master study and supported my application of the PhD study in the U.K.

Thanks to all the interviewees who kindly supported my research and answered my questions. Without your involvement, this research cannot be completed.

Far away from China, I am lucky to have a group of Chinese friends to dilute the nostalgia. I have learned so much from Zhen Yu and Wenbo Cai from their research works. My daily work has been enriched by Chi Zhang, Hui Yang, Hui Shi, Yiman Fang and Yanhua Liu.

To my dear family – my parents and Wenhong Yan, I dedicate this thesis in token of affection and gratitude. I am grateful for your unconditional love and support.

Abstract

Since around 2010, Chinese central and local authorities have made increasingly vigorous efforts in curbing industrial pollution. One approach has been the eco-transformation policies for industrial areas. This thesis defines the eco-transformation of industrial areas as the transformation lead by state-led policies/strategies by multi-scale (central/local government) and multi-department (Environment Protection Bureau/ Development and Reform Commission/ Urban and Rural Planning Bureau/ Science and Technology Bureau, etc.) for greening development in industrial areas. Policies and practices for the eco-transformation of industrial areas in China have a resemblance to the Ecological Modernisation approach that has been applied in the European context. Ecological Modernisation can be summarised as a strategy of systematic (technical) innovation and expansion of economic growth that also has the potential for environmental improvement (Jänicke, 2008).

This thesis contributes to debate as to the nature of Ecological Modernisation in the Chinese context and the extent to which the concept has evolved alongside the geographic transfer from the European origins of the concept. As Ecological Modernisation is a theory but also a practical strategy for policy discourse, the shifting in governance perspective impacted by eco-transformation policies of industrial areas through rescaling framework of environmental governance was analysed. Also, since the spatial perspective that both Western countries and China concerned during EM practise, this thesis also explored the spatial impacts on industrial areas through eco-transformation.

Data was collected both by second and first hand source (incl. semi-structured interviews, field visits and observations as well as participant observation). Semi-structured interviews of 19 peoples from seven different organisations (i.e. governmental sectors, state-owned industrial companies, private industrial companies, private pollution treatment companies, state-owned finance companies and developer companies (PCs), spatial planning agencies, and environmental NGOs.) in Changsha-Zhuzhou-Xiangtan urban agglomeration were undertaken. Extensive policy analysis and use of official statistics were undertaken.

As the results, in terms of the rescaling process of environmental governance, this thesis finds that the environmental governance of industrial areas in China has changed from centralised to decentralised as in most other capitalist countries when they are applying Ecological Modernisation. However, environmental decentralisation in China did not achieve expected performance shifts like in western countries, therefore, a round of rescaling-up and 'soft-recentralisation' was generated after around 2015. The same situation also happens in the cooperative governance between governments with private sectors and with environmental

NGOs. China is undertaking a different way to western countries for Ecological Modernisation given Chinese political-economic regime and development pathway. Regarding spatial perspective, industrial areas proceeded both geographical movement and spatial restructuring during the eco-transformation process. A new understanding about the relationship between Ecological Modernisation with space was presented. This thesis not only gives Ecological Modernisation Theory broader application confines and diversified scales but also provides references for the policy-makers.

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Abbreviations

CZT: Changsha-Zhuzhou-Xiangtan Urban Agglomeration

DZ: Development Zone

EIP: Eco-industrial Park

EM: Ecological Modernisation

ET of IA: Eco-transformation of Industrial Area

ETDZ: Economical and Technological Development Zone

FDI: Foreign Direct Investment

HIDZ: Hi-tech Industrial Development Zone

IS: Industrial Symbiosis

NDRC: National Development and Reform Commission

PC: Platform Company

PPP: Public-Private Partnership

TIA: Traditional Industrial Area

Two-Oriented Society: Resource-Economical and Environment-Friendly Society

Chapter 1 Introduction

Since the 2010s, Chinese central and local authorities have made increasingly vigorous efforts in curbing industrial pollution. One approach has been the eco-transformation policies for industrial areas. This thesis defines the Eco-transformation of Industrial Areas (ET of IAs) as the transformation lead by state-led policies/strategies by multi-scale (central/local government) and multi-department (Environment Protection Bureau/ Development and Reform Commission/ Urban and Rural Planning Bureau/ Science and Technology Bureau, etc.) for greening development in industrial areas. The policy included various designations by different state agencies, e.g. the 'new type of industrialisation', 'industrial transformation and upgrading' or 'transformation of economic development mode[1]'. Those policies have a resemblance to the Ecological Modernisation (EM) approach that has been applied in the European context. This thesis contributes to debate as to the nature of EM in the Chinese context and the extent to which the concept has evolved alongside the geographic transfer from the European origins of the concept.

The high speed of GDP growth in China was enabled by the government's endeavour of rapid industrialisation and urbanisation (Xiong and Li, 2013). Industrialisation and urbanisation in China were regarded as the critical strategy to realize modernization (Li, 2012), continuing power of economic growth (Wang, 2013) and the inevitable requirement to achieve the great rejuvenation of the Chinese nation and the Chinese Dream[2] (Huang, 2013). During the very fast and geographically extensive development of industry and urban areas, poverty levels were reduced significantly (Chen and Ravallion, 2007) and China became the second largest economy entity globally in 2010 (http://www.china.com.cn/economic/node_7111030.htm). According to different tactics for industrialisation, building on the classification of Chen and Huang (2005), industrial areas in China for analyse in this thesis were divided into two categories: (1) traditional industrial areas (TIAs) (Wu, 2007; Cai, 2007) which were established under a traditional planned economic system in the 1950s-1960s and set the foundation of Chinese industry; and (2) development zones (DZs) which were shaped by reform politics and opening-up policy in the 1970s-1980s.

However, industrialisation without environmental consideration generated severe environmental pollutions in China. The leitbild of taking economic construction as the central task in the primary

[1] The transformation of the economic development mode was announced by the Chinese central government during the 12th FYP (Five-Year Plan). Within it, economic growth should be driven by technical progress, high skilled work force, innovative governance mode and synergistic effects of the primary, secondary and tertiary industries, and decoupled from resource consumption (Wu and Huang, 2010).

[2] The Chinese Dream is an important governing idea initiated by President Xi in 2012 which seeks to achieve the rejuvenation of the Chinese nation has been the greatest dream of the Chinese people since modern times. Its basic idea is to make China prosperous and strong, and enable Chinese people to lead a happy life.

stage of socialism was initiated by the Communist Party and central government in 1980, which led to long-term ignorance of environmental protection particularly where it conflicted with economic growth. The traditional industries characterised by high energy demand and high pollution and emission levels were developed across the country during the 1st to 2nd Five-Year-Plan (FYP) (1953-1962) and the 'Third-line Construction' policy published in 1964. The qualities of water, soil and air all suffered from pollutions in varying degrees by the unsustainable development of TIAs. In 2007, 90% of water area and 65% of drinking water sources in urban area were polluted (Lu et al., 2007). TIAs were the prime culprits. They normally located near natural water resources, e.g. rivers and lakes, since those traditional industries need large amounts of water. Waste water has been directly disposed into river and generated severe pollution to the whole water basin. In 2014, the Ministry of Environmental Protection and the Ministry of Land and Resources released the First National Survey about Soil Pollution reporting that 16.1% of soil in China was polluted, and most polluted soil were located nearby traditional industries (69.7%). After the reform and opening-up policy in 1979, industrial pollution further aggravated through industrial transfer of industrial activities from West to East[3]. The transfer was fuelled by Foreign Direct Investment (FDI) and driven by increased environmental regulation in Western countries that presented China as 'pollution haven' and led to large-scale industrialisation of coastal cities (Lan et al., 2012). Since the 'Rise of Central China[4]' strategy and the 'China Western Development' strategy issued in 2004, many industries moved from the east to central and western areas. Pollutions also transferred from east to central and western areas (Dou and Shen, 2014; Cheng and Zhao, 2015). The large-scale development of DZs in central and western areas resulting in large-scale expansion or urban areas, e.g. Yibin, Kunming and Shanghai city (Deng et al., 2008), which occupied a wide-range of farmlands and forests (Tang and Lv, 2008; Liu et al., 2005) and consumed a striking amount of natural (energy) resources (Lu et al., 2007).

This development strategy resulted in an incompatible relationship of economy and environment with a clear political priority for the former which resulted in unsustainable forms of industrialisation and urbanisation. Serious environmental pollution during industrialisation also accompanied with problems of economy, social and urban. Just like Detroit in the U.S.A. and Ruhr region in Germany, TIAs in China also suffered industrial declines since the early 2000s, e.g., resource exhausted and industrial competitiveness declined in TIAs (Yang, 2004). Under the rapid urbanisation and city expansion, TIAs gradually occupied the centre area of cities. The behindhand facilities and living

[3] West here refers to developed countries in the Europe and the America where developing EM around 1980s-1990s, e.g., Netherland, Germany, U.K. and U.S.A. East here refers to developing countries in the Asian and the Middle East, e.g., China, India and Iran.

[4] Rise of Central China is an economic development strategy for central China published by central government in 2004. The transferring of industries from the eastern to the central is one of an approach.

environment in TIAs limited the development of urban to an extant (Li, 2013). The establishment of DZs didn't consider other functional areas of cities (e.g. residential areas, green spaces, commercial areas and other urban infrastructures), then the 'ghost city' problems generated that few people lived there and DZs became empty areas in holidays (Chen and Yang, 2013). Industrialisation and urbanisation was unbalanced in China that urbanisation lag behind industrialisation for a long time (Ye, 1999; Chen and Lin, 2010; Lin and Wang, 2012). The isolated development of DZs will make the situation worse.

Chinese central and local authorities have made increasingly vigorous efforts in curbing those problems mainly since the 2000s ---- considering environmental performance during industrialisation and urbanisation process. This thesis identified this green development focusing on transformation of industrial areas as the ET of IAs. The reform/transformation of the traditional development mode of industrialisation and urbanisation to more sustainable development has been identified as core objective by policy-makers as reflected in, for example, the publishing of the New Road of Industrialisation[5] (2002), Transition of Economic Growth Pattern (12th FYP, 2011-2015) and New Type of Urbanisation (2014).

Those policies have a resemblance to the EM approach that has been applied in the European context. EM can be understood as marrying environmental and economic gains through growth-oriented, systematic (technical) innovation which also bears incredible potential for environmental improvement (Jänicke, 2008). It is a policy approach to respond to environmental degradation and pollution through clean(er) technology and eco-efficiency policies (Jänicke and Jacob, 2002). EM's conception of the reinforcing relationship of modernisation and the environment, and its technical political approaches are mirrored in the ET of IAs in China.

These sustainable reforms/transformations in China have drawn the attention of many scholars who have heatedly debated whether this series of sustainability reforms carried out by the Chinese government can be understood as an adaptation of EM theory from the Western context. Some scholars (Mol, 2006; He, 2007; Zhang et al., 2007) claimed that there were differences in how EM has been implemented with China taking a very different way than Western countries.

Most debates presented relate to the different relationship of three stakeholders (i.e. governments, private sectors and civil societies) for EM development in China. Mol (2006) argued, based on Christoff's (1996) classification, that EM implementation in China is only a weak version of EM.

[5] The *New road of Industrialisation* was introduced by the 16th National Congress of the Communist Party in 2002. It refers to the new direction of industrialisation characterised by industries of high technology, excellent economic benefits, low resource consumption and low environmental pollution.

According to Bäckstrand and Lövbrand (2006: 53), '[t]he weak version is a technocratic and neo-liberal economic discourse that does not involve any fundamental rethinking of societal institutions. In contrast, the strong and "reflexive" version of EM adopts a critical approach to the limits of dominant policy paradigms and modern institutions in addressing environmental threats'. However, the updates in 2010s were seldomly discussed in EM literature. In 2010, China started paying more attention to public participation and coordination between government and civil society with regard to environmental management (Yee et al., 2013). And EM development in China paid more attention to the adaptation of social and cultural perspectives of governing illustrated by, for example, the implementation of the 'Two-Oriented Society' policy (2008), the 'Ecological Civilisation[6]' policy (12th FYP, 2011-2015). There is a need for a more recent follow-up study due to the recent political endeavours related to this topic.

Moreover, no matter whether considering EM practices in Western countries or China, there is an important perspective has not been involved in the theoretical structure ---- spatial perspective, but seldomly discussed in EM literature. The industrial transfer of resource-intensive industries from developed countries to developing ones and the industrial restructuring of heavy industrial areas, for example, in the Ruhr region of Germany, are both regarded as the spatial approach to adopt EM in Western countries. Land-use policies and strategies in China have been changed to optimise green industry and urbanisation.

In response to these shortcomings in the literature, the overall goal of this thesis is to provide empirically based evidence that will contribute to filling those theoretical gaps by exploring the new trends of EM adaptation in China, especially after 2010. The thesis uses a case study of Changsha-Zhuzhou-Xiangtan (CZT[7]) urban agglomeration in central China to unpack eco-transformation processes in China. CZT is one of many agglomeration in China consisting of three prefecture governments and a range of industrial areas from different eras (i.e. TIAs established during 1950s-1960s and DZs established from the late 1900s to early 2000s). The location and the different types of IAs in CZT, and lots of green political strategies applied in this area make it a good case study to understand the ET process of IAs both in organisational and spatial perspectives. CZT agglomeration was used as the context for a multi-case analysis of eleven industrial areas (incl. three typical TIAs and eight national DZs. The thesis research involved both primary and secondary sources. Primary data collection involved semi-structured interviews with 21 stakeholders from seven groups of

[6] Ecological Civilisation is a new ecological development concept following the industrial civilisation. It was put forwarded by central government during the 12th FYP (2011-2015) to guide the development of economy, politics, culture and society.

[7] As Xiangtan city is called Tan in short in China, 'CZT' is used as acronym for Changsha-Zhuzhou-Xiangtan urban agglomeration following Chinese language habit.

organisations, and field and participant observations for the eleven case study industrial areas within CZT urban agglomeration. Secondary data collection involved a range of relevant sources including news articles, policy documents, official reports from government, business reports from enterprises and work reports from environmental NGOs.

Therefore, this thesis centred on four main research questions, which are as follows:

- Q1: What are the trends in policies affecting Chinese EM?

  Exploring this question could help to understand the policy context in China for EM development, and the differences between the Western countries with China.

- Q2: How have governing modes changed in the eco-transformation of industrial areas in China?

  This research question is to identify shifting power and role of key participants (i.e. governmental authorities, private sectors and civil societies) in different scales (from local to national) for EM in China. The changes of power allocation among stakeholders represent the changes of cooperation approaches among them, and lead to different environmental governance mode[8]. How EM adapted in Chinese context can be investigated though this question.

- Q3: How have industries and industrial areas changed during eco-transformation in China?

  Investigating the spatial changes of industries and industrial areas during the eco-transformation in China is a key task of this research. Spatial tools were adopted by Chinese government for the EM development, but seldomly discussed in EM literature.

- Q4: How can these research findings contribute to EM in China and other centralised developing countries?

  This question focuses on the theoretical and practical contributions of this research.

The thesis proceeds as follows. **Chapter 2** reviews the literature on the concept of EM in Western countries and China. One concern is whether EM theory and practices in China are similar to those applied in Western countries, and how and why they may differ. **Chapter 3** reviews the literature on rescaling of environmental governance, industrial transfers and spatial structures, and then provides analytical frameworks to guide the analysis in China. **Chapter 4** presents the research methods. **Chapter 5** presents the methods and the context of the case study of CZT urban agglomeration. **Chapter 6** firstly analysed the national and local policy context of Chinese EM to gain an insight into

[8] Governance mode here refers to who is collaborating or also about how different actors are collaborating.

the EM paths in China. And then, analytical framework built in chapter 3 will be embodied in the research in CZT. **Chapter 7** analyses the rescaling process of environmental governance during the ET of IAs in CZT. Moreover, the shifting roles of central government, local government, private sectors and civil societies are examined to better understand the features and development phases of environmental governance through EM in China. **Chapter 8** investigates the changes of industries and industrial areas from a spatial perspective during the ET of IAs in CZT. **Chapter 9** presents the conclusion of the findings. Furthermore, this chapter also reflect on the limitations and formulate a future research agenda.

Chapter 2 The Development of Ecological Modernisation from the West to the East

With increasing evidence of environmental degradation since the 1960s and 1970s, academics and policymakers have reconsidered the relationship between environment and economy in terms of three main conceptualisations: Sustainable Development (mainly introduced in the 1980s), EM (also emerged primarily in the 1980s), and Green Economy (in particular in the wake of the 2008 economic crisis). Even though these approaches all emphasise the win-win potential of environmental protection and economic growth, they represent different disciplines and approaches (Pepper, 1998; Huber, 2000; Brand, 2010; Lidskog and Elander, 2012). Sustainable Development concerns not only the environment but also justice between and within generations (Brundtland Report, 1987; Langhelle, 2000). Based on various studies and national conferences (e.g., UN Conference on Sustainable Development), sustainable development has become an internationally recognised concept and normative goal, although it can be said to lack a detailed methodology or well-defined vision. Meanwhile, EM and Green Economy offer two different notions regarding the theory and implementation of sustainable development. EM theory is mainly considered within the social sciences. Joseph Huber and Martin Jänicke in Germany first developed the idea of advancing both environmental and economic goals through what they termed 'ecological modernisation' (e.g., Jänicke, 1985; Huber, 1985). Although the approaches and emphases of this theory have developed over time, it can be summarised as a strategy of systematic (technical) innovation and expansion of economic growth that also has the potential for environmental improvement (Jänicke, 2008). EM emphasises economic development and technological advances within a suitable policy framework. Green Economy is mainly considered as a sustainable mode of economic-political systems and economic behaviours. It serves as an 'engine for growth … while significantly reducing environmental risks and ecological scarcities' (United Nations Environment Programme, 2011:1). Green Economy fits squarely within the context of sustainable development as a means of reconciling economic policies and behaviours with social and environmental needs (Bina, 2013). Even though there has been a greater focus placed upon political perspective within the Green Economy literature, Green Economy only examined the impacts of policies, but not the social institution perspective like EM.

Both Green Economy and EM approaches have been adopted in China for sustainable development (see Mol, 2006; Zhang et al., 2007; Yi and Liu, 2015; Shi et al., 2016; Pan et al., 2019; He et al., 2019). However, as the case study here reflects more EM than Green Economy(i.e. the political and institutional efforts that China made for SD), this thesis uses EM as theoretical framework. However, given that Green Economy and EM have overlapping aspects in the context of sustainable

development (Pepper, 1998; Langhelle, 2000), the Green Economy concept is also mentioned as it provides a politico-economic relationship for EM (details in section 6.1).

Accordingly, sections 2.1 and 2.2 discuss how EM theory was developed and implemented in Western countries (e.g., Germany, UK, and Netherlands) and in China. The diverse backgrounds, conditions, pathways, and strategies for EM development in the West and China are compared. This examination will show how and why China pursues EM in a unique way while also revealing the gaps in current debates about Chinese EM which are worthy of further exploration. Finally, section 2.3 gives a summary and research focus of this thesis.

2.1 Development of Ecological Modernisation in Western Countries

EM theory first emerged in Western countries in the 1980s, especially in Germany, the Netherlands, and the UK (Jänicke, 1985; Mol, 1995; Mol and Sonnenfeld, 2000; Gu, 2015). Those were some of the first countries where concerns related to the ecological crisis as a result of capitalist development and industrialisation emerged. This section examines how EM was developed and implemented in those countries. This will not only help us to better understand the characteristics of EM theory in the West but will also provide a foundation for the subsequent analysis (in section 2.2) of the differences between China and the West in EM implementation.

2.1.1 Theoretical Development: From Technological Innovation to Institutional/Systematic Transformation

In the development of EM theory, its emphasis, field of focus, leading stakeholders, and level of implementation were extended and modified over time. Based on this, this thesis identifies two stages of development: the 1980s to the early 1990s and the late 1990s onwards (Table 2.1).

At its beginning, in the 1980s, the EM concept was proposed to promote harmony between modernisation and the environment by emphasising the use of technological advances (especially environmentally friendly technologies) and market-based approaches to address environmental degradation. Huber (1982) proposed that, after the 1980s, industrial society would enter into an age of 'superindustrialisation' (*Superindustrialisierung*), where the industrial system and structure would become more sustainable through the development and application of more sophisticated technologies. Such innovations not only upgrade traditional 'end-of-pipe' strategies with specific environmental advantages over previous technologies but also introduce 'smarter' environmental technologies throughout the life-cycle processes of production and products (Huber, 2008). This could include upgrading raw materials, energy, production modes, final products, and recycling through various innovations. Market-based approaches also play a significant role in EM in that the

environment is internalised into the market and governed by market-based approaches (Jänicke, 2007) (e.g., taxes on industrial pollution). Thus, the roles and responsibilities of economic sectors and entrepreneurs are emphasised, as opposed to a 'top-down' government approach (Huber, 1984).

In the late 1990s, however, scholars increasingly recognised the limitations of technological upgrading and the potential failures of the market (Jänicke, 2008). Instead, they started to focus on transforming the institutional and economic structure of society by incorporating ecological concerns. Dobson (2012) argued that technology alone could not deal with all environmental problems, suggesting that 'a sustainable and fulfilling existence presupposes radical changes in our relationship with the non-human natural world, and in our mode of social and political life' (Dobson, 2012: 2). Thus, external support needs to be coordinated by internal reforms. Here, institutional or systematic transformation refers to two changes: adjustments to 'precautionary' policies and regulations (e.g. Hajer, 1995; Gouldson and Murphy, 1996; Mol, 2006) and transforming politics, institutions, social structures, and policymaking. This can be regarded as a transformation from a 'weak' EM to a 'reflexive' or 'strong' EM (Christoff, 1996). According to Bäckstrand and Lövbrand (2006: 53), '[t]he weak version is a technocratic and neo-liberal economic discourse that does not involve any fundamental rethinking of societal institutions. In contrast, the strong and "reflexive" version of EM adopts a critical approach to the limits of dominant policy paradigms and modern institutions in addressing environmental threats.' The increasing importance of 'good governance' and the greening of society and economy all promote the further development of EM (Huan and Jänicke, 2010). During policymaking and management processes, government is involved, but not in an exclusive role; instead, multiple economic sectors and civil societies all participate. At the same time, with the trends toward economic globalisation and transnational organisations, EM comes into play on a global scale.

Table 2.1 The Development of EM Theory in Western Countries

Start Time	Characteristic	Emphasis	Field	Leading Stakeholders	Level
The early 1980s	Weak EM	Technological Innovation and the Market	Life-cycle process of production and products	Economic sectors and entrepreneurs	National
The late 1990s	Stronger EM	Institutional/ Systematic Transformation	Production and consumption	Multiple actors, including governments, private enterprises, NGOs, environmentalists, researchers, the public	Transnational

In sum, EM theory has gradually matured in Western countries. It focuses not only on technological development but also on politico-economic reforms and environmental policymaking. It emphasises the engagement of firms and civil societies in addition to the government. Moreover, the operational level has been expanded from local and regional levels to the transnational level.

2.1.2 Practical Implementation: Political Discourse and Environmental Policymaking

EM emphasises economic development and technological advances within a suitable policy framework (Deutz, 2009). EM is a theory but also a practical strategy for policy discourse. In the beginning, EM only pertained to a small academic body of environmental policy research, known as the 'Berlin School'. Then, it gradually began to spread from academic to policy circles and informed radical policies of the governing party, such as the Social Democratic Party (SPD) in Germany. In 1998, the SPD explicitly implemented EM, and it became the subheading of the environmental policies in the Treaty of the Union with the Green Party (Hauff and Scharpf, 1975; Huan and Jänicke, 2010). By 2013, there were more than 70 green parties worldwide (Du and Yang, 2013), which have played positive roles in national and international political realms through 'ecocentric approaches' (see Eckersley, 1992). International organisations have also made EM-related efforts, such as the 'Europe 2020' project and the 'Eco-innovation Action Plan' introduced by the EU in 2010 and 2011. Based on the development of EM theory in Western countries described in section 2.1.1, the implementation of EM in political discourse can also be divided into two stages.

First, environmental concerns were internalised in existing patterns of economic production and consumption via regulations and incentives. For example, in Germany, the government published a series of policies to facilitate and encourage innovation in production and environmental

technologies and to strengthen the environmental accountability of polluters via economic instruments (e.g., taxes on energy, electricity, and cars) (see Kohlhaas, 2003). Such policies can mitigate many environmental issues to some extent. For example, the paper-making industry is considered a high-pollution industry, but with technological upgrading, it became an environmentally friendly industry in Finland (see Kivimaa and Mickwitz, 2004; Nurmesniemi et al., 2007). Peeze, a coffee producer in the Netherland, implemented cyclic utilization during the whole life cycle process of production and consumption, and achieved great results of environmental protection and economic benefits (see Du, 2017).

Second, there have been more structural and systematic transformations focused on political, institutional, and social objectives. These include upgrading of industrial structures, transformation of the economic development mode and adjusting of participants' roles in environmental governance. Since 2009, the U.K. published a series of policies and regulations to promote EM centre on low-carbon development. While et al., (2010) proposed a new notion of eco-state restructuring that a new form of state control and a reworking of state-society relations were generated by low-carbon goal. The roles and functions of central governments have been reconsidered. Through environmental decentralisation processes, local governments have assumed more responsibility for environmental performance in their regions. Moreover, non-state actors have increasingly become involved in policymaking and governance processes. This is because of the limitations of the market and 'top-down' approaches, as well as the concept of democracy and equity under political modernisation (Van Tatenhove and Leroy, 2003). Environmental education has been strengthened to enhance the public's awareness of and participation in environmental protection. Firms and environmental NGOs also play vital roles in EM in the Western context; they possess powers comparable to—and even sometimes surpassing—those of governments (Driessen, 2012).

2.1.3 Conditions and Limitations of EM

From the development and practices of EM theory in western countries, we can see that there are many prerequisites for EM development which act as the drivers for EM. Firstly, EM should be built on "the capitalist logic of technological modernisation and the competition for innovation in combination with the market potential of global environmental needs" (Jänicke, 2007: 563). Environmental technologies provide solutions for environmental problems. Secondly, the involvement of 'good environmental governance' is also indispensable. The environmental regulation in pioneer countries influenced other countries through global trade, transnational corporations and organisations. Strict environmental regulations also apply (economic) pressures on

polluters, and indirectly give rise to the development of environmental intensive industries (i.e. companies for environment monitoring and pollution treatment).

However, the limitations of EM are also widely recognised by scholars (e.g. Gibbs, 2006; Jänicke, 2007; While, 2010). "Economic growth tends to neutralise environmental improvements if increases in eco-efficiency remain incremental (below the growth rate), if environmental innovations are restricted to niche markets and/or if the 'solution' addresses the symptoms, not the causes" (Jänicke, 2007: 564). Moreover, EM is often met by the resistance of the 'EM losers'. If they hold strong power to control and limit the environmental policies (Inc. policy-making and execution), then EM could be restricted to a large extent (Jänicke, 2007). Last but not least, EM practices (e.g. industrial transformation) will inevitably conflict with vested interests. To address this, "fears arising from 'creative destruction[9]' should be reduced through co-operative transition management" (Jänicke, 2007: 564). Meanwhile, 'good environmental governance' also needs structural and detailed solutions, regardless of the national level or local level (Gibb, 2006).

2.2 Ecological Modernisation Practices in China

After the 2000s, alongside the internationalisation of environmental problems, EM application in developing countries became a subject of academic analysis (Mol and Sonnenfeld, 2000; Carter, 2001; Eckersley, 2004; Mol, 2006). China has been a typical case of a developing Eastern country that has attracted increasing attention from Western scholars (Mol, 2006). However, whether China has the capabilities and conditions needed to meet the challenges of EM development remains a topic of debate.

2.2.1 Drivers of and Challenges for Chinese EM

2.2.1.1 Domestic and International Pressures

Few countries have focused on urbanisation and industrialisation as intensively as China. Taking the Competitive Industrial Performance Index as an example (Fig 2.1), China experienced the highest year-on-year average growth rate of the industrialisation intensity index (1.24%) for the time period 1990 to 2014. While the level of urbanisation lags behind industrialisation (Li, 2008), the growth rate of urbanisation is at a high level. The urbanisation rate of China increased from 17.38% in 1970 to 55.61% in 2015, and is expected to reach 60.34% in 2020 (Li et al., 2017).

[9] Creative destruction can be described as the dismantling of long-standing practices in order to make way for innovation. Creative destruction was first coined by Austrian economist Joseph Schumpeter in 1942. Schumpeter describes creative destruction as innovations in the manufacturing process that increase productivity, but the term has been adopted for use in many other contexts.

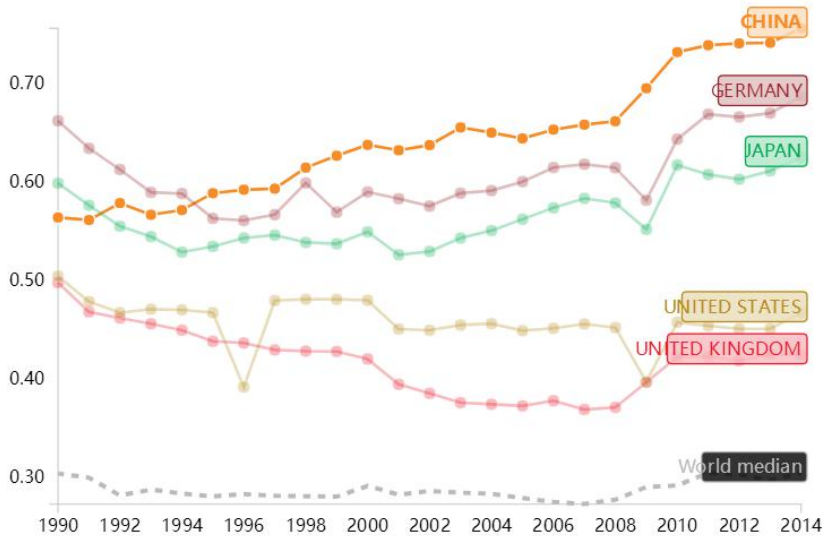

Figure 2.1Competitive Industrial Performance Index[10], 1990-2014

(Data Source: https://tcdata360.worldbank.org/indicators/mva.ind.int?country=BRA&indicator=3793&viz=line_chart&years=1990,2014)

However, the rapid and uncontrolled urbanisation and industrialisation in China resulted in environmental problems (e.g. Zhang et al., 2011; Hu et al., 2013; Xu and Lin, 2015). Economic growth achieved successes at the expense of the environment, and such unsustainability may ultimately influence economic growth itself. The challenges posed by unsustainable urban and industrial development include not only environmental pollution and natural-resource shortages but also societal impacts, such as urban sprawl, traffic congestion, health issues, lifestyle changes, urban culture expansion, and social inequality (Ren, 2017). Furthermore, China's environmental problems extend beyond China affecting the entire world that relatively local environmental problems in China are of global significance.

Moreover, the green turn in the global economy has greatly affected exports and foreign direct investment (FDI) into China, which have increased over the past 30 years (Wang, 2012). Such pressures are mainly related to the following developments (Fig. 2.2). First, increasingly strict environmental standards for exports have created economic barriers for China. Ignoring the environmental performance of its products may harm China's economy. Second, foreign enterprises introduced through FDI are highly competitive in China. Thus, to obtain higher market shares, local firms need to adopt greener approaches. Third, big enterprises, brands, and international environmental NGOs exert a powerful influence on Chinese enterprises and consumers. Lastly,

[10] The Competitive Industrial Performance (CIP) index considers countries' productive capacity, intensity of industrialization and impact on the world market as major components of industrial performance (tcdata360.worldbank.org).

China's emphasis on technological development also provides a significant basis for EM development. Therefore, as shown in Fig 2.2, the pressures and drivers related to EM development in China exist at both domestic and international levels. Thus, to promote its image as a major responsible power, the Chinese government devoted more attention to its environmental performance during its process of modernisation (http://www.china.com.cn/environment/2007-12/03/content_9333983.htm).

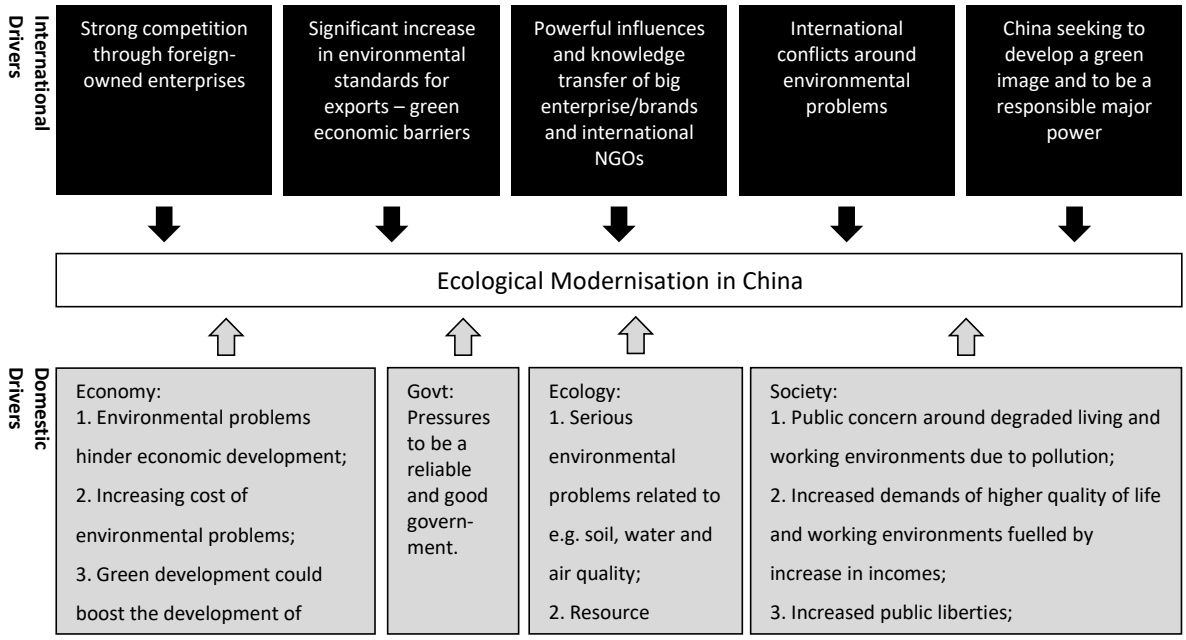

Figure 2.2 International and domestic drivers of EM in China

2.2.1.2 Challenges

However, introducing a Western-based EM concept into China faces potential challenges. Such challenges are mainly related to: 1) the **behindhand** nature of China's economy and industrialisation level, independent technological innovation, and civil society and 2) its **different** political regime, institutional mechanisms, industrial structure, and market system compared to the West. These factors give rise to discussions about whether China has the capabilities and conditions needed for EM development.

First, although China's economy has grown rapidly, China as of 2010 was still technically a developing country characterised by moderate average incomes (World Bank Report, 2010). Some scholars argue that China suffers from the 'middle income trap[11]' and will be locked at that level for a long time, which could hinder further transformation and reform (e.g., Chen, 2016). Moreover, China has been seen as lacking the capabilities needed for independent technological innovation

11 Middle Income Trap is the phenomenon of hitherto rapidly growing economies stagnating at middle-income levels and failing to graduate into the ranks of high-income countries (Aiyar, 2013).

which is considered an important condition for EM (Huber, 2008). After the 1980s, China's economic boom was realised by a large amount of FDI, making it 'the factory of the world', and Chinese companies have mainly imitated advanced foreign technologies (Wang et al., 2006). The Chinese government has recently acknowledged this problem and has propagated various plans and strategies to support technological advancement (e.g. the development of high-tech industrial areas, renewable energy research, the 'Made in China 2025' initiative of 2015). However, significant gaps still exist among the eastern, central, and western regions in terms of green technological innovation (Luo and Liang, 2016). Furthermore, despite a rapid increase in the GDP share and employment in tertiary industries, heavy industries (e.g., electricity, steel, mechanical equipment, autos, chemical engineering, building materials) still played a dominant role in China since 1993 (Wu, 2006). This existing industrial structure along with the long-term requirements of economic growth both pose challenges to EM development in China.

Second, China, as a centralised, socialist country, has different institutional mechanisms, and market systems, compared to Western states which have implications for EM. Civil society emerged much later in China than in Western countries (Zhang, 2013). In China, personnel appointments and the removal of local government officials are determined by government superiors, not citizens. Regulations and incentives are implemented top to bottom and lack the participation and supervision of non-state actors (Mol, 2006). The public's perception of environmental protection shows high awareness but low accuracy, indicating that citizens only passively accept environmental concepts and knowledge at this stage (China Environmental Awareness Project Office, 2008). Moreover, state-owned companies are the core force for national economic development (President Xi Jinping, 2015). Yet, the efficiency and technological innovation capability of state-owned companies are considered low compared to private companies (Yao and Zhang, 2001; Xing and Zhou, 2016).

In short, though China needs EM development, the EM path of Western countries is not easily transferable to the Chinese context. Indeed, EM processes can differ from country to country and region to region (Mol, 2006). As Huan and Jänicke (2010: 179) noted, 'In the increasingly globalized world, the differences between developed countries and China cannot be the obstacle of EM application […] actually, the purpose of EM theory was enlightened by the "Four Modernisations" (1954) policy (i.e., industrial modernisation, agriculture modernisation, national defence modernisation, and technical modernisation) in China.' China, therefore, needs to seek a specific EM path for itself. As the 'internationally oriented' and 'domestically driven' EM is different (Milanez and Bührs, 2008), in order to avoid the risks carried by international involvement, such as institutional

dependence and introduction of inappropriate technologies, China are seeking EM solutions domestically, even though China is also experiencing international pressures.

2.2.2 Characteristics, Gaps, and Debates Related to Chinese EM

2.2.2.1 Leapfrogging Pathway

Different from Western countries, Chinese EM was introduced before full industrialisation. However, a attempted leapfrogging approach for Chinese EM was presented, i.e. the integrated EM path presented by The *China Modernisation Report: Study on Ecological Modernisation* (2007) by the Chinese Academy of Sciences. This report (2007) proposes three pathways for EM (Fig 2.3):

- Pathway 1: **Comprehensive EM** applies to highly developed countries where EM takes place through dematerialisation, decoupling, and ecological rationalities.
- Pathway 2: **Integrated EM** applies to developing countries that adopt a leapfrogging approach to an eco-modernised society by focusing on accelerating a green industrialisation and urbanisation toward a knowledge society.
- Pathway 3: **Ecological Modification of a Classical Modernisation Path** is relevant for developing countries that are still in the midst of conventional industrialisation and urbanisation processes.

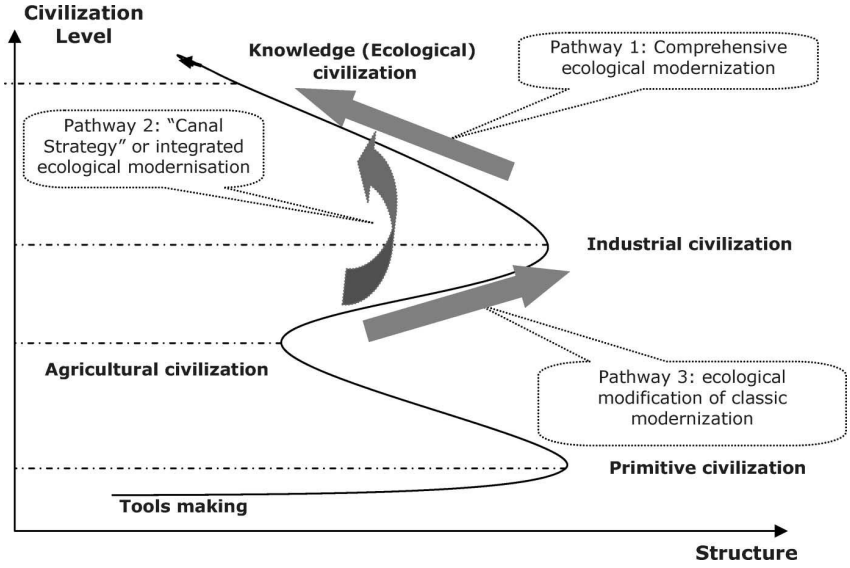

Figure 2.3 Pathways toward EM

(Zhang et al., 2007)

Like most developing countries, China is in the midst of conventional industrialisation and urbanisation processes, but the difference is that China aims to proceed the second pathway (i.e. integrated EM) with a leapfrogging approach to an eco-modernised society by focusing on accelerating a greening industrialisation and ecologist economy toward a knowledge society (China Modernisation Report, 2007; He, 2007; Zhang et al., 2007). The China Modernisation Report (2007) indicated that, by 2004, China consumed 100 times of natural resources more than Japan, France

and Germany; the density of industrial wastes in China was 20 times than it in Germany, 12 times than it in Korea and the U.K. The China Modernisation Report (2007) also captured the degree of EM to establish a world ranking based on 30 indicators related to ecological quality, ecological economy, and ecological society. China's EM index was 42 points, ranking it at 100 out of 118 countries. In order to catch up with the EM levels of developed Western countries, the integrated EM pathway should adopted. Through this pathway, China has set goals that should improve its ranking by 80 places by the end of the twenty-first century—that is, its EM degree should be raised from an elementary level to an advanced level (He, 2007).

2.2.2.2 Greening of Urbanisation and Industrialisation

In order to achieve the EM goal, China's first step involved the goal to realise the greening of urbanisation and industrialisation during the period 2011–2020 (He, 2007).

Since urbanisation and industrialisation are the leading forces for both modernisation and pollution in China, the greening of urbanisation and industrialisation is regarded as a significant strategic measure for integrated EM in China (China Modernisation Report, 2007; He, 2007).

As the world's second-largest economy, China views urbanisation as a crucial strategy for achieving modernisation and economic growth (Li, 2012; Wang, 2013). Moreover, industrialisation is necessary for the 'Chinese Dream' (Huang, 2013). In the process of rapid industrialisation and urbanisation, there was also a decline in the percentage of people living in absolute poverty (Ravallion and Chen, 2007).

However, imbalance between economy and environment caused industrialisation and urbanisation to proceed in unsustainable ways, and water, soil, and air quality all suffered as a result. In 2007, 90% of water areas in urban were seriously polluted, and more than 50% drinking water sources of urban did not meet the standards (Data provided by the Ministry of Environmental Protection). In 2014, the Ministry of Environmental Protection and the Ministry of Land and Resources released the First National Survey about Soil Pollution. The survey indicated that 16.1% of China's soil was polluted, mostly in the areas around polluting industries (36.3%), industrial wasteland (34.9%), and mining industries (33.4%). Also, the Report of Environmental Quality in China, issued in 2014 by the Ministry of Environmental Protection, indicated that air qualities in 145 of a total of 161 investigated cities had broken the minimum environmental standard.

With the green transformation of development and governance modes, it is argued that the environment could exist in harmony with urbanisation and industrialisation (Zhang, 2006; Tu and Xiao, 2009; Ryan, 2012). This has been increasingly recognised by policymakers and urban planners,

causing them to rethink approaches to urban and industrial development. Traditional economic development models should be replaced by ecological models to achieve the symbiosis of nature, economic, and society.

Concepts such as 'green city', 'garden city', and 'eco-city' have been widely adopted in China (Baoxing, 2009; Yu, 2014). In 1986, Yichun was designated as China's first eco-city. This was followed by the gradual ecological transformation of more cities. By 2011, 259 cities in China included ecological and low-carbon development as purpose, of which 90.2% of those cities set the goal to become an eco-city. Those cities include both new urban developments (i.e. cities from scratch) and existing cities. *The Contemporary Method to Manage the Construction of Low-Carbon Eco-City*, published in 2011 by the Ministry of Housing and Urban-Rural Development, introduced six criteria for national low-carbon eco-city construction: 1) land use is mixed and intensive, 2) at least 20% of energy is renewable, 3) green buildings account for at least 80%, 4) biological diversity and natural spaces are protected, 5) green transportation accounts for more than 65%, and 6) high-pollution industrial projects are excluded. Eco-cities differ from traditional urban development pathways in terms of concepts, industrial structure, social value, ecological development standards, urban management, and urban lifestyle (Zhang et al., 2007).

Regarding the greening of industrialisation, the central government initiated the 'Shifting of Economic Development Mode' (2007) and 'New Type of Industrialisation' (2002) strategies. The Shifting of Economic Development Mode stipulated that: 1) the driving force of economic development should transform from only secondary industries to the synergy effects of primary, secondary, and tertiary industries, and 2) the driving force of economic development should transform from resource consumption to advancing technology, improving the quality of workers, and innovating management. Meanwhile, the *New Type of Industrialisation* refers to industrialisation that: 1) is driven by information and knowledge and 2) supports sustainable development. In these ways and in an era of the knowledge economy, there is potential for developing countries such as China that did not complete traditional industrialisation to catch up with advanced countries and avoid the 'middle income trap' (Jian and Xiang, 2004).

2.2.2.3 Spatial Perspectives of EM

Space is not just an absolute physical container but also a powerful tool that can be used for social, economic, and political development (Lefebvre, 1991; Macnaghten and Urry, 1998; Leff, 2000; Escobar, 2001; Franquemagne, 2007; Garavan, 2007; Seghezzo, 2009). Spatial constructions are shaped by social, economic, and political reforms and transformations that are influenced by new paradigms, such as EM theory. Space can also be a tool to lead or accelerate such reforms and

transformations. The spatial perspective has been adopted in Western EM, as with the industrial transfer of resource-intensive industries from developed countries to developing ones and the industrial restructuring of heavy industrial areas, for example, in the Ruhr region of Germany. A spatial perspective has also been adopted in China's EM implementation. Land-use policies and strategies have been changed to optimise green industry and urbanisation. Examples include designating spaces with different land-use intensities based on ecological carrying capacity, stipulating intensive land use to promote industrial agglomeration, and integrating the development of industrial areas within cities. As in the West, spatial practices have not been integrated into EM theory in China.

2.2.2.4 Debates over Consideration for Social Institutions

It has been suggested that while China has focused on technological aspects when adopting EM, it has paid less attention to political reforms and public participation (Zhang et al., 2007). Mol (2006) argued, based on Christoff's (1996) classification, that EM implementation in China is only a weak version of EM. Chinese scholars have also recognised this deficiency. For example, Chen (2010) developed an assessment indicator for EM and evaluated its progress in China (taking Hunan Province as a case) in terms of economy, society, and environment. The study found that the EM level (measured by the assessment indicator for EM created by Chen) gradually increased in China during 2007–2009, though the economic and environmental contributions were more significant than the social contribution. EM in China is led by the central government while participation by local governments and civil society is passive, which differs from how EM proceeds in Western countries (Liu, 2011).

After 2010, China started paying more attention to public participation and coordination between government and civil society with regard to environmental management. With the stated aim of the 'improvement of the governance system and modernisation of governance capability' mentioned in the Third Plenary Session of the 18th CPC Central Committee held in 2013, 'governance' became a key topic in China. Different from 'government,' 'governance' requires 'the actions of the state and, besides, encompasses actors such as communities, businesses, and NGOs' (Lemos and Agrawal, 2006: 298). In 2014, President Xi said that 'most environmental problems are attributed to the problems of the governance system.' As such, many policies have aimed to restyle China's governance mode. Cao (2015) and Hao (2019), for example, noted that the 'Ecological Civilisation' project, initiated with the 12th Five-Year Plan (2011–2015), included strategies for modernising state governance for EM. Public participation is meaningful because the public's environmental rights are the realisation of environmental justice, on the one hand, environmental supervision from the public is a vital replenishment of judicial supervision system on the other hand (Li, 2013). Although civil society still

has little effect currently (especially, given its the limited ability to influence decision making), due to the increasing concerns from scholars and Chinese government and pressures from media coverage and the public complaints, the role of non-state actors is expected to be improved gradually in the future (Yee et al., 2013; Gu and Li, 2017; Ning, 2018).

Gu (2015), meanwhile, suggests that although China has made some adjustments to the relationship between government and the public, the government will always be the leading force. Thus, having the market and civil society play more significant roles—as in Western countries—is a challenge for China. Does this relationship between government and civil society pose an obstacle for achieving EM in China? On the one hand, over-dependence on administrative intervention may generate failures in environmental supervision and produce information asymmetry (Mol, 2006; Liu, 2011). On the other hand, some suggest (Huan and Jänicke, 2010; Ding, 2013) that countries with the authoritarian model also have their advantages in achieving the aim of sustainability. Market-based approaches to environmental protection are based on economic effectiveness but could not be outside of governmental control sometimes. Some scholars suggest that centralised government could help avoid failures associated with the market and public participation (e.g. Ding, 2013). Moreover, environmental activities across regions are hardly organised or coordinated from the bottom. Therefore, although the involvement of non-state actors is needed, China does not need to take Western pluralistic democracy as a premise. Pathways based on the centralised state could also implement EM and might be more suitable for China (Huan and Jänicke, 2010). Notably, however, the vision of sustainable development promoted by the UN since the Earth Summit of 1992 does specifically include an element of public participation and local awareness/consultation in decision making. Chinese EM is by definition almost not complying with that vision. There is still a need to explore ways to balance the relationship between state and non-state actors for EM development in China.

2.2.2.5 Struggles of Local Governments

Even though, central government published a series of environmental policies and strategies, local governments have gone through a period of struggle to put these into practice (e.g. Kostka and Mol, 2013; Qi et al., 2014; Zhang et al., 2016). Since high governance levels rather than the public determine the assessment of officials' political performance, local governments prefer to consider central government’s guidance but not demands from the public. With the Chinese state having taken economic development as the central task within the past two decades, it generated a government policy system which favoured economic objectives (Li and Lang, 2010). Thus, local governments focus on local economic growth even at the cost of the environment. Even though the Chinese state empowered local officials through more environmental responsibilities, initiated

'Green GDP', and China tried to slow down the GDP growth rate for better development qualities (Inc. environmental performance during economic growth) after 2012 (http://finance.sina.com.cn/china/bwdt/20120305/152411516342.shtml), local governments were still bonded to the 'treadmill of production' (Li and Lang, 2010). From 1979 to 1994, decentralised fiscal management was also regarded as an obstacle to local environmental protection that it weakened central government's power to guide local officials' practices on environment protection (Qi et al., 2014). Local governments in China are likely to become the 'EM losers'. As they have strong power to control and limit the environmental policies (incl. policy-making and execution) after the decentralisation of fiscal power and environmental management, there is a risk that they will restrict or hollow-out EM to a large extent (refer to Jänicke, 2007).

Despite some local officials making efforts towards local environmental protection and initiating local environmental institutional transformation, e.g. Vertical Reform of Sub-national Environmental departments[12] in Shenyang city in 2008, without central government's support, this reform did not achieve expected outcomes and was abolished in 2015 (http://www.infzm.com/content/120922/). The environmental institutional transform or any other sticker environmental policies only implemented in one region may conflict with local economic growth and failure to control pollutions national wide.

Therefore, the relationship and how powers are allocated between central and local government is crucial in China for the local environmental protection (Zhou and Dong, 2018). It evokes further analysis in this thesis about what can be understood as an 'appropriate' relationship between central and regional/local governments for 'good environmental governance'.

2.2.3 Summary: Limitations of Previous Studies on EM in China

Investigating China's environmental reforms from an EM perspective reveals that, China's lagging economic and industrialisation levels and the different political regime have not stopped its EM development. Rather, it has generated a unique EM pathway—namely, 'integrated EM' with a leapfrogging approach. Given the significant contribution of urbanisation and industrialisation to both modernisation and environmental degradation, the greening of urbanisation and industrialisation is a crucial strategy for achieving 'integrated EM'. By this 'integrated EM', the greening of urbanisation and industrialisation during the period 2011–2020 is regarded as the first step (He, 2007). Various policies and strategies focusing on green cities, eco-cities, and a new road of

[12] The *Vertical Reform of Sub-national Environmental Department* was issued by the General Office of CPC Central Committee in 2016, few duties and responsibilities shifted from lower levels to superior levels which enhanced the power of vertical/hierarchy management.

industrialisation have emphasised environmental performance by specified adjustments to land-use pattern of industries and urban areas. However, the 'integrated EM' concept still rests on the envision phase that it pointed out a general direction but did not provide clear and detailed plans (both central and local level), especially plans different from 'classic EM' path adopted by Western countries.

At the same time, there are relatively few analyses of EM practices in China during the 2010s. Most studies of EM in China consider practices during the mid-2000s and the early 2010s. However, in the 2010s, Chinese governments issued a series of policies and strategies for sustainable development, which may constitute a significant change in the circumstances of Chinese EM (see section 6.1). Debates about whether non-state actors have stronger influences, whether China considered social institutions, and whether local governments devote themselves more into EM maybe have different answers during the mid and late 2010s. Changes and possible causes are being explored in this thesis to strengthen and expand previous reviews.

2.3 Summary: Research Focus of this Thesis

In order to explore how EM theory has been adapted to the Chinese context, firstly, this chapter explored the theoretical development and practical implementation of EM in western countries and China. As EM theory emerged in the Western context, introducing a Western-based EM concept into China faces potential challenges related to different industrialisation levels, industrial structure and political regime in China that differ from advanced capitalist Western countries (e.g. the UK, Germany and Netherland). However, pressures and drivers from national and international levels both promoted the EM development in China (see section 2.2.1). Therefore, differences between the West and China did not limit the EM development in China, but led China down a unique way/path for EM.

Section 2.2.2 organised the characteristics of this unique path. In general, China adopted a leapfrogging approach (i.e. integrated EM) to an eco-modernised society by focusing on accelerating a green industrialisation and urbanisation toward a knowledge society (China Modernisation Report, 2007; He, 2007; Zhang et al., 2007). In order to achieve its EM goal, the greening of urbanisation and industrialisation is the first step during the period 2011–2020 (He, 2007). So, the greening of urbanisation and industrialisation is regarded as a significant strategic measure for integrated EM in China.

Section 2.2.2 also highlighted some limitations of current EM analysis in China that this thesis will discuss further. Firstly, although the greening of industry and urban areas was regarded as a crucial

way to achieve the 'integrated EM' in China, detailed plans and strategies (both in central and local level) did not provide in previous papers. Secondly, most studies of EM in China consider practices during the mid-2000s and the early 2010s. There is a need for a more recent follow-up study due to the recent political endeavours related to this topic, e.g. whether non-state actors have stronger influences, whether China considered social institutions, and whether local governments devote themselves more into EM after the late 2000s. Moreover, the relationship between EM and space is closely linked in practice and relevant to the success of the ET of IAs but very little attention has been paid to spatial processes as part of these transformation processes. To extend these debates and to address the limitations of previous studies, this thesis aims to focus on EM practices on two perspectives after the late 2000s: governmental/organisational perspective and spatial perspective.

Firstly, the relationship between government, private enterprises, and the public in terms of EM remain an essential topic for further exploration, that is, the governmental/organisational perspective of EM. Relationships and allocation of powers between central and local government, and between governments and non-state actors were gradually regarded as the crucial instruments for the effects of environmental protection. However, there is no systematic or structural analysis about it during Chinese EM at present.

Secondly, no matter whether considering EM practices in Western countries or China, there is an important perspective has not been involved in the theoretical structure ---- spatial perspective. It was adopted by Western countries for EM, and plays a more prominent role during Chinese EM practice, which made it as one of the tools that cannot be ignored. A structural investigation of it is needed for the understanding of EM adaptation process in China, and also the rethinking of EM theory.

However, in what ways could these two perspectives be analysed? To address this question, according to some relevant theories, the next chapter (i.e. chapter 3) outlines an analytical framework to guide the analysis of the CZT urban agglomeration highlighting governmental/organisational and spatial dimension.

Chapter 3 Theoretical Basis and Analytical Framework

Following from the debates and gaps in EM theory discussed in chapter 2, this thesis will now focus on the adaptation of EM to the Chinese context from two perspectives: organisational perspective and spatial perspectives. For further investigation of these two perspectives, this chapter will refer to previous discussions about environmental governance and spatial theories (i.e. industrial transfer and urban spatial structure) to build analytical frameworks to guide the analysis of the ET of IAs in China.

In section 3.1, an analytical framework for organisational studies of the eco-transformation (ET) of industrial areas (IAs) is constructed based on theories of rescaling environmental governance. This framework can help to detect how stakeholders at different scales (vertical and horizontal scales) cooperate with each other and how 'powers' (i.e., responsibilities and duties) shift among diverse scales. Meanwhile, in section 3.2, theories about the spatial analysis of IAs during ET (i.e., industrial transfer and urban spatial restructuring) are referenced. And, a framework for spatial analysis of IAs during ET in China will be built. Finally, section 3.3 gives a summary of this chapter.

3.1 Constructing an Analytical Framework for the Institutional Study of EM in China

Since this thesis focuses on EM concerns in policy discourse and societal institutional considerations related to EM, then, modes or styles of environmental governance are examined. Moreover, as this thesis focuses on China and CZT, conceptual and analytical frameworks which developed from Western theories were referenced and also adapted according to the situations in China and also in CZT urban agglomeration.

3.1.1 Environmental Governance

3.1.1.1 From Government to Governance

Recent decades have witnessed a shift from centralised government-based nation-states toward liberalised, market-based, decentralised decision-making structures in modernised European democracies (Benn et al., 2009; Loorbach, 2010). There is a growing debate on the changing patterns of governance, which has largely centred on the putative shift from 'government' to 'governance' (Rist et al., 2007) and the promotion of shared policy making among a wide range of actors (e.g., Sabatier and Pelkey, 1987; Jänicke, 2006). This has triggered a series of questions regarding the definitions of and differences between government and governance.

Some scholars claim that governance is the opposite of government in that government is 'the formal, centralized and vertical exercise of power and authority, such as through regulation or

market-based instruments' (Harrington, 2008:200). Meanwhile, governance, according to Hyden et al. (2004: 16), is the 'formation and stewardship of the formal and informal rules that regulate the public realm, the arena in which the state as well as economic and societal actors interact to make decisions'. Governance is also 'where power and authority are horizontally decentralized and devolved to broader members of society', which 'includes the actions of the state and, in addition, encompasses actors such as communities, businesses, and NGOs' (Lemos and Agrawal, 2006: 298). State actors are not necessarily the only or most significant participants in governance (Bulkeley, 2005). In this regard, scholars have mainly focused on the importance and participation of non-state actors in decision-making processes at different levels of governance (Bache and Flinders 2005; Papadopoulos 2007; Bulkeley, 2005). In a sense, another modifier of 'governance' is 'multi-actor'—that is, diverse actors from public and private domains need to cooperate with each other to address the issues they have a stake in (Driessen et al., 2012). A broader definition of governance suggests that it can be understood in terms of democratic politics (Beall, 2005) and the power relations that exist between the state and civil society (Harriss et al., 2004). In this context, governance refers to the management of collective relations through spatiotemporally specific articulations of behavioural rules regarding the principles for allocating resources among the individual and collective members of a community or society (Healey, 1997). Governance 'emerging new forms of collective decision-making at the local level which lead to the development of different relationships, not simply between public agencies, but between citizens and public agencies' (Goss, 2001: 11). Environmental governance, then, embraces regularities, institutions, interactions, and processes to determine the powers and relationships of each stakeholder in decisions and implementations about environmental issues (Driessen et al., 2012). It is also commonly regarded as an increasingly collaborative form of environmental policy formulation (Durant et al., 2004).

Around 2000, increasing analyses focused on urban environmental problems from governance perspective (Chen, 2011). The political failure caused by inadequacy of political mechanism was regarded as the root of environmental problems (Shang, 2005; Wang, 2008). Then, more attention has focused on the roles and the cooperation approaches of each stakeholder (i.e. central government, local government, private sectors and civil societies) for environmental governance (e.g., Wang, 2003; Liao, 2005; Zhang and Wang, 2005; Zhang, 2006; Xiao, 2007; Deng and Luo, 2007; Hong and Peng, 2009).

Meanwhile, some scholars (e.g. Bulkeley, 2005) regarded state and non-state actors as a continuum instead of opposite of governing system that they play various roles. Pierre (2000) stated the same concept that there are no necessary a decline of the state but a more interactive state with

interaction of public and private. Current literature on the governance of social and environmental decision-making involving multiple stakeholders does not assume 'governance without government' (Peters and Pierre, 1998). Participation is thus not an end in itself but a means to facilitate processes of a reflexive or deliberative system and a stable coalition with shared objectives between different categories of actors through the 'power of social construction', which is crucial for addressing the complex collective issues at hand, such as apparently intractable disputes (Potapchuck et al., 1999; Rist et al., 2007; Benn et al., 2009).

By parity of reasoning, the shift from government to governance is not an end in itself but a process for improving problem-solving management. Ongoing learning, adaptation and innovation in existing practices and the use of resources are essential if humans are to survive (Rosenbaum and Bressers, 2000; Bressers and Kuks, 2003; Dovers, 2005). Accordingly, so-called good governance is more networked and should provide a flexible approach to finding solutions when various stakeholders are engaged in decision-making (Potapchuck et al., 1999; Benn et al., 2009). Therefore, only discussing the participation of non-state actors is not sufficient; it must include the allocation of power and shifting modes of governance.

3.1.1.2 Environmental Governance and EM

According to Lemos and Agrawal (2006:298), 'Environmental governance is synonymous with interventions aiming at changes in environment-related incentives, knowledge, institutions, decision making, and behaviours. More specifically, we use environmental governance to refer to the set of regulatory processes, mechanisms and organisations through which political actors influence environmental actions and outcomes'. Given the emphasis on and concerns about EM for policy discourse and policy making, the relationship among actors for environmental governance is also affected by EM theory (Hajer, 1995; Leroy and Arts, 2006). Moreover, as EM processes can differ geographically and over time (Mol, 2006), various forms of environmental governance have been adopted (Paterson et al., 2003; Adger et al., 2003; Kluvánková-Oravská et al., 2009; Driessen et al., 2012).

The roles and functions of the central government, local governments, private actors, and civil society in environmental governance have been reconsidered based on EM's effect on the organisation and strategy of environmental policy. In the early 1980s, economic sectors and entrepreneurs, rather than governmental sectors, were regarded as the leading actors for EM development. Under the marketing approaches (e.g., taxes on energy, electricity, and cars), firms enhanced their environmental performance, such as the advancement of environmental-friendly technologies during the whole product life-cycle. In the late 1990s, however, the limitations of

market-based and 'top-down' approaches have been recognised. The role of government was re-emphasised. Through environmental decentralisation processes, local governments have assumed more responsibility for environmental performance in their regions. Moreover, along with concepts of democracy and equity (Van Tatenhove and Leroy, 2003), non-state actors have increasingly become involved in policymaking and governance processes. As such, the importance of the involvement of multiple actors (including governments, private enterprises, NGOs, environmentalists, researchers and the public) was emphasised for EM development. In this regard, increasing attention has been paid to interactions between actors in relation to the state, the market, and civil society for EM development (Driessen et al., 2012).

The environmental governance analysis in China is later than it in west. Although the governance approach in China could be different since its different situations (e.g., political regime), the development and analytical approach about environmental governance in western countries could offer important lessons and references for further research in China.

Lemos and Agrawal (2006) similarly discussed the relationships between the main actors in environmental governance: state, community, and market (private sector) (Fig 3.1). Each actor participates in environmental governance and cooperates with each other in different modes, such as co-management, public–private partnerships, and private–social partnerships. Meanwhile, new terms describing the interactive relationships between actors in environmental governance have emerged, such as nested governance (Marshall, 2008), network governance (Sørensen, 2002; Khan, 2013), co-operative environmental governance (Pieter Glasbergen, 1998), and new collaborative environmental governance (Gunningham, 2009). Driessen et al. (2012) summarised the modes of environmental governance and the key features according to relationships among the state, the market, and civil society—a shift from centralised government to decentralised governance, to public–private governance, to interactive governance, and then to self-governance.

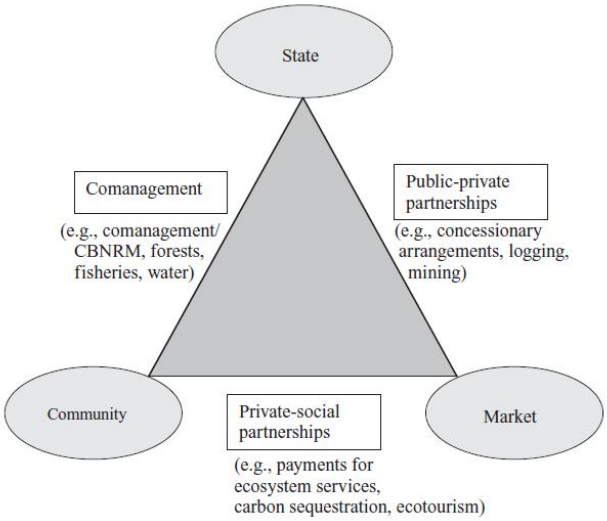

Figure 3.1 Mechanisms and strategies for environmental governance

(CBNRM: community-based natural resource management)

(Source: Lemos and Agrawal, 2006: 310).

Regardless of the mode of environmental governance, its essential characteristics are the political-economic relationships that institutions embody and the roles, powers, actions, and outcomes that are shaped by it (Lemos and Agrawal, 2006). Various social responses to environmental issues are manifestations of a new modernity, including the building of new political and societal institutions that have the capacity (Jänicke and Weidner, 1997) and legitimacy (Irwin, 2001) needed to adequately deal with these issues (Leroy and Arts, 2006). Therefore, different environmental governance modes do not have a rigid order; countries apply different environmental governance modes, sometimes more than one governance mode at the same time.

There are significant differences between China (i.e. single state) and countries with federal systems[13] (e.g. Germany and USA) with regard to environmental governance (Mol and Carter, 2006). Despite downsizing and the 'hollowing out' of the state in environmental protection, the state remains a significant actor in China (Reed and Bruyneel, 2010). There are also differences in discussions about whether and how social institutions should be considered in EM in China (see section 2.2.2.4). Regarding the relationships between government and public actors, the theory of environmental authoritarianism[14] (Beeson, 2010) reflects the strategies of environmental governance in China and most other highly centralised states (e.g., Gilley, 2012; Zhu et al., 2015; Eaton and Kostka, 2014; Han, 2015; Beeson, 2016; Van at al., 2016; Han, 2017; Teets, 2018; Li et al.,

[13] Although, France is a centralized country, but it implements the presidential election system, so this thesis classified it into western system.

14 Environmental authoritarianism refers to adopting authoritarian rule as political elites to regulate the destructive risks of climate change.

2019). As Mol and Carter (2006, p. 156) point out, 'in China, as elsewhere, decentralisation does not automatically result in better protection of the environment, as local authorities typically give preference to economic growth and investment over the progressive development of environmental policies and stringent enforcement of environmental regulation and standards'. Local governments may reduce environmental standards to achieve economic benefits if there is not a powerful central government. Scholars have thus noted the potential advantages of centralisation over decentralisation (Zhang and Wang, 2013).

EM analysis tends to lack an understanding of power (Berger et al., 2001; Gibbs, 2006). To understand EM adaptation in the Chinese context, attention should be paid to how powers are allocated for environmental governance—that is, 'who is in control, who sets agendas, who allocates resources, who mediates disputes, who sets the rules of the game' (Wilbanks 1994: 544). Rescaling of environmental governance which will be discussed in next section could be regarded as the understanding process of power of environmental governance.

3.1.2 Rescaling Environmental Governance

Regarding power-related analyses of environmental governance, one of the most interesting themes is how environmental governance plays out across scales (Lemos and Agrawal, 2006; Batterbury and Fernando, 2006; Newig and Fritsch, 2009; Young 2002; Bulkeley, 2005).

3.1.2.1 Scale

Neumann (2009) suggests that to understand environmental politics, we should focus on the power asymmetries embedded in networked relations within and between scales. Scale is a key concept in human geography, especially economic, political, and urban geography (Liu and Wang, 2011; Wang and Liu, 2015). According to Wang et al. (2016), scale is the division of the real world in terms of size, range, level, and so on. It is 'a spatial category that affects the construction of models and the transfer of results across levels of observation' (Reed and Bruyneel, 2010: 647). It can be divided into macroscopic, mesoscopic, and microscopic scales; international and national scales; or global, country, province, city, and prefecture scales.

Scale, however, is not only a physical landscape but also a platform for special social activities by actors (Yin and Luo, 2013). Neumann's (2009: 399) take on scale and political ecology encouraged researchers to examine the 'scalar practices of social actors'. Human geography frequently analyses the scales Under dynamic social contexts. The main term discussed in scale analysis is politics of scale (or scalar politics) (Wang et al., 2016). Smith (1993) regards scale as the materialisation of competition among various social powers: it is the product of a compromise between capital

movement and social struggle. Swyngedouw (1997) similarly described scale as the embodiment and arena of the social relationship of authority and decentralisation. Scale is no longer an objective fact to be discovered but a concept of practice (Moore, 2008). It is not a fixed concept but one constructed by society. Scale is constructed by multiple social relationships while also restructuring power and capital.

3.1.2.2 Rescaling of Environmental Governance

The debates over scale focus on the process of its production and its impact on the distribution of power, termed scaling and rescaling (Herod and Wright, 2002; Sheppard and McMaster, 2004; Wissen et al., 2008; Moss and Newig, 2010). Building on Young (2008), Andonova and Mitchell (2010:257) defined the rescaling of environmental governance as 'a shift in the locus, agency, and scope of environmental politics and governance across scales, with scales understood as the various ecological and social levels at which environmental problems and societal efforts to address them occur.' Scholars from different backgrounds have increasingly paid attention to this shift in environmental governance, noting the importance of scalar politics 'in understanding shifts in the nature of the state and its authority, and hence for the nature of environmental governance' (Bulkeley, 2005:883). In other words, rescaling processes are often articulated in terms of restructuring states' roles in regulation and services provision, with a putative shift from government to governance (Cohen and Bakker, 2014). Scholars have increasingly used scale to understand and address environmental problems and the following social problems.

When scales are analysed, greater attention should be paid to vertical and horizontal linkages (Scharpf 1997; Papadopoulos 2005; Paavola 2008; Andonova and Mitchell, 2010). Just like what Armitage (2008: 14-15) stated how "social actors and institutions respond to change, adapt and cope with uncertainty by improving communication, coordination and collaboration" should be explored. This relates to the concept of multi-level governance, which is the interdependencies between different levels of governance, which not only include management by multiple levels of government but also the involvement and participation of non-government actors at various levels (Bache and Flinders, 2004; Driessen et al., 2012). Vertical and horizontal analyses of multi-level governance provide a basis for understanding various environmental problems and solutions. According to Andonova and Mitchell (2010: 257) (Fig 3.2), vertical rescaling refers to the 'shifting or linking of political action across geographical space and/or jurisdictions from the local to the global level'. Meanwhile, horizontal rescaling refers to the increasing number and types of actors and networks involved in decision-making processes and political activities related to environmental issues as well as the 'increasing linkages between actors and environmental issues that cross traditional

boundaries between jurisdictions, institutions, sectors, and actor groups' (Andonova and Mitchell, 2010:257).

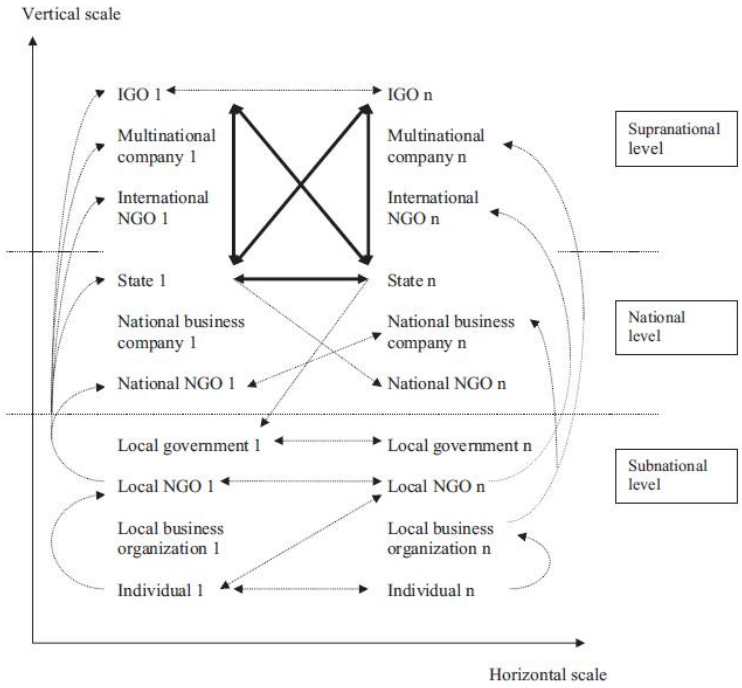

Figure 3.2 Vertical and horizontal structures for the rescaling of environmental governance

(Source: Andonova and Mitchell, 2010:258)

3.1.3 Differences between the west and China for rescaling of environmental governance

Building on Andonova and Mitchell's (2010) vertical and horizontal Structure of rescaling, more and more discussions focused on how power (in decision making and role functions) are being rescaled along three main axes of this framework: downward, upward, and outward (e.g. MacLeod and Goodwin, 1999; Pierre and Peters, 2000; Jessop, 2002; Bulkeley, 2005; McCarthy, 2005; Perreault, 2005; Reed and Bruyneel, 2010; Moss and Newig, 2010). Differences between the west and China for rescaling of environmental governance are presented in these three dimensions.

3.1.3.1 Rescaling down

Downward rescaling is the 'hollowing out' of state/national political-administrative systems that involves the redistribution of functions and the delegation of responsibility to regional/provincial and local/municipal authorities (Bulkeley, 2005; Reed and Bruyneel, 2010; Cohen and Bakker, 2014), mainly by way of decentralisation (Moss and Newig, 2010). Decentralisation is often suggested as a way to reduce the role of the central government in general, by fragmenting central authority and introducing more intergovernmental competition and checks and balances (Bardhan, 2002). This

process has led to significant changes in the ways that central ministries, local governments, and regional authorities are managed and structured (Batterbury and Fernando, 2006).

In matters of governance, decentralisation has been attempted around the world. Aside from the widely debated issues of subsidiarity and devolution in the EU and states' rights in the US, decentralisation has been central to policy experiments in the last two decades in many developing and transitional economies in Latin America, Africa, and Asia. The World Bank, for example, has embraced it as a major governance reform. The political decentralisation of decision-making power downward to local institutions is an important feature of governance since it improves, at least in principle, both accountability and participation for local people and their representatives (World Bank, 1992). There is a large body of literature on decentralisation. Batterbury and Fernando (2006), for example, empirically studied the effects of changes to established modes of governance, especially in terms of decentralising the scale at which state institutions operate. This literature has mainly focused on the decentralisation of fiscal policies (often called 'fiscal federalism') (Bardhan, 2002), taxation (Huang et al., 2012; Liberati and Sacchi, 2013), and environment protection (Batterbury and Fernando, 2006). It is regarded as one of the most essential contemporary changes in environmental governance occurring at sub-national levels, and it is linked to efforts to effectively incorporate lower-level administrative units and social groups into formal processes of environmental governance (Lemos and Agrawal, 2006). Increasing attention has also been paid to national–provincial relations, not only in developed countries but also in developing countries, such as Sub-Saharan Africa (Adams, 2004; Beall, 2005), Latin America (Faguet, 2005), and China (Beyer 2006; Chen and Wang, 2009; Liu et al., 2012).

In contrast to federalist countries, China has a long history of centralised control. After the 'reform and opening up' in 1979, decentralisation became a major feature of state governance in China (Li, 2011; Zhang and Wang, 2013). Decentralisation in China included political, administrative, economic, and social decentralisation (Zhang and Wang, 2013). In terms of environmental management, decentralisation has made it possible for local governments to set local policies for environmental protection. For example, the 13th Five-year Plan (2016–2020) charges local governments with local environmental protection. It also sets environmental improvement objectives for local governments, along with responsibility and evaluation mechanisms. Research on the decentralisation of environmental management in China has mainly focused on evaluation and the relationship between centralisation and decentralisation. However, the practices, performance, and evolution of China's decentralisation of environmental management have been less discussed.

3.1.3.2 Rescaling up

The upward rescaling of environmental governance where functions are redistributed upward is also present in Western and Chinese systems. In light of grassroots organisations' frustration with governmental inability to muster resources, upward rescaling provides a way of dealing with large-scale environmental problems at higher spatial levels (Marshall, 2008).

Because of the form of multinational agreements or the growing influence of the European Union, tensions exist between the traditional nested hierarchies of national political-administrative systems and trends towards the upscaling of governance (Moss and Newig, 2010) that the functions of the state are redistributed upwards, to international and transnational organisations and institutions (Bulkeley, 2005; McCarthy, 2005; Perreault, 2005; Reed and Bruyneel, 2010). In the Western context, rescaling-up of environmental governance often focused on transnational organisations (most notably the EU in Europe), international organisations and cross-border governance on various issues, such as, water governance across the US–Canada border (Norman and Bakker, 2008) and rescaled environmental politics in the Mekong region (Hirsch, 2001).

More attentions been paid to the global environmental governance, then the rescaling-up process in the west was mainly driven by globalisation and also the common responsibilities of neighbouring countries related to environmental problems. However, few concerns on upscaling in local levels, regional or domestic levels while emphasising global influences.

In China, upscaling of environmental governance increasingly happened from the local level to the regional/central level (e.g. the *Central Supervision to Local Environmental Performance* and the *Vertical Reform of Sub-national Environment Departments* publishes in 2016, details in chapter 5). As this thesis aims to focus on the domestic scale, the rescaling-up process from the local to regional/national levels will be explored. The insight of domestic perspective could also be regarded as a supplement for previous upscaling framework of environmental governance.

3.1.3.3 Rescaling out

Rescaling out is a redistribution of state functions where decision making is not centralised or made exclusively by governmental authorities but involves increased participation by non-state actors (MacLeod and Goodwin, 1999; Pierre and Peters, 2000; Jessop, 2002; Bulkeley, 2005; Reed and Bruyneel, 2010). Here, scale relates to constructed boundaries that signify different social groups but also political borders (Reed and Bruyneel, 2010). It is different from Andonova and Mitchell's (2010) horizontal rescaling, it focuses more on the relationship analysis between state and non-state actors, rather than the relationships of multiple organisations across boundaries (especially the jurisdictions boundaries).

A rescaling-out process generates more open and accountable forms of environmental governance. Most scholars are optimistic that such polycentric governance systems are effective for addressing complex environmental management problems since they offer improved reciprocity and trust between local and regional scales (Marshall, 2008; Reed and Bruyneel, 2010). Also, the involvement of public–private networks in multilevel governance can enhance the representation of the diverse interests that are affected by environmental problems (Bardhan, 2002; Papadopoulos, 2003). Moreover, the involvement of non-state actors mainly has the features of governance rather than government.

From another perspective, however, rescaling out challenges the authority of elected representatives and questions traditional forms of legitimacy. There are growing debates about rescaling-out efforts (Khan, 2013), especially its effects on democratic systems and decision making (Larson and Ribot, 2004; Batterbury and Fernando, 2006). Public participation can be regarded as an unavoidable attribute of modern politics (Meadowcroft, 2002; Sørensen, 2002; Bogasson and Musso, 2006).

The Chinese government has recognised the importance of public participation for environmental governance (Ma, 2007). It published corresponding regulations for public participation in *China's Agenda for the 21st Century* (1992) and *The National Program for Environmental Protection (1998–2002).* However, debates still exist about whether and how social institutions have been considered in China for EM (details in section 2.2.2.4). Public participation in environmental governance in centralised contexts also has the advantage that China can follow pathways that are different from Western approaches. For instance, according to Khan (2013), since informal interactions and dependencies often take place outside of democratic control and public scrutiny, there is a risk that powerful groups will take control, and deliberation will deteriorate into bargaining and abuse of power. Political leadership is essential for ensuring that accountability is maintained (Bell and Park, 2006).

3.1.4 Adaptation for studies of the ET of IAs in China

3.1.4.1 Scales for environmental governance during the ET of IAs in China

Building on Andonova and Mitchell's (2010) vertical and horizontal structure for rescaling analysis, and based on the differences between the West and China, this section constructs an analytical framework to analyse how power is allocated for environmental governance during the ET of IAs as a part of EM adaptation in China (Fig 3.3).

In this framework, the vertical rescaling refers to the shifting or linking of political actions for the ET of IAs (including political organisations within and across jurisdiction divisions) from local to regional/national levels differentiating between upwards and downwards distribution of power (see above). Rescaling-out processes take place horizontally as an increasing number and different types of non-state actors and networks become involved in decision-making processes and political activities related to the ET of IAs. In this way, the shifting relationships among government (incl. central, regional and local levels), the private sector and civil society in the evolution of environmental governance modes can be illustrated clearly.

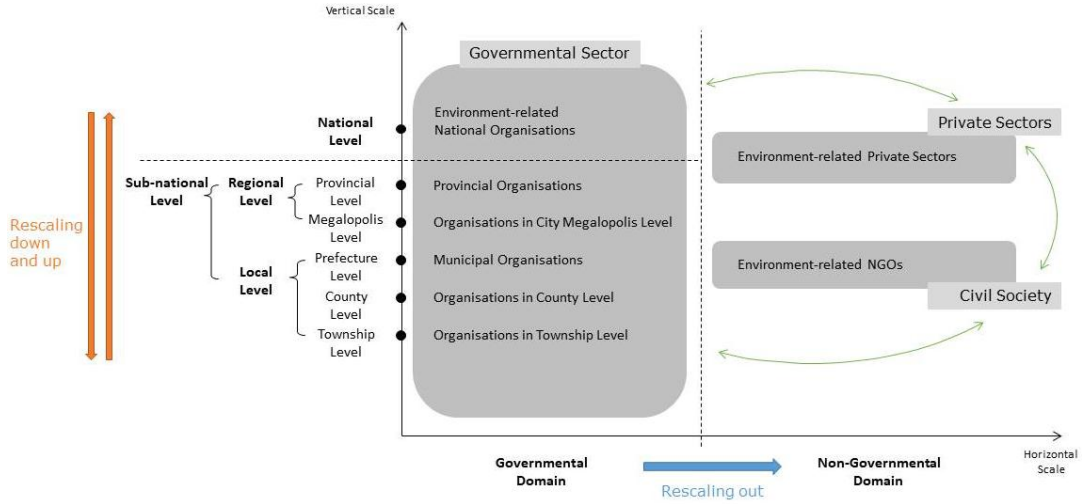

Figure 3.3 Analytical framework for the rescaling of environmental governance in the ET of IAs in China

Based on Andonova and Mitchell's (2010) rescaling framework and drawing on the previous discussion on rescaling of global environmental governance in a Western context, some adaptations were made for the rescaling analysis of domestic environmental governance in China.

Firstly, as this thesis focuses on rescaling processes within China, the supranational level is not considered.

Secondly, Andonova and Mitchell's (2010) scale division does not adhere strictly to a administrative division. The demarcation of a country's jurisdictional divisions is much more complicated than the model, and most powers shift among divisions of jurisdiction in practice. So, this thesis adapted the rescaling framework by China's hierarchy of administrative organisations (as distinct from the hierarchy of administrative regions). The vertical axis is divided into scales of national, provincial, urban agglomeration, prefecture, county and township from higher order (higher scale) to lower order. The ET of IAs in China was implemented by multiple departments in China; actors in vertical axis including not only the Environmental Department in different scales, but also the Communist

Party, the Committee and People's Governments and other governmental departments (e.g., Department of Science and Technology, Department of Industry and Information, and Department of Land and Resources) in different scales. Both regional and local levels can be termed sub-national level. The provincial and urban agglomeration levels are assigned to regional levels; the municipal, county and township levels are called local level. Various scales in sub-national level could be investigated by this framework, which wasn't able to achieve at Andonova and Mitchell's (2010) structure.

Thirdly, the involvement of governmental organisations across administrative boundaries is increasingly important for governmental governance both in the West and China. But interaction was not clearly addressed out by Andonova and Mitchell's (2010) structure. The case study place of this thesis is a city urban agglomeration (i.e. Changsha-Zhuzhou-Xiangtan City Urban agglomeration in Hunan Province, China). City urban agglomeration is not an administrative division in China, but there were some governmental organisations built in this level. This thesis adds the city urban agglomeration level (as a regional level) in the analytical framework, and tries to explore the engagement of organisations across administrative boundaries during environmental governance.

Fourthly, both vertical and horizontal scales of non-state actors are mixed with scales of governmental authorities in Andonova and Mitchell's (2010) structure, which made it hard to analyse the power shifted among the government with non-state actors clearly. As the analysis of how social institutions are integrated during Chinese EM is one of the crucial foci of this thesis, this thesis sets the horizontal scale only for non-state actors (incl. private sectors and civil societies). As a result, the relationships of central government, local government, private actors and civil society could be investigated more easily. In this research, private actors include industrial companies, platform companies and environment-intensive companies; while, civil society refer to environmental NGOs.

3.1.4.2 The measurement of rescaling

It is noteworthy that sovereign power, dominion power or ruling power is always held at the central level in China. So, descriptions about rescaling powers for environmental governance in China in this thesis all refer to environmental responsibilities, obligations, roles and influences, duties and functions related to environmental management, but not actual ruling powers.

In order to analyse how powers for environmental governance in China are rescaled, on the one hand, this thesis analyses policies and political strategies which guiding (environmental governance) power rescaling in China directly and indirectly. Policies and strategies reallocating powers for

environmental governance are regarded as the direct factors. The *Vertical Reform of Local Environment Governance* (垂直管理) implemented in 2016, for example, redistributed many powers (e.g. power of personnel and budgetary allocation) from the local to regional scale. Policies indirectly leading to power rescaling also be investigated, such as, the fiscal decentralisation after 1979. This indirectly resulted in environmental decentralisation in China. Besides, actions responding to those policies and strategies are also explored, e.g., adjustment of local institutional structure and struggles of local authorities after environmental decentralisations, so as to understanding the impacts and effects of those policies and strategies.

In addition, this thesis surveys the situation by interviews. Governmental officials (in regional and local scale), local environmental NGOs and environment-intensive companies who related to the ET of IAs were interviewed. How power actually rescaled among them could be understood through questions like: how do you understanding your relationship with government/private sectors/civil society? how did your duties/influences change during these decades? how have you cooperated with other stakeholders?

3.2 Theoretical Basis and Analytical Framework for Investigating Spatial Changes of IAs during ET in China

In both the west and east spatial change has been adopted as a tool for EM development. However, to date, spatial perspectives have only been marginally considered within EM theory (details in section 2.2.2.3). Therefore, in order to understand how to analyse spatial changes of industrial areas during ET in China, the analysis of spatial changes of IAs during ET considers two dimensions: the geographical movement of industries/industrial areas from one location to another (the transfer of industrial activities) and the spatial restructuring of industrial areas. The latter includes changes to the spatial structure of industrial areas such as changes to the size, land-use (e.g. inclusion of green space), and industrial activity and the spatial relationship between these industrial areas and non-industrial urban land-uses, in particular within urban areas.

Then, development and practices of industrial transfer theory and urban spatial structure theory, and their relationship with EM development and analysis were explored separately in section 3.3.1.1 and 3.3.1.2. Following the studies of those two theories, section 3.3.2 identifies key factors and dimensions that will guide the following empirical analysis of IAs during ET in CZT urban agglomeration.

3.2.1 Previous Studies Relate to Spatial Changes of IAs during ET

3.2.1.1 Industrial Transfer and Environmental Performance

According to Wang and Zhao's (2003) theoretical review about industrial transfer, industrial transfer could be understood as the geographical movement and relocation of whole or partial industries from their place of origin to another place. And, depending on the scale of relocation, this can be divided into two types of industrial transfer: international industrial transfer (including transfers among developed countries and transfers between developed countries with developing countries) and domestic industrial transfer.

International industrial transfer is mainly based on FDIs and international trade, whole or partial production line or trade, or even research and development of some industries moving to other countries with regional advantages. One international industrial transfer happened the 1970s-1980s when a large number of resource- and labour-based industries moved from West to East, especially to China. This made China become 'the world's factory' (Xing, 2003; Mees, 2016). The internal causes of such transfer are mainly growing costs (including costs for labour force and increasing strict environmental standard) in origin countries and the demand for business expansion in light of global trade (Lewis, 1982). Eastern countries could provide lower costs and high consumption potentials (Lu, 1997). Vernon interpreted the international industrial transfer by product life-cycle theory, and Vernon (1996) stated that products would transfer among countries where need different product factors. During this process, many resource-based and polluting industries were moved to China (especially the eastern coastal cities), which could also be regarded as a crucial means of EM for Western countries.

Although international industrial transfer helped China achieve great economic growth in a short period of time, becoming the world's second-largest economic entity in 2010 (http://www.china.com.cn/economic/node_7111030.htm), but increased environmental degradation in cities where foreign industries were based was inevitable (Xia, 1999; Huang and Xiao, 2007). China became the pollution haven[15] (Sha and Shi, 2006; Lan et al., 2012).

A round of domestic industrial transfer happened between the early 2000s to the early 2010s with support from the government for balanced development in China (e.g., 'common prosperity', 'rise of central China' and 'western development' strategies). A high number of resource- and labour-based industries moved from the eastern coastal cities to China's central and western areas (Tao, 2010). This is regarded as an industrial gradient transfer where industries gradually moved from advanced areas to less-advanced areas (Zhou and Cao, 2010; Liu et al., 2014). While this enhanced economic growth in the central and western areas of China and reduced the interregional gap between rich

[15] Polluting industries moved to areas or countries with lower environmental standard, which made those areas or countries as the pollution heaven.

and poor, as with international industrial transfer, environmental problems were exacerbated (Dou and Shen, 2014; Li, 2016).

Since the late 2000s, the Chinese government started paying more attention to environmental performance of industries during the modernisation process. In 2014, the Chinese State Council published *The Guidance of Relocation of Traditional Industrial Areas in Urban Areas* (关于推进城区老工业区搬迁改造的指导意见), and designated 21 TIAs as the pilots. According to this guidance (2014), as a strategy for green development of IAs and cities, the relocation projects of selected TIAs in urban areas should be finished before 2022. As a response, locals (e.g., TIAs in northeast, Shougang Group in Beijing and Qingshuitang TIAs in Zhuzhou) initiated domestic industrial transfers where many polluting industries (e.g., chemicals, smelting, cement, and mining industries) in TIAs were relocated (e.g., to suburban areas) or even shut down (see Tan et al., 2017; Qian, 2019). This round of industrial transfer focuses on win-win of the environment and the economy, so it is identified as a crucial strategy for EM in China by this thesis.

This regional industrial transfer is similar to the spatial transformation from classic industrial cities to neo-Fordist cities in the west. “Flexibility is therefore the key factor under the numerous changes that have modified the Fordist system to the point where we now have to think of a neo-Fordist system. Workers are now much more likely to be multiskilled rather than committed to just one task as under Fordism” (Knox and Pinch, 2014:27). The result has been massive deindustrialisation and the consequent transformation of the classic industrial city, such as the industrial heartlands of Britain (e.g., Midlands, the North, Wales and Scotland) and the ‘rustbelt’ of the United States (e.g., Chicago, Cleveland, Detroit and Pittsburgh). Heavy industries were beginning to decrease, while service industries were growing (Bell, 1973). Fig 3.4 illustrates the evolution of the urban form of Los Angeles from 1850 to after 1975 by ‘lay structure’. With the influence of the new regime, factories and warehousing zones in the city centre moved to from rural semi-peripheral areas though ‘deindustrialisation’ process of cities. Service industries gradually developed in the city centre area.

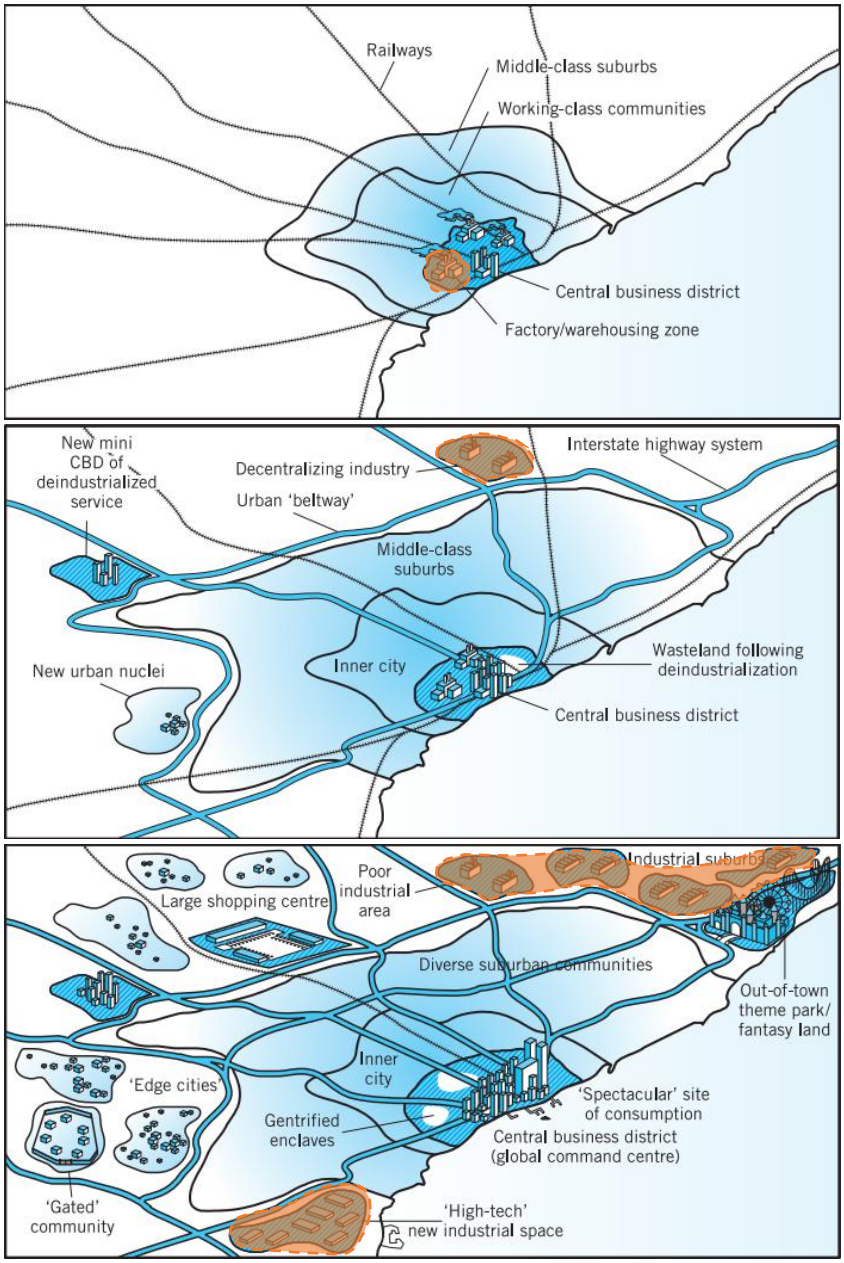

Figure 3.4 Transition from the classic industrial city, circa 1850–1945 (upper) to the Fordist city, circa 1945–1975 (middle) and neo-Fordist metropolis, circa 1975– (lower)

(Source: adapted from Knox and Pinch, 2010: 31, orange blocks added by author to highlight industrial areas)

This thesis considers whether the transfer of polluting industries in China shows similar patterns and characteristics as this 'deindustrialisation' process in Los Angeles and whether it is also a sign of neo-Fordist society. Then, this thesis aims to explore this polluting industrial transfer by comparing it with the previous two industrial transfers mentioned above (i.e. international industrial transfer from Western countries to China and domestic industrial transfer from eastern areas to central and western areas). It will also consider the differences with 'deindustrialisation' in Western countries

and the relationship of industrial transfer to EM theory. As such, this research extends and supplements the definition and practice of industrial transfer theory.

3.2.1.2 Urban Spatial Restructuring toward Green Development

Urban spatial structure is a way to investigate urban form and urban organisation by its spatial expression, in other word, urban spatial structure offers a spatial dimension of urban structure (Gu et la., 2000). The geographical movement of industries which discussed in the last section could also be regarded as one activity of urban spatial restructuring. But industrial transfer theory and urban spatial structure theory focus on different perspective: the former one focuses on the location moving, while, the latter one focuses on the urban spatial factors (i.e. Location, distance, area size, integral or discrete, density) and their relationships (Bourne, 1982).

Urban spatial structure is the outcome of economic, social, political and culture forces. The urban spatial structure presents distinct different before and after industrialisation: industrialisation collapsed the traditional urban spatial structure which give priority to household manufacturing, and promote urban form transformed from extensive to concentrated development approach (Yang, 2003).

From the 1800s to the 1960s, increasingly complicated social, economic and urban structure and increasing severe environmental problems made more attentions to the adjustment and upgrade of urban spatial structure. Scholars started to explore the way to "make city back to nature" (Arturo Soria Y Mata, 1882). Representative concepts during this period are Mata's (1882) Linear City, E.Howard's (1903) Garden City, Garnier's (1904) Indusial City. Analyses about urban spatial structure transformed from spatial form layout to urban functional structure (Yang, 2003).

After the 1970s, more practices for urban restructuring were made to adapt and promote green development, e.g., ecologically centred urban development and planning, construction of eco-city and EIP (Ye et al., 2008). The importance of green space system was also noticed that increasing attentions been paid to regional green space system, ecological corridor and ecological parks when building eco-city. Spatial structure is not based on a single spatial element (e.g., agricultural, industrial, residential, commercial area and green space) but the interaction of multiple elements across space (Wen, 2011). Moreover, spatial structure involves not only the spatial distribution and spatial pattern of urban elements but also the interactions among elements (Webber, 1909; Bourne, 1982; Li, 2008; Zhu, 2012; Li et al., 2012).

3.2.2 The framework for spatial analysis of IAs during ET

Combining the focuses and tendencies of two theories (i.e., industrial transfer and urban spatial structure) which discussed in the above, an analytical framework for the spatial changes of IAs during ET for EM development in China was built (Fig 3.5). The analysis of spatial changes of IAs during ET considers two dimensions: the geographical movement of industries/industrial areas from one location to another (the transfer of industrial activities) and the spatial restructuring of industrial areas. The relocation of polluting industries in TIAs (the third domestic industrial transfer) would be explored as the industrial transfer for Chinese EM; while, how TIAs and DZs in China changed in terms of spatial distribution and area size, spatial density and spatial relationship would be investigated as the study of spatial restructuring for Chinese EM. To address this, the spatial distribution and area sharing of different types of industries (i.e. second and third industries), the spatial density of industrial companies in IAs would be explored. Moreover, the spatial relationship of different IAs in a region, the spatial relationship of IAs with other functional areas in city (e.g., green space, residential and commercial areas), and the spatial relationship of IAs with landscapes would be analysed.

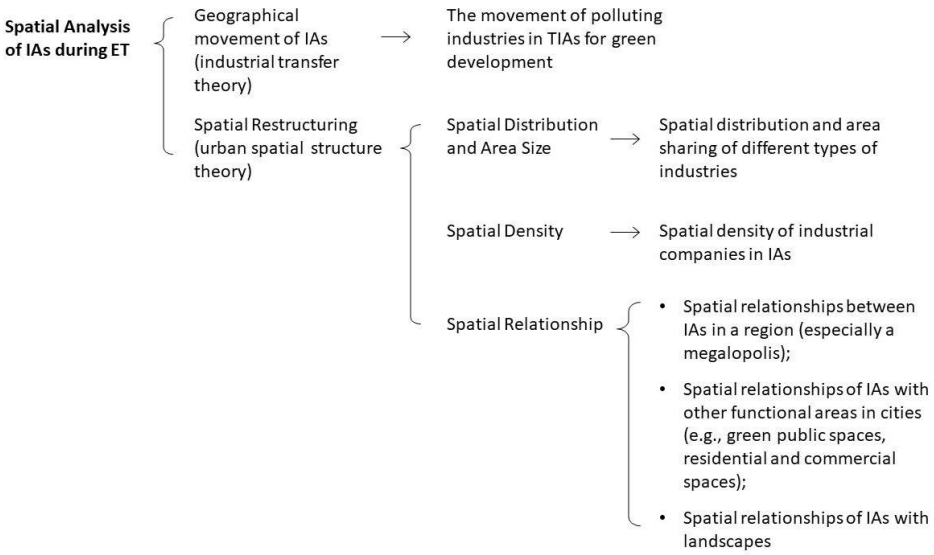

Figure 3.5 The framework for spatial analysis of IAs during ET

Since EM "is essentially a political concept" (Jänicke and Jacob, 2006: 12) and since the central role of the government for Chines EM, this thesis regards the spatial changes of IAs during ET which guided by the government as the main research object. This thesis collected and discussed the related contents from related policy documents, urban/regional development plans (especially the development plans of industries), and urban/regional comprehensive spatial plans (especially,

spatial plans of industries/IAs) before and after 2010 as the research data. Moreover, this thesis also researched some statistic data offered by government (e.g., the amount of industrial companies and area size of IAs in the region), interviews with related people (i.e., local governmental sectors, state-owned industrial companies, private industrial companies, private pollution treatment companies, state-owned finance companies and developer (platform) companies, spatial planning agencies, and environmental NGOs). The changes of location, distance, area size, land-use mode (integral or discrete), density, relationships of industries/IAs in CZT as the case would be explored.

This spatial analysis is closely related with the rescaling analysis of environmental governance. On the one hand, spatial policies and management for green development also one of the content of environmental governance; on the other hand, the environmental governance mode have profound influences for the policy-making, implementation and effectiveness of spatial policies and management. Therefore, the influences of rescaling of environmental governance on spatial practices during the ET of IAs in China would also be discussed.

3.3 Summary

Chapter 2 showed the motivation and ultimate goal of this research by way of a literature review of EM theory and practice in the West and in China. Based on gaps in the research (especially between the West and China), two main perspectives were identified for further analysis in this thesis – an organisational perspective and a spatial perspective of EM in China. To guide the investigation of those two perspectives, this chapter constructed relevant theories and built research frameworks.

Regarding the organisational perspective, this chapter introduced environmental governance and debates on rescaling as theoretical framework based on the Western context and the applicability of these perspectives to China. According to the differences of rescaling processes within different contexts, this thesis uses a more nuanced rescaling framework based on Andonova and Mitchell's (2010) structure for the analysis of the ET of IAs in CZT city urban agglomeration (see Fig 3.3). How central government, local government, private sectors and civil societies take part in institutional organisation for EM development could be investigated clearly.

Regarding spatial changes during EM in China, this chapter firstly reviewed the relevant practices and theories from two perspectives (i.e. industry transfer and urban spatial structure), and their relationship with EM. It then emphasised key dimensions this thesis should pay attention to during the spatial analysis of industrial areas during ET in CZT urban agglomeration (see Fig 3.5).

Next Chapter will introduce the case study place of this thesis ---- CZT urban agglomeration in China. How analytical framework explicitly be applied for the researches in CZT will illustrated in next chapter.

Chapter 4 Method

This chapter explores the methods used in the qualitative research in this thesis. Qualitative research can be described as an exploration of meaning of social phenomena by individuals' experiences, circumstances and situations (Malterud, 2001; Creswell, 2012). It involves the systematic collection, organisation, and then, interpretation of data derived from talk or observation (Malterud, 2001). So, the research approach taken in this thesis is outlined in Fig 4.1. Case study method was selected for the EM research in China, and both primary and secondary sources were collected for data. Here, Primary data collection involved semi-structured interviews with 21 stakeholders from seven groups of organisations, and field and participant observations for the eleven case study industrial areas within Changsha-Zhuzhou-Xiangtan (CZT) urban agglomeration. Secondary data collection involved a range of relevant sources including news articles, policy documents, official reports from government, business reports from enterprises and work reports from environmental NGOs. Next, through organisation and analysis of collected data, research results will be presented in chapter 7 and 8.

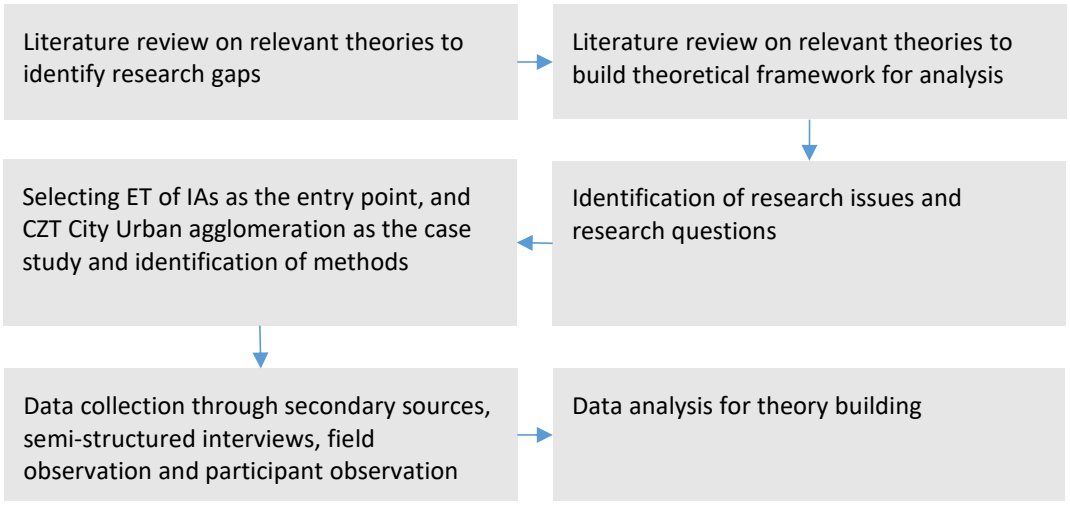

Figure 4.1 Research Approach

This chapter presents and justifies the methods used for the study. Section 4.1 interprets the usage of case study method in this thesis. Section 4.2 presents the data collection and fieldwork process involving mixed research methods (i.e. semi-structured interviews, field observation and participant observation methods) in CZT during February to April 2017. 21 relevant persons from seven organisations were interviewed and 11 industrial areas (Inc. TIAs and DZs) in CZT were field observed. Section 4.3 discusses the four-step technique for content analysis following Erlingsson and Brysiewicz (2017). Furthermore, the validity and research ethics of this research are considered respectively in section 4.4 and 4.5.

4.1 Case Study Method

Case study method is widely recognised in many social science studies especially when in-depth explanations of a social process are sought (Zainal, 2007). Yin (1984) defines case study research as:

> 'An empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used'
>
> (Yin, 1984: 23)

Case study research enables a researcher to closely examine the data within a specific context (Zainal, 2007). And, using case study approach can help explore research topics in a real-life environment which may not be captured through experiment (Zainal, 2007). Case study method could be divided into two categories: holistic and embedded case studies (Yin, 1994).

> "A holistic case study is shaped by a thoroughly qualitative approach that relies on narrative, phenomenological descriptions. […] Embedded case studies involve more than one unit, or object, of analysis and usually are not limited to qualitative analysis alone. The multiplicity of evidence is investigated at least partly in subunits, which focus on different salient aspects of the case."
>
> (Scholz and Tietje, 2002: 2).

EM practice varies in different areas. As this research aims to analyse the EM path of China, case study analysis can give access to quantitative data, reasons and paths for EM development in a specific area. Therefore, for detailed contextual analysis of research questions, a case study research design was chosen. CZT urban agglomeration was chosen as the case study place, and eleven case study IAs are within the case study urban agglomeration, then, it is an embedded case study.

4.2 Methods for Data Collection

The thesis research involved both primary and secondary sources. Primary data collection involved semi-structured interviews with 21 stakeholders from seven groups of organisations, and field and participant observations for the eleven case study industrial areas within Changsha-Zhuzhou-Xiangtan (CZT) urban agglomeration. Secondary data collection involved a range of relevant sources including news articles, policy documents, official reports from government, business reports from enterprises and work reports from environmental NGOs.

4.2.1 Methods for Primary Data Collection

Following the identification of eleven IAs in the CZT urban agglomeration as case studies, this research used semi-structured interviews, field visits and observations as well as participant observation to collect first-hand data.

4.2.1.1 Semi-structured Interviews

There are different types of interviews, i.e. unstructured, semi-structured and structured interviews for qualitative research (Baumbusch, 2010). A semi-structured interview method includes a set of open-ended questions, which allow for spontaneous responses and detailed description on interviewees' opinions and experiences about a phenomenon (Lambert and Loiselle, 2008; Ryan at al., 2009). This is the reason why this method was used for this research as it allows to cover some predefined topics as well as allowing to make interviewees' stories, concepts and perspectives heard.

After the selection of interview type, a sample target and size were considered. The author aimed to interview 20-25 stakeholders from both governmental sectors and non-state actors (incl. private and civil societies). Then, seven groups of organisations which have close relationship with environmental governance and the ET of IA were selected: local governmental sectors, state-owned industrial companies, private industrial companies, private pollution treatment companies, state-owned finance companies and developer companies (PCs), spatial planning agencies, and environmental NGOs.

Next, the author prepared the interview protocol. Referring to Rabionet's (2011) stages to conduct the semi-structured interview, there are two essential components for an interview protocol: 1) an opening statement to introduce the author (including the aims of the interview) to interviewees; 2) and questions to be asked during the interview. Therefore, the author prepared two opening statements and a few general questions to elicit conversation. The first opening statement is the introduction before the formal interviews. When the author makes an appointment with interviewees via telephone or face-to-face, a useful and accurate introduction at this point can directly determine whether they will accept the interview or not, and whether the person contacted is relevant to the topic. The second opening statement was prepared for the beginning of the formal interview. In particular in the case where the interviewee is not the same person as originally contacted (many persons the author interviewed were introduced by an intermediary, e.g. interviewee's superior), a repetitive introduction is vital. A formal introduction letter (see appendix 1) by the author's principal supervisor was also provided to interviewees.

The most crucial part should be the development of questions (Kallio et al., 2016). After the literature review of papers directly and indirectly related to my area of interest, the author developed a draft list of questions. To further refine the quality and validity of this question list, the author discussed the questions with the supervisors and amended repeatedly. More than that, the author tested the questions with a few persons outside of academic circles to make sure questions could be understood by all interviewees from different positions and backgrounds. Questions for participants from the same organisations were the same, but questions varied a little bit between organisations to better reflect each interviewee's role. Question topics are listed in Table 4.1.

Table 4.1 Main question topics of each organisation type

Organisation Type	**Main Question Topics**
Environmental NGOs	The understanding of the ET of IAs The drivers, strategies, barriers and beneficiaries of the ET of IAs in CZT The role of NGOs during ET
Governmental Sector & State-owned PCs	The understanding of the ET in industrial areas, and its relationship with the city The drivers, policies/strategies, barriers and beneficiaries of the ET of IAs in CZT The implementation process of the policies/strategies The roles and differences of national policies and local policies
Industrial Companies (Inc. state-owned and private)	(1) The understanding of the ET of IAs (2) The drivers, status, barriers and beneficiaries of ET of IAs and CZT (3) The response to policies/strategies (4) The role of companies (in different industries and DZs) during ET of IAs
Planning Agencies	(1) The understanding of the ET of IAs (2) The drivers, status, barriers and beneficiaries of ET IAs in CZT (3) The role of design agencies during ET of IAs (4) The strategies to coordinate the relationship between industrial areas and cities by planning and design

From February 2017 to November 2019, the author interviewed 21 stakeholders in CZT. From the 11th February 2017 to the 14th April 2017, the author went to CZT and interviewed 17 individuals (16 face-to-face interviews and one telephone interview). In 2018, two more interviews were conducted by telephone. In 2019, the author interviewed two more individuals by face-to-face interview resulting in a total of 21 interviews with respondents from seven types of organisations in CZT urban agglomeration (see Table 4.2). All participants are Chinese, so, interviews were conducted in Chinese (most of them in Mandarin but a few in the regional dialect of Hunan). It was helped by the author being a native speaker of Chinese and Hunan dialect. All respondents held roles relevant to this research topic and were delighted to answer questions. For better preparation of responses,

some interviewees even requested a list of questions before the formal interview. Nine out of 21 interviews were audio recorded. In the case of the other 12 interviews, respondents particularly those from governmental organisations preferred not to have the interview recorded. This suggests that officials were very cautious in giving personal opinions as they did not want their comments to bring any detrimental effect to their official career. Not recording interviews may have also allowed richer responses, as interviewees could feel free to give opinions without any pressures. Another reason for the low number of interview recordings is due to some interviews having been conducted during a guided tour of IAs where the surrounding was too noisy to get audio recording (interviews # 1 and 9). Where interviews were not recorded, notes were taken during the interviews, and the author also writes up further comments following the interviews.

Table 4.2 Details of semi-structured interviews

No.	**Date**	**Time**	**Research Category**	**Audio Record**	**Organisation Type**	**Location**	**Interviewee's Position**
1	11/02/2017	12:30 - 14:30	Face-to-face		Environmental Protection and Energy Saving Company (Private)	Qingshuitang TIA, Zhuzhou	Office Staff
2	13/02/2017	16:30 - 20:00	Face-to-face	√	Daily Chemical Company (Private)	Lukou ETDZ, Zhuzhou	Chairman
3	13/02/2017	16:30 - 20:00	Face-to-face	√	Daily Chemical Company (Private)	Lukou ETDZ, Zhuzhou	Technical Director
4	14/02/2017	10:00 - 11:00	Face-to-face		State-owned financer and developer (PC)	Zhuzhou	Vice General Manager
5	14/02/2017	10:00 - 11:00	Face-to-face		State-owned financer and developer (PC)	Zhuzhou	Head of Technology Department
6	14/02/2017	11:00 - 11:30	Face-to-face		Government Sector (Science and Technology Bureau in district level)	Shifeng Direct, Zhuzhou	Director
7	25/02/2017	11:30 - 12:00	Telephone Interview	√	Chemical Company (Central government-owned)	Qingshuitang TIA, Zhuzhou	Head Engineer
8	23/02/2017	15:00 - 15:30	Face-to-face		Government Sector (Municipal Land Resources Bureau)	Xiang Tan	Section Chief

9	23/02/2017	15:00 - 17:30	Face-to-face		Government Sector (Municipal Land Resources Bureau)	Xiang Tan	Director
10	28/02/2017	12:30 - 13:20	Face-to-face	√	State-owned financer and developer (PC)	Railway Industry HIDZ, Zhuzhou	General Manager
11	05/04/2017	10:00 - 10:30	Face-to-face		Spatial Planning Agency	Changsha	Planner
12	21/04/2017	9:00-10:00	Face-to-face		Environmental NGO	Changsha	Council Member
13	22/03/2017	14:00 - 14:40	Face-to-face		Environmental NGO	Changsha	Council Member
14	05/04/2017	15:00 - 15:30	Face-to-face		Government Sector (Provincial Environmental Protection Department)	Changsha	Deputy Director
15	14/04/2017	9:00-10:30	Face-to-face	√	State-owned financer and developer (PC)	Zhuzhou	Strategy Planning Department Director
16	14/04/2017	9:00-10:30	Face-to-face	√	State-owned financer and developer (PC)	Zhuzhou	Strategy Planning Department
17	14/04/2017	14:00 - 15:30	Face-to-face	√	State-owned financer and developer (PC)	Zhuzhou	Secretary of the board
18	12/04/2019	14:00 - 16:00	Telephone Interview	√	Government Sector (Provincial Environmental Protection Department)	Zhuzhou	Deputy Director
19	15/05/2019	10:00 - 11:30	Telephone Interview	√	Chemical Company (Central government-owned)	Zhuzhou	Chairman
20	20/07/2019	19:00 - 20:00	Face-to-face		Resident of a TIA, also a former worker in a industrial company in TIA	Zhuzhou	Resident/ Technical worker
21	04/11/2019	11:00 - 12:30	Face-to-face		Pollution Treatment Company (Private)	Zhuzhou	Director of the Business Department

4.2.1.2 Field Observation

Filed observation is a method where the researcher observes people (or research subjects) in 'real' location and situation. It enables the researcher to observe research objectives in a natural setting, which can avoids problems inherent in self-reported accounts (Mays and Pope, 1995), and reveal penetrating insights unavailable through other methods (Furlong, 2010). However, this method is regarded as a time-consuming, expensive, and ethically challenging in some settings (Landsberger, 1958).This method of filed research is widely used in a public setting or environment but not in a private environment as it raises an ethical dilemma. Moreover, field noted/video-recorded observations are influenced by what the observer chooses to record/analyse (Landsberger, 1958). Those challenges were considered and tried to be avoided throughout the field observation of this thesis.

Some typical areas in and surrounding TIAs and DZs in CZT relating to eco-transformation were selected for observation (see Table 4.3). Most field sites are public areas, and the author got permissions when entering private areas, e.g. industrial companies. Some observations were led by interviewees (including government officials and private sector representatives), and some were conducted independently. Both approaches have their advantages and disadvantage. Guided tours enabled the author to enter areas that are usually not accessible by the public. They also included explanations of specific phenomena. However, there are also some limitations of guided tours. There is a risk of my review being biased towards what was shown around certain selected routes. As a result, for more comprehensive and objective observations, the author also did field tours independently and tried to visit selected industrial areas several times. The selected industrial areas were at different stages that allowed to record and understand developments before, during and after eco-transformation during a short time frame at different sites. Additionally, the author revisited one area (i.e., Qingshuitang TIA) several times from 2017 to 2019 to be able to document the eco-transformation process over time.

During the field observations, some intuitive feelings may be obtained, e.g. the amount of plant coverage, people in the field and how they use it, the smelling/colour of air and soil and the production status of industrial enterprises. Useful information obtained through field observations was recorded by photos, text notes and mapping. The current situation of polluting industrial enterprises was recorded and the spatial structure of IAs was also recorded through land-use mapping. Placards and banners hung up by governmental agencies or enterprises were unanticipated but important data the author collected during field tours. For example, most

environmental treatment projects (e.g. treatment projects of contaminated soil and water) during ET of IAs would have some placards installed at the entrances which included a variety of information, e.g. co-operators, procedures, plans, and aims of ET projects. In TIAs, banners for eco-transformation projects had been posted on street sides by local government sectors.

Table 4.3 Details of Field observations

Date	Photo Record	Category	Organisation
26/01/2017	√	HIDZ	Zhuzhou HIDZ (Inc. Liyu HIDZ, Automobile Accessory HIDZ and Xinma DZ)
10/02/2017; 15/02/2018; 28/09/2019	√	TIA	Zhuzhou Qingshuitang TIA (Inc. Qingshuihu Ecological Park)
23/02/2017	√	TIA	Zhubugang TIA (Inc. Xiang Tan Manganese Ore National Mineral Park)
28/02/2017	√	HIDZ	Zhuzhou Railway Industry HIDZ
11/03/2017	√	ETDZ	Changsha ETDZ
26/01/2017; 15/02/2018; 08/07/2019	√	Environmental sensitive area surrounding IAs	Riverside of Xiang River

4.2.1.3 Participant Observation

During the data collection stage, participant observation was also used by the author. Participant observation is a qualitative method with roots in traditional ethnographic research, whose objective is to help authors learn the perspectives held by the study population (Mack, 2011). It is viewed as a supplementary method for interviews as it provides contextual information for other data collection methods (DeWalt, 2011). Participant observation has many advantages but also disadvantages. It allows for insight into contexts, relationships and behaviour, and can provide information previously unknown to an author that is crucial for project design, data collection, and interpretation of other data. But it also costs a lot of time, and the objectivity of data outcomes were doubted that taking part in an activity might make author feel sympathy for the stakeholder and therefore less able to critique (Mack, 2011). Therefore, the author always kept her personal discipline, diligence, objectivity, and criticalness.

The author gathered data by participating in the daily life of a local state-owned company, and to see what situation this company ordinarily met and how this company dealt with it during the ET process of IAs. From the 1st March 2017 to 18th April 2017, the author undertook a part-time

internship in the Strategy Planning Department of a PC (PC) in Zhuzhou city (working two days a week). The company is a local state-owned company mainly responsible for the financing and development of the Zhuzhou HIDZ and its surrounding urban areas. It has first-class rights to control and manage lands and incomes of lands. The main businesses are land development, industrial real estate, residential and commercial real estate, construction, enterprise incubation, venture investment, financial services, and property management. The Strategy Planning Department the author attended is mainly responsible for 1) the long-term development strategy and annual objectives of the PC and 2) the plans and management of big projects.

As part of the participant observations in this PC, the author attended meetings/events of the transformation of PC and a PPP projects. Internship diaries and meeting notes were used to record the data collected through participant observation. This participant observation also provided the author with new contacts and some interview opportunities.

4.2.2 Methods for Secondary Data

"Secondary data analysis involves the analysis of an existing dataset, which had previously been collected by another researcher, usually for a different research question […] secondary data analysis is widely used by researchers undertaking analysis of quantitative data, and has begun to be applied to qualitative data" (Heaton, 2003: 285). It is a time-saving and fund-saving ways to get high quality of data maybe with larger sample size and maybe inaccessible (Heaton, 2003). This thesis uses second-hand data for analysis, e.g. policy documents, news, official reports from government, business reports from enterprises and work reports from environmental NGOs. In terms of the source, most of secondary data come from the official websites of related organisations, some secondary data were collected from books/brochures published by related organisations e.g., yearbooks published by the local government, and some secondary data were provided by interviewees, e.g. undisclosed reports from government or industrial companies.

4.3 Data Analysis

The objective of qualitative content analysis is to systematically transform a large amount of textual information into a highly organised and concise summary of key results. Using the guidance of Erlingsson and Brysiewicz (2017) on content analysis, the data was analysed according to the following steps:

- Familiarising the data and the hermeneutic spiral

The initial step of data analysis is to read the transcribed records[16] several times and gain the sense of the text as a whole while keeping the research aims and research questions clearly in focus. This is for the hermeneutic spiral during the following analysis: whole text may be broken down into smaller parts in the following data analysis, and the author should return to the 'whole' text with the initial impression to check if the 'parts' and 'whole' reflect each other.

- Dividing up the text into meaning units

Interviews contain lots of information, but just parts of them are useful for the research. Then, the author divided up the text into meaning units and even further condensed meaning units in the next step. Erlingsson and Brysiewicz (2017) remind that short meaning units may lead to fragmentation, and large meaning units with too many information may make novices getting lost in the condensation process. The author took warning from this and kept meaning units to an appropriate size.

- Formulating Code

Subsequently, the condensed meaning units have been developed into codes, such as descriptive labels. Here, codes were primarily derived from the primarily data rather than set prior. Codes could help the author to identify the connection between meaning units. Meanwhile, corrections of codes were undertaken throughout the analysis process. For a list of the coding categories see appendix 2.

- Developing coding categories and themes

The author grouped the codes with similar content and context into categories, and then, themes were created by codes with latent meanings. There are different definitions of 'Category' and 'Theme'. Categories are an expression of manifest content, answer questions about *who, what, when or where?* Themes are an expression of interpretative content, answer questions such as *why, how, in what way, or by what mean?* This step helped to illuminate the connection between codified information and provided answers to the research questions.

4.4 Research Validity

4.4.1 Triangulation

In this research, various sources of data were collected through in-depth interviews, field observations, participant observations and document analysis (e.g. policy documents, spatial plans, reports from government/ companies/ NGOs, news) which covered qualitative data. The use of multiple methods for data collection, also called triangulation, reflects an attempt to secure an in-

[16] All data were transcribed by the author.

depth understanding of the phenomenon in questions (Denzin, 2012). Triangulation is regarded as an alternative to validation but not a tool or a strategy of validation. It provides complexity, richness, breadth and depth for research (Flick, 2007). Interview data were checked and supplemented by data collected through field observations, participant observations and documents.

4.4.2 Language Translation

As all interviews were conducted in Chinese and all documents are in Chinese, this research involves translation between languages (from Chinese to British English). All text was translated by the author. During this process, the elimination of bias, the validity in terms of 'correct' interpretation and the matching of social characteristics were chief concerns (Temple and Young, 2004). The author tried to ensure that she plays an objective role and keeps neutral stances during data analysis, but the author have to acknowledge that her analysis will be influenced by who you are and your understanding of the processes. Consultations with professional English translator and English native speaker were also used to check the sense of quotes. Back translations were also used to ensure the veracity.

4.5 Ethical Considerations

The protection of human subjects or participants in any research study is imperative (Orb et al., 2001). Responding to this, the author completed the module of 'Research Integrity and Ethics' of the Postgraduate Training Scheme (PGTS) in 2016 before conducting any interviews and observations for my research. The ethical issues raised by the study were discussed and approved by the PhD supervisor and the Faculty Ethics Committee prior to the beginning of any research following the established research ethics approval process of the Faculty of Science and Engineering at the University of Hull. And, the research is strictly based on guidelines of the ethic policies and framework[17].

4.5.1 Informed Consents

The introduction of the research topic and the aim was clarified before every interview and observation together with a formal introduction letter from my supervisor.

Regarding interviews, the informed consent from each individual whom the author interviewed was prepared in two languages (English and Chinese), and was signed by all participants during interviews (telephone interviewees had e-signatures). In terms of observations, the author

[17] Research Ethics Policy published by the office of the Pro Vice-Chancellor for Research and Enterprise (PVC-RE) in Hull University (https://www.hull.ac.uk/work-with-us/research/site-elements/docs/research-ethics-policy.pdf), the NERC Ethics Policy (http://www.nerc.ac.uk/about/policy/policies/nerc-ethics-policy/), the ESRC Framework for research ethics (http://www.esrc.ac.uk/funding/guidance-for-applicants/research-ethics/our-core-principles/).

contacted the relevant person in charge in advance to get their permission to conduct the fieldwork and internship. A formal internship as well as data collection during internship for research were agreed through a formal letter which was signed and stamped by organisation leaders.

4.5.2 Data Resources

The data collected from existing documents will be listed as a reference in Harvard Referencing Style. To ensure the accuracy and authenticity, general information (including date and information of interviewee), question and answers during interview had been written down or audio recorded with the permission of the interviewee through the *Consent Form for Participants*. Interviewees were provided with the complete transcript of the interview if they expressed an interest in the information. As promised, where respondents are cited in the dissertation, their names will be withheld by numbers (e.g. interviewee 1, 2 or 3). The author will convey information truthfully and honouring commitments, and report findings precisely and will take care to avoid errors.

4.5.3 Possible risk to the author's physical well-being

Risks to the author's physical well-being relate to air travel between the UK to China and the use of public transport in the three case cities, such as hijacking, plane crash, theft, delay, negative encounters with other people, especially as the author will be travelling solo. Potential safety hazards also existed in case study industrial areas (especially TIAs) that some fragile equipment in TIAs during closing-own or relocation process may fall down. Safety precautions were taken when entering the industrial sectors including, for example, wearing a safety helmet and staying out of dangerous places circled by the lifeline. However, the risks rate was low and precautions were taken where possible. The author followed safety instructions and stayed with the guides all the time when the author had a tour of an industrial area. A full risk assessment for the research has been undertaken according to University of Hull requirements and has been approved.

4.5.4 Intellectual property

The fieldwork was carried out all by the author including data analysis and interpretation of results. Therefore, there are no problems of intellectual property and interest conflicts related to the data and emerging ideas. However, the author will respect any requests for confidentiality from interviewees, my internship hosts, and anyone else with whom the author come into contact.

4.5.5 Data sharing

When the data are fully published, they should be made available to the scientific communities and the interested public within a reasonable period.

Chapter 5 Case study place - Changsha-Zhuzhou-Xiangtan Agglomeration

This research selected Changsha-Zhuzhou-Xiangtan (CZT) agglomeration in China and eleven industrial areas of this agglomeration as a case study of eco-transformation processes in China.

CZT is one of many agglomeration in China consisting of three prefecture governments and a range of industrial areas from different eras (i.e. TIAs established during 1950s-1960s and DZs established from the late 1900s to early 2000s). The location and the different types of IAs in CZT, and lots of green political strategies applied in this area make it a good case study to understand the ET process of IAs both in organisational and spatial perspectives.

Section 5.1 introduces CZT agglomeration and the reason why an agglomeration as the unit of study and CZT agglomeration for the case study were chosen. Section 5.2 introduces the different environmental problems of two kinds of industrial areas – TIAs and DZs – in CZT. Section 5.3 introduces eleven specific case study industrial areas (incl. three TIAs and eight DZs) within CZT agglomeration. Finally, section 5.4 gives a summary of this chapter.

5.1 General Information of CZT

Yao (1992) defined urban agglomeration as a relatively complete group of cities (in different scales) interlined with each other based on close geographical conditions, within a certain distance and with a highly accessible transportation network. Based on this definition, Yao et al. (2001) proposed a 10-standard approach to judge whether a specific cluster of cities could be identified as an urban agglomeration. Fang and Yu (2017: 131) organised those 10-standard approach as following,

> "1) the total population must be 15–30 million; 2) there are at least two large cities (with a population of more than 1 million); 3) the urban population must be over 35% of the total; 4) the non-agricultural population must be greater than 40% of the total; 5) the non-agricultural population of any areas within the agglomeration must be over 55% of their respective intersected provinces; 6) there must be a complete five-hierarchical urban system structure (megacity, large city, medium-sized city, small city and township); 7) the railway density must be between 250 and 350 km/10,000 km2 and the road density between 2000 and 2500 km/10,000 km2) the total retail sales of social consumer goods of any areas within the agglomeration must be above 45% of their respective intersected provinces; 9) the number of migrants of any areas within the agglomeration must be over 65% of their respective intersected provinces; and 10) the total industrial outputs of any areas within the agglomeration must be greater than 70% of their respective intersected provinces."
>
> (Fang and Yu, 2017: 131)

Several Urban Agglomerations or even one single Urban Agglomeration can be a national economic circle which may affect national or global economic growth (Gu, 2011). The realization of the strong economic development driving capability of urban agglomerations further encourages the Chinese government to engage in very active research on, and involvement in the formation and development of urban agglomerations (Fang and Yu, 2017). A hierarchical urban agglomeration system ---- the '5+9+6' system for Chinese urban agglomerations was proposed (Fang, 2014). It shows in Fig 5.1: there are five national-level large urban agglomerations marked by red circles, nine regional-level medium-sized urban agglomerations marked by purple circles and six sub-regional-level small-sized urban agglomerations in yellow circles. CZT urban agglomeration is one of the national urban agglomerations in the"5+9+6" system. It circled by black line in Fig 5.1 and shows it located in the central place among 5 national urban agglomerations.

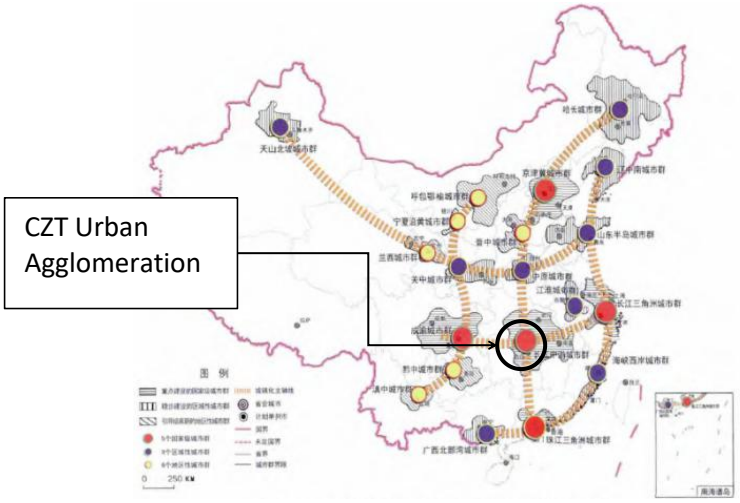

Figure 5.1 The "5+9+6" system of Chinese urban agglomeration

(Source: Fang, 2014: 1140)

CZT urban agglomeration covers 28.07 km^2 and has 15.09 million populations (Table 5.1). CZT agglomeration is located in Hunan Province, central China, and is made up of three independent cities: Changsha, Zhuzhou and Xiangtan (see Fig 5.2). Changsha is the capital city of Hunan province. Fig 5.3 is the satellite imagery of three cities, and it presents how much of the area is built area and how much is green space. In 2006, the '3+5' strategy has been carried forward that consolidated Changsha, Zhuzhou and Xiangtan and their adjacent five cities (i.e., Yueyang, Changde, Yiyang, Loudi and Hengyang) into an extensive CZT agglomeration (or agglomeration) (see Fig 5.2).

Table 5.1 Some general status of CZT

	Area of Land (thousand sq.km)	**Resident Population (million person)**	**GDP (billion yuan)**
CZT	28.07	15.09	1155.64
Proportion of Hunan province	13.3%	20.9%	41.1%
Extensive CZT	99.6	40	2221.3
Proportion of Hunan province	47.1%	55.4%	79%

Data Source: Statistical yearbook of Hunan Province 2015.

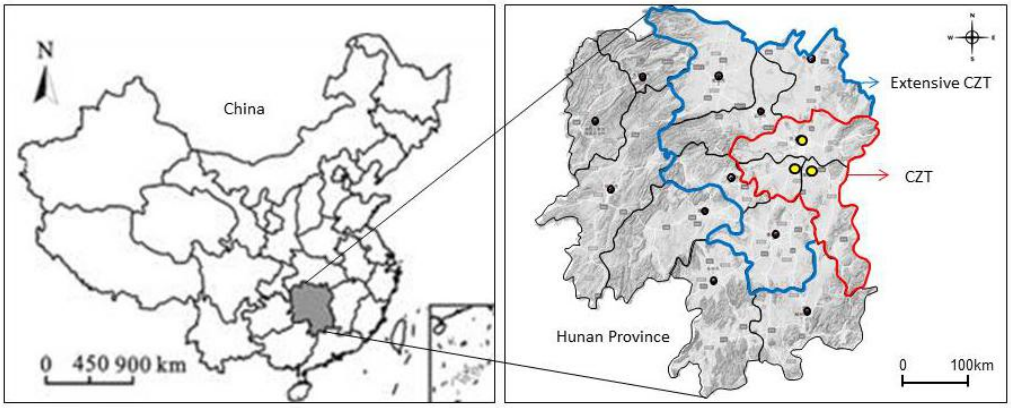

Figure 5.2 CZT Urban Agglomeration locates in Hunan Province, central China

(Data source: bigemap.com, compiled by the Author)

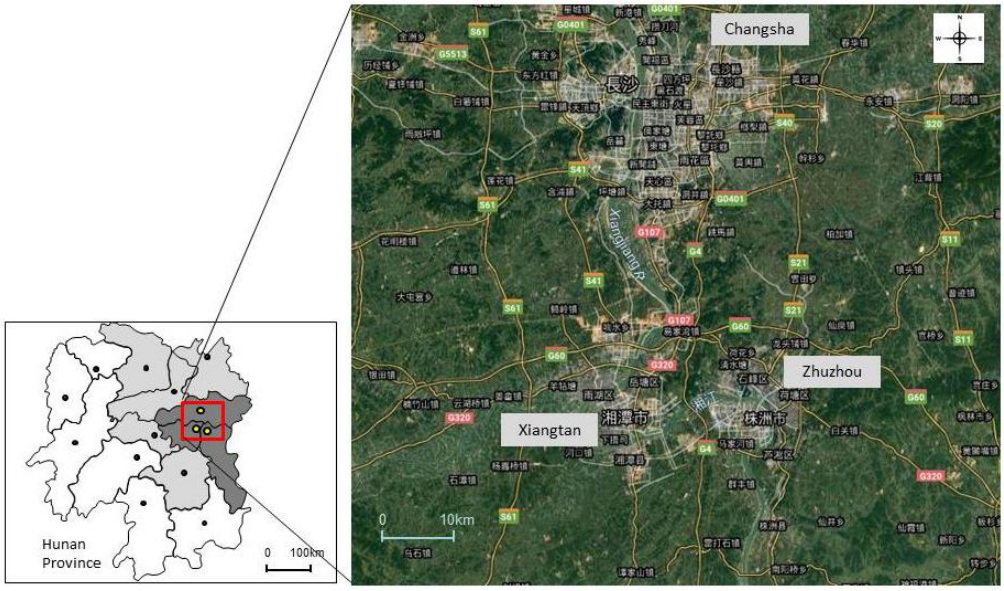

Figure 5.3 Satellite imagery of Changsha, Zhuzhou and Xiangtan Cities

(Data source: Google Map, 2019)

Urban agglomeration in China is not an administrative area, but a strategy for scale economy. Then, CZT agglomeration still managed by Hunan provincial government and three cities in CZT are managed by respective municipal governments (more details about the institutional set-ups of CZT see section 6.2.1). Different from other urban agglomeration, as CZT was designated as the national pilot area of 'resource-economical and environment-friendly society (two-oriented society)' in 2008, a governmental organisation was established for the environmental governance in CZT agglomeration level (details see section 7.2.1.3).

Urban agglomerations (including CZT) in China were created to boost the regional economy. But due to the increasingly severe environmental degradation through rapid urbanisation and industrialisation, environmental sustainability has gradually become incorporated into decision making at the agglomeration level. Both central and local governments had published a series of policies and strategies to enhance the environmental performance of CZT agglomeration during industrialisation and urbanisation process. In 2006, CZT has been designated as the national pilot zone for building 'resource-conserving and environment-friendly societies (two-oriented societies)' by the Chinese State Council in 2008. *The Regional Plans for CZT* (2008-2020) were also published in the same year. A series of environmental policies and strategies were introduced (e.g. The Action Plan of Pollution Treatment of Xiang River, 2013; National Demonstration of the Industry Transformation and Upgrading in Old Industrial and Resource-Based City, 2016). ET of IAs (both TIAs and DZs) in CZT were implementing which worth deeper investigation.

Moreover, those policies and strategies implemented both in institutional and spatial perspective, which fits the focuses of this thesis. Projects are in different stages when the author doing interviews and field visits ---- some projects have done and some projects are on-going ---- then, changes before, during and after ET process could be investigated.

Last but not least, the share of the economy in CZT was below average level by comparing with other national urban agglomerations in China (Report on the integration of urban agglomerations in China, 2019). Therefore, CZT is a good demonstration area for the EM adaptation process in common Chinese context. Comparing to agglomerations with high income bracket, CZT better reflects the leapfrogging approach of Chinese EM.

5.2 IAs in CZT

5.2.1 Classification of IAs in China

Building on the classification of Chen and Huang (2005), based on the differences of the stages, policies, development aims and relationships with cities, industrial areas in China can be divided into

two categories: (1) TIAs (Wu et al., 2007; Cai et al., 2006) which were established under a traditional planned economic system in the 1950s-1960s and set the foundation of Chinese industry; and (2) DZs which were shaped by reform politics and opening-up policy in the 1970s-1980s. The two types are characterised by different industries and development orientations (see Table 5.2) resulting in different relationships with cities and different environmental issues, which require different policies/strategies to address.

Table 5.2 Two categories of industrial areas in China

	TIAs	**DZs**
Start Time	1950s-1960s	1980s (after the reform and open-up policies)
Distribution	Uniformly distributed mainly in middle and northeasters parts of China	East-coastal cities/areas at first, and gradually moved to central and western areas
Aim	Industrialisation begins to take shape	Attracting FDIs to achieve rapid economic growth
Industry	Resource-intensive industries	Labour-intensive industries for export-oriented economy and hi-tech industry
Operate Subject	Most are state-owned enterprises	Most are privately-owned enterprises

TIAs represent a specific type of industrial area/planning and is specific to a certain period (Xu, 2006), so that, it also is known as the old industrial area (Qin, 2011). About 90% of industrial enterprises in TIAs are state-owned companies. TIAs are highly concentrated on resource-intensive industries, such as, coal mining industries, steel industries, metal smelting industries and heavy machinery processing industries. With ongoing urbanisation, a number of problems emerged in TIAs: 1) TIAs became economic recession areas due to out-dated technology and resource exhaustion (Cai et al., 2006; Zhao and Yang, 2008); 2) there were increasing environmental pollutions generated by TIAs; 3) large scale of land resources are wasted through extensive land use mode, especially when TIAs gradually located in city centre during urbanisation and city expansion in the last few decades; and 4) social pressures build up as workers and surrounding residents of TIAs require better working and living conditions.

The DZ is a particular concept in developing countries, especially in China, that describes an specific industrial area that enjoys preferential policies of production, consumption and revenue (Krugman, 1991; Porter, 1998). After the reform and opening-up policy in 1978, much capital flowed into China from the world, and many Economical and Technological Development Zone (ETDZs) have been built

as the main space to attract foreign businesses and investment (Pi and Wang, 2004). In May 1984, Chinese government established 14 National ETDZs in 14 coastal cities, e.g. Tianjing, Dalian, Yantai, Qingdao and Guangzhou (Pi, 2004). After that, large amount of DZs were built, and the government differentiated them intro different types by different industries and development purposes. For example, by 2018, there are 522 DZs in China: 219 ETDZs, 156 Hi-tech Industrial Development Zones (HIDZs), 19 border economic cooperation zones, 23 export processing zones (Data source: *List of* Chinese DZs, *中国开发区审核公告目录*, 2018). This thesis aims to focus on two main categories of DZs: ETDZs and HIZDs. The similarities and differences of HIDZs and ETDZs are listed in Table 5.3.

Table 5.3 The similarities and differences of HIDZ and ETDZ

		Difference		**Similarity**
		ETDZ	HIDZ	
Start Time		1980s	1990s	/
Prototype		Export processing zone	Science park	Industrial area
Amount (by 2016)		219 (national level)	146 (national level)	/
Purpose		Attracting FDIs and localising foreign technologies	Industrialising the native technology	Improving economic and technological development
Policy emphasis		Mainly for enterprises with foreign investment	Mainly for high-tech companies	Implementing preferential policies
Enterprise Type		Sino-foreign joint ventures, sino-foreign cooperative joint venture, wholly foreign-owned production and export-oriented processing enterprises	High and new technology enterprise	The enterprise of relatively high technology
Location		Close to the city, good traffic condition, relatively independent area	Located in the urban area (city centre), the dense regions of intelligence, good environmental quality	Relying on the central city
Management Agency	**National level**	Ministry of Commerce	Ministry of Science and Technology	Approved by the State Council
	Local level	The Commerce Department of the province/city/area	The Commerce Department of the province/city/area	The Commerce Department of the province/city/area

Reference: Han et al., 2007; Zhang, 2011; Kang, 2014; Yin, 2015; Chen, 2016; Official Websites of the Ministry of Commerce and the Ministry of Science and Technology.

ETDZs are the outcomes of international industrial transfer. It was built to attract FDIs and localise foreign technologies, large amount of labour- and resource-intensive industries located in here, so ETDZs usually located in the area where away from city centre and even residential areas have. While, HIDZs was built to improve the development of knowledge- and technology-intensive industries with trifling pollution potentials (e.g., electronic information technology, aerospace engineering, new material, bioengineering, new energy and environmental protection industries). So, in general, HIDZs locate close to city centres.

In sum, since the different industrialisation purposes and locations of TIAs, ETDZs and HIDZs, the influences to the environment, environmental strategies, and role in ET process would be different which worth further research.

5.2.2 IAs in CZT for case study

This thesis uses CZT agglomeration as the context for a multi-case analysis of three typical TIAs and eight national DZs[18] (incl. three national HIDZs and five national ETDZs) (see Table 5.4). Three TIAs including Pingtang TIA in Changsha, Qingshuitang TIA in Zhuzhou and Zhubugang TIA in Xiangtan. These were established in 1950s, and had 47, 28 and 172 industrial companies respectively (Governmental Documents). Industrial companies in these three TIAs including state owned companies and private companies, however, state owned companies (especially, central government owned companies) played the dominant role in terms of production value and scale. Eight national DZs including Changsha HIDZ, Liuyang ETDZ, Ningxiang ETDZ, Changsha (Xinsha) ETDZ and Wangcheng ETDZ in Changsha city; Zhuzhou HIDZ (China Power Valley) in Zhuzhou city; Xiangtan HIDZ and Xiangtan (Jiuhua) ETDZ in Xiangtan city. These were built during the late 1900s to early 2000s.

The selected IAs are suitable demonstrative regions as some of them have already transformed and some of them are under transformation by the guidance of government currently. They hence allow analysis of processes and outcomes before, during and after eco-transformation.

[18] DZs were classified by government into three levels: national, provincial and district levels. Here, three levels are not administrative levels, but levels designated by governments for different preferential policies and funds.

Table 5.4 Industrial areas in CZT for case study

City	Category	No.	Name	Create Date	National HIDZ/ETDZ Award Date	Main industry
Chang-sha	National HIDZ	1	Changsha HIDZ (http://www.cshtz.gov.cn)	1988.10	1991.03	Advanced Equipment Manufacturing, Electronic Information Industry, New Energy Industry, New Materials Industry, Biological Industry, Medical Industry, Modern Service Industry
	National ETDZ	2	Liuyang ETDZ (http://www.letz.gov.cn/)	1997	2012.03	Biological Medicine Industry, Electronic Information and Health Food Industry
		3	Ningxiang ETDZ (http://www.nxdz.gov.cn)	1998	2010.11	Food Industry, Mechanical and Electrical Industry, New Materials Industry, Modern Service Industry
		4	Changsha(Xingsha) ETDZ (http://www.cetz.gov.cn/web/csjkq/index.html)	2000	2000	Engineering Machinery Industry, Automobile and Parts Manufacturing, Electronics Industry, New Materials Industries
		5	Wangcheng ETDZ (http://www.hnjkq.com/)	2000	2014.02	Nonferrous Metal New Material Industry, Food Processing Industry, Electronic Information Industry, Modern Commercial Logistics Industry
	TIA	6	Pingtang TIA	1950s	/	Mining Industry, Cement Industry, Chemical Industry, Building Materials Industry
Zhu-zhou	National HIDZ	7	Zhuzhou HIDZ (China Power Valley) (http://www.zzgxq.gov.cn/)	1992.05	1992.11	Rail Transportation Industry, General Aviation Industry, New Energy Vehicles Industry, and other power industries
	TIA	8	Qingshuitang TIA	1950s	/	Smelting Industry, Chemical Industry, Building Materials Industry and Energy Industry
Xiang-tan	National HIDZ	9	Xiangtan HIDZ (http://www.xtctp.com/)	1992	2009.03	New Materials Industry, Environmental Protection Machinery Industry, Fine Chemical Industry, Modern Logistics Industry

	National ETDZ	10	Xiangtan (Jiuhua) ETDZ (http://en.jiuhua.gov.cn/)	2003	2011.09	Automobile and Auto Parts Manufacturing, Advanced Equipment Manufacturing, Electronic Information Industry, Modern Service Industry and Strategic Emerging Industry
	TIA	11	Zhubugang TIA	1950s	/	Mining Industry, Chemical Industry, Electrolytic Manganese Dioxide Industry

Data source: Official Website of the Ministry of Commerce (http://www.mofcom.gov.cn/xglj/kaifaqu.shtml); Official Website of the Ministry of Science and Technology (http://www.most.gov.cn/gxjscykfq/gxjsgxqml/); Official Website of the Ministry of Environmental Protection (http://kjs.mep.gov.cn/stgysfyq/m/201302/t20130222_248379.htm); Official websites of each DZs; Yearbooks of Development Zones in Hunan Province.

The spatial location of the IAs in CZT is illustrated in Figure 5.4. TIAs were originally located in the suburb, but after the expansion of the cities, they were gradually incorporated into the city and have gradually moved to the centre in the cities. Since the late 2000s, Zhubugang TIA and Qingshuitang TIA located close to city centre, Pingtang TIA located close to urban area but had a distance to city centre comparing to other two TIAs. In respect to the location of DZs, HIDZs are located close to the city centre but ETDZs are far away from the city centre.

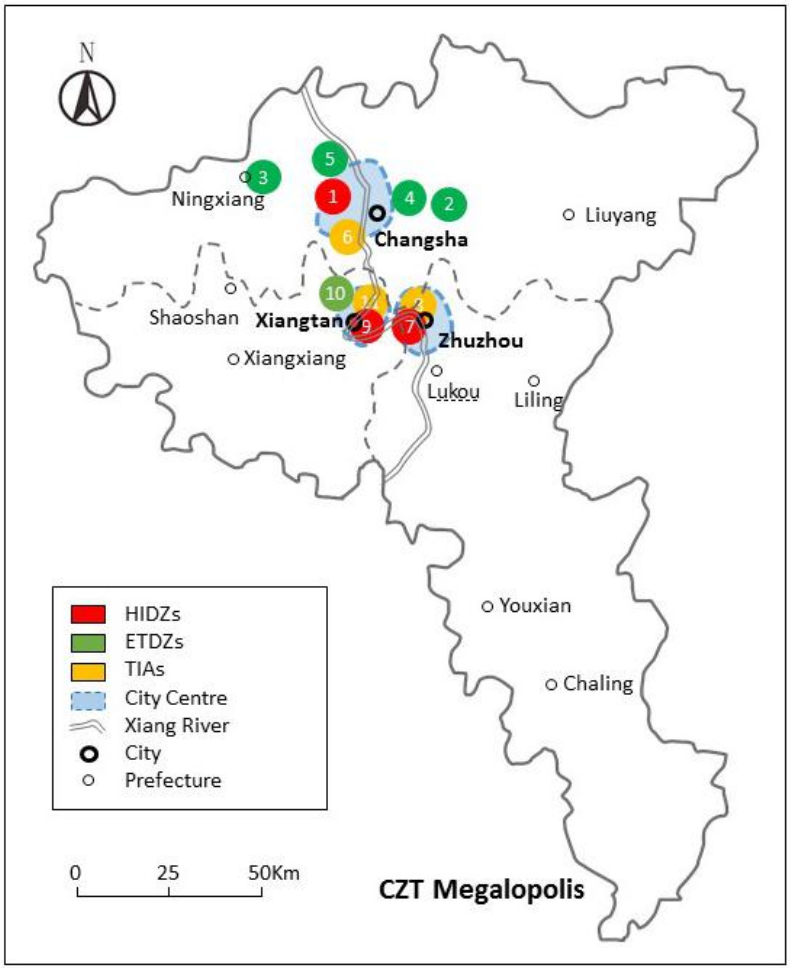

Figure 5.4 Location of IAs case in CZT map

5.3 Environmental Problems of IAs in CZT

5.3.1 Environmental Problems of TIAs

Hunan province has abundant mineral resources and has been coined the 'Home of Non-ferrous Metals' (Yearbook of Hunan Province). This provided great conditions for the development of TIAs, and three TIAs were built for resource-intensive and heavy industries with high-energy consumption. The development of TIAs promoted the development of three cities of CZT. In 2008, iron and steel, nonferrous metallurgy, chemical industry and building materials industry accounted for 40% of total industrial added value in CZT (CZT statistic yearbook).

> "All those three cities [in CZT] are old industrial bases with the approval of The National Development and Reform Commission (NDRC). They have superior resources and basics for heavy chemical industries. There is no other agglomeration in central China like it."
>
> (Wei Houkai, Researcher in the Institute of Chinese Academy of Social Sciences, 2008, http://www.scio.gov.cn/xwfbh/gssxwfbh/xwfbh/hunan/Document/317593/317593.htm)

However, the development of TIAs also generated increasing severe environmental pollutions in CZT. For example, in Changsha city, the land area polluted by mining industries was 19.53 sq.km in 2007 (*The Overall Planning of Mineral Resources of Changsha*, 2007). Zhuzhou has been ranked amongst the top-ten most air polluted cities in China by the Ministry of Environmental Protection for three consecutive years from 2003 to 2005, and Qingshuitang TIA is regarded as the culprit of Zhuzhou's air pollution levels (http://hunan.sina.com.cn/news/m/2017-12-22/detail-ifypxrpp3286040.shtml).

As industries in TIAs need plenty of water (e.g., cement industries), three TIAs in CZT are located close to this river (see Fig 5.4). The Xiang River flows through six cities (including three cities of CZT) in Hunan province (See Fig 5.5) serving as source of drinking water for 20 million people. Waste water has been directly disposed into Xiang river and generated severe pollution to the whole water basin. For example, Qingshuitang TIA discharged tens of millions of tons of wastewater and millions of tons of waste residues into Xiang river every year, which caused severe heavy-metal pollution along 5km of Xiang riverside resulting in polluted bottom sludge in a depth of up to 20 meters (*The Report of CZT 2016*:5). The industrial pollution of TIAs of the Xiang river basin has become the main environmental problem in CZT.

Figure 5.5 The drainage basin of the Xiang River in Hunan province

Moreover, with urbanization, the TIAs that previously were located outside the city were incorporated into the city and became part of the central area as cities grew further and further (see Fig 5.4). Industrial pollution of those areas deeply influenced citizens and limited the development of the urban core. The 'shanty areas' built around TIAs for workers became the 'urban village[19]'. TIAs

[19] Urban Village describes rural villages that have been surrounded or otherwise encroached upon by urban expansion. Rural settlements that have been transformed into poor living spaces for migrant workers. (Zheng et al., 2009)

largely undermined urban land-use efficiency, limited the improvement of the land value (e.g. land price) of city centres and development of whole cities. Low salaries and polluted working and living environments were main concerns of workers and residents in TIAs in CZT, who exerted plenty of pressures to government as well.

With the guidance of the central government, the local government made an increasing effort on the green transformation of TIAs, e.g. *The transformation plan of TIAs in CZT (2004-2010)*. The transformation of behindhand polluting industries, pollution treatment of Xiang riverside, better living environments for surrounding residents and the harmonious relationship of TIAs with other areas of city centre lay at the centre of the eco-transformation projects of TIAs in CZT.

5.3.2 Environmental Problems of DZs

In 1985, Deng Xiaoping (former core leader of central government in China) announced an economic strategy to realise common prosperity that some people and some regions are encouraged to get rich first, and then others will be brought along. Eastern part of China was regarded as the place to get rich first, so most FDIs introduced to DZs in the east of China first. Until the 'Rise of Central China' strategy issued in 2004, many industries moved from the east to central areas, e.g. DZs in CZT. DZs became the economic growth pole in Hunan Province. In 2012, DZs accounted for 0.4% of lands, and created 44% of added value of scale industry in Hunan Province (Data source: Department of Statistic in Hunan Province).

However, ETDZs (in CZT) were located far away from city centres (see Fig 5.4) and struggled to keep and attract workers, residents and talents. The extensive land-use modes of DZs wasted lots of lands and occupied lots of farmlands (Tang et al., 2012). The lax environmental standard of those ETDZs also led to environmental problems and pollution transferring from the eastern region. Besides, although DZs were divided into ETDZs and HIDZs in Hunan Province with respective preferential policies and funds, but without an integrated management and plans, two kinds of DZs in Hunan Province had similar industries and development directions, and had serious homogeneous competition with each other (The FYP of DZs in Hunan Province, 2010).

To address these different environmental and subsequent problems in TIAs and DZs, local governments in CZT published a series of policies and strategies with the guidance of central government. These policies and strategies are regarded as the ET process of IAs for EM development in China, and focused on both organisational and spatial perspectives which worth further analysis in this thesis.

5.4 Summary

Firstly, section 5.1 introduced the general information of case study place of this thesis ---- CZT urban agglomeration. The increasingly environmental concerns about IAs and the medium economic level in CZT made it a good case study to understand the ET process of IAs, and ET practice in China.

Next, as different types of IAs face various environmental problems and require different solutions. This thesis (section 5.2) selected eleven typical IAs in CZT for further analysis and divided them into two categories: three TIAs and eight DZs (incl. five ETDZs and three HIDZs). Section 5.3 introduced the different environmental problems and subsequent social, spatial and economic problems of TIAs and DZs in CZT. Analysis (especially, spatial analysis) about IAs during ET process in CZT will consider the differences of two types of IAs.

Chapter 6 Policy Analysis and Application of the Theoretical Framework to the Case Study Location

EM is a theory but also a practical strategy for policy discourse (Deutz, 2009). Based on the development of EM theory in Western countries, the political focus of EM implementation in Western countries also developed from environmental technologies to more structural and systematic transformations concerning political, institutional, and social objectives, i.e. from weak to strong version of EM (details in section 2.1.2). After the 2000s, alongside the internationalisation of environmental problems, EM application in developing countries (especially, China) became a subject of academic analysis (Mol and Sonnenfeld, 2000; Carter, 2001; Eckersley, 2004; Mol, 2006). Mol (2006) argued that EM implementation in China is only a weak version of EM. But, most studies of EM in China consider practices during the mid-2000s and the early 2010s. There is a need for a more recent follow-up study due to the recent political endeavours related to this topic. As the greening of urbanisation and industrialisation is regarded as a significant strategic measure for integrated EM in China, the national political context and local practices of the ET of IAs in China are illustrated respectively in section 6.1.1 and 5.1.2.

Besides, to extend these debates and to address the limitations of previous studies, this thesis aims to focus on EM practices on two perspectives after the late 2000s: governmental/organisational perspective and spatial perspective. Chapter 3 built the analytical frameworks for these two perspectives' research to the ET of IAs in China following on discussions from related theories and papers. After the selection of CZT as the case study place (see Chapter 5), section 6.2 embodies the analytical framework built in chapter 3 to the research in CZT. Finally, section 6.3 gives a summary of this chapter.

6.1 Policy Analysis of the ET of IAs in China

To present the embodiment of EM practices in China, this thesis proposes the term ET of IAs. This thesis defines the ET of IAs as the engagement of multiple stakeholders in the greening of industrial areas in China's EM practice. Combining the investigation of policy context and practices, the ET of IAs guided by state-led policies and strategies published by multiple departments (e.g., Environment Protection Bureau/ Development and Reform Commission/ Urban and Rural Planning Bureau/ Science and Technology Bureau) in a multi-scalar (central to local) context for the green development of industrial (and urban) areas. Eco-transformation, hence, describes specific policies and strategies as a process and tendency of increased emphasis of eco-development by the government.

There are a growing number of policy initiatives for the ET of IAs that have drawn upon EM ideas in China. ET of IAs refers to specific policies and strategies as well as increasing efforts made by the government to emphasise eco-development. According to the investigation of the policy context of the ET of IAs in China, it is a top-down process where concepts are delivered layer by layer: from politico-economical system to five-year plans, and then to national policies/strategies and local policies/strategies, finally address specific industrial areas. Given the central government's dominant role in EM in China, the policy context of ET of IAs presents a 'top-down' approach consisting of five parts: (a) the transformation of politico-economic systems, (b) national plans and guidance, (c) national environmental initiatives, (d) national policies/strategies guiding ET of IAs, and (e) regional or local practices for the ET of IAs (see Fig 6.1).

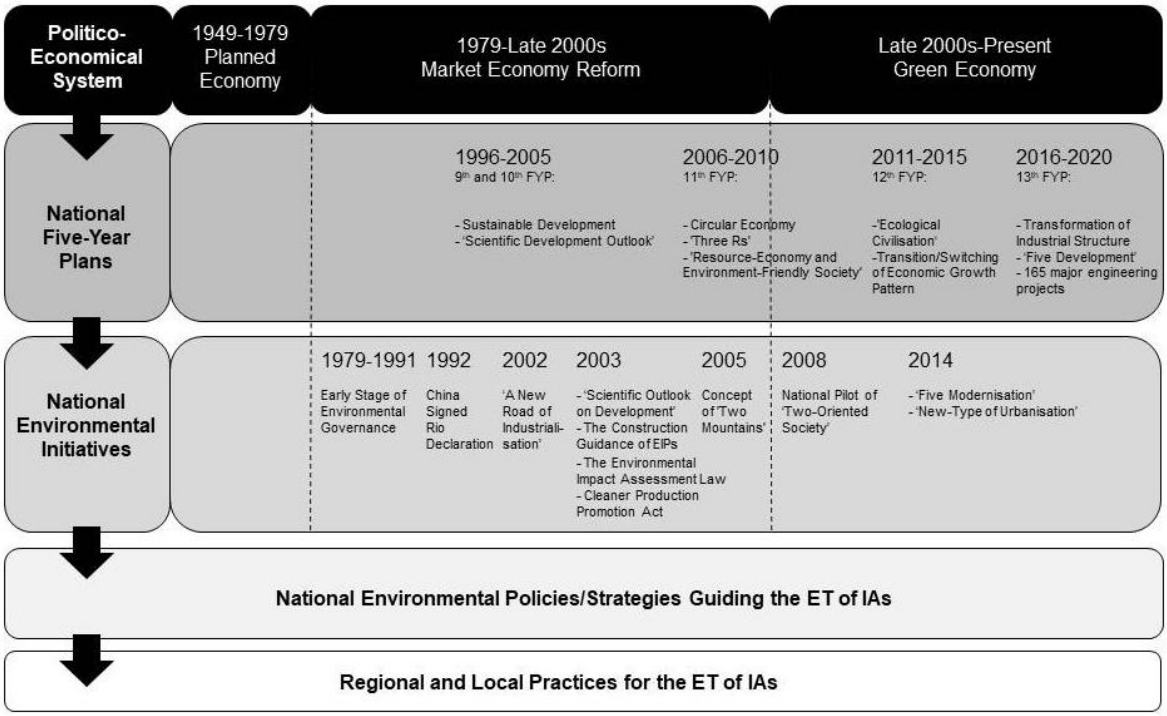

Figure 6.1 Policy context of the ET of IAs during EM in China

6.1.1 National Policy Context of the ET of IAs in China

6.1.1.1 Transformation of Politico-Economic Systems

EM is predicated upon the potential transformation of industrial society/civilisation (Huber, 1982) and capitalist economies (Gibbs, 2006), that is, the industrial system and politico-economic system become more sustainable than before. This is particularly apparent in China. After the establishment of the People's Republic of China in 1949, the politico-economic system went through three stages: planned economy (1949–1979), market economy reform (1979–late 2000s), and Green Economy(late 2000s–present) (Chai, 1998; Su and Li, 2011).

After 1949, as a socialist country, China had adopted a planned economy. The overall direction of national economic and social development, including the distribution and scale of production, was set by the government. The first generation of industrial areas was built during this period. Most resources were owned and controlled by the government, and 78.3% of the total industrial capital was state owned at the end of 1949 (China Statistic Yearbook). Industrial production was not market oriented but in compliance with compulsory national strategies. Because of this system, China's new regime was recognised by only a few countries, such as the Soviet Union (USSR), so there were few opportunities for international trade. Also, with a concern for national development, the industries of inland cities located far away from the national borders were prioritised (see the '156 Project' during the 5th FYP, 1953–1957, and the 'Third-line Construction' Policy of 1964). With a large population and scarce resources per capita, China made economic development its central task, and alleviating poverty as the main objective. Although institutions for environmental management were initially built, the environmental performance was not a core concern. At the same time, China prioritised developing heavy industries (e.g., steel and chemicals) for economic growth (Zhang, 2009). Such development of heavy industries gave rise to a potential future pollution crisis.

The planned economy system did make an enormous contribution to economic recovery and development in the 1950s (Han, 2014). Over time, however, the disadvantages of the planned economy became obvious. It failed to achieve high efficiency or rapid economic growth; this was the main reason why the planned economy was replaced with a market economy (Wu, 2013; Han, 2014). The environmental problems of the planned economy were also recognised in China (Qi, 1983), as in Eastern Europe (Schultz and Crockett, 1990; Steenge, 1991; Turnock, 2001). In 1978, the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party introduced the reform and opening-up policy. 'Opening-up' meant opening markets up both internally and externally, and thus the market economy system was established. New diplomatic relations with countries, such as the US and Japan were established, which helped make China become the 'factory of the world' (Zhang, 2006). The reforms directly led to the construction of DZs to absorb FDI. DZs were built in the coastal cities (e.g., Shenzhen, Zhuhai, Xiamen and Shantou) with approval from the Party Central Committee and the State Council during the 1970s and 1980s (e.g., initiatives of the Five National Economic Zones designated by the State Council from 1980 to 1988; the economic opening coastal areas designated by the State Council from 1985 to 1988). By 2004, 60% of exported industrial products were produced mainly in Shenzhen, Zhuhai, Xiamen, and Shantou (Chinese Statistical Yearbook). Since economic growth had been the primary objective, environmental degradations were aggravated during this period. Environmental management had been in the early stage until the Rio Summit in 1992 (Zhou and Ji, 2009; Chang et al., 2016). However, the market

economy system created opportunities for the participation of non-state actors (e.g. private enterprises) in environmental protection and regulation.

In 2008, the financial crisis erupted in the US and spread rapidly around the world (Wang, 2008; Zhen, 2009). Affected by this crisis, the growth rates of real estate, exports, and other industries were reduced in China (Wang, 2008). In the context of global recovery and transformation after the financial crisis (Chen, 2009; Ou, 2010), the United Nations Environment Programme (UNEP) proposed the 'Green Economy' and the 'Green New Deal'. Ban Ki-moon, secretary-general of the UN, claimed that Green Economywould have a positive effect on innovation activities and generate unprecedented prosperity. After 2009, many advanced countries entered the 'economy revolution' and regarded Green Economyas a primary driver of future economic growth. Strictly speaking, compared to planned and market economies, Green Economyis not a type of economic system, but it does provide a new understanding of economic growth and the environment.

In the 1990s, the Chinese government became increasingly concerned about the coordinated development of the economy, society, and the environment. After the 1992 Rio Summit, China took the lead in formulating and publishing *The 21st-Century Agenda: White Paper on China's Population, Resources, and Environment*. China implemented its first national sustainable development agenda and published Ten Strategic Policies for Environment and Development, which led to a new era of environmental management. During the executive meeting of the State Council in August 2009, the premier of the State Council, Wen Jiabao, argued that low carbon development should characterise new economic growth, and a pilot demonstration of the low-carbon economy needed to be carried out. The same year, the Standing Committee of the National People's Congress introduced the *Resolution on the Positive Response to Climate Change*, suggesting that China should seize the opportunity to develop a low-carbon economy by accelerating the low-carbon utilisation of high-carbon energies and the development of low-carbon industries and transportation (e.g., clean energy vehicles, rail transits). Facilitating this new economic growth with high-energy efficiency, low energy consumption, and low-emissions industry has become characteristic of Green Economy development in China.

In these transformations of China's politico-economic system, environmental pollution was internalised in product costs by market-based approaches, and the industrial system and structure became more environmentally friendly and sustainable (Table 6.1).

Table 6.1 Comparison of the three stages of politico-economic evolution in China

Politico-Economic System	Capital Ownership	Industrial Structure	Spatial Feature of Industries	Economy–Environment Relationship
Planned Economy	Mostly state owned	Most are heavy industries	Inland cities	Environmental Protection is inferior to economic growth
Market Economy	Increasingly privately owned	FDI: resource-intensive and labour-intensive industries; Hi-tech industries	Coastal cities City centres	Environmental Protection is inferior to economic growth
Green Economy	Mixed ownership	Increasing tertiary industries and environmental protection industries	Industrial transfers from coastal to inland cities; relocation of polluting industries (details in section 3.2.1.1)	Win-win objective of economic growth and environmental protection

6.1.1.2 National environmental initiatives guiding the ET of IAs

Under the transformation of the politico-economical system, the central government introduced a series of programmes and initiatives as guidance, e.g. Five-Year-Plan (FYP) and national environmental initiatives. In China, FYPs are social and economic development initiatives in tune with the economic-political reforms. The economy is shaped by the Communist Party of China through the plenary sessions of the Central Committee and national congresses. The party plays a leading role in establishing the foundations and principles of Chinese socialism, mapping strategies for economic development, setting growth targets, and launching reforms. All the environmental policies and initiatives are guided by the FYPs in China, and since 1953, 13 FYPs have been introduced. However, until the 9th FYP (1996) after the 1992 Rio Summit, environmental protection was focused by the Ministry of Ecology and Environment in China (Xie, 1998). The following highlights national FYPs (from the 9th to 13th) and environmental initiatives that are leading and supporting the ET of IAs (Source: governmental and policy documents of each FYP and initiative).

The 9th FYP (1996-2000) set 'sustainable development' of environment and economy as the national environmental goal that the impacts of the environment should be considered in planning of urban and industry. Strategies were adopted: (1) Enhancing the discharge controlling of primary contaminants; (2) Implementing green projects to manage water, air and solid wastes; (3) Adopting 'veto power' of the environment so that projects which do not reach environmental standard are

not allowed to receive loans; and (4) Endowing environmental-friendly companies with IS014000 certification.

During the period of the 10th FYP (2001-2005), the realisation of the *Scientific Outlook on Development*[20] and *Harmonious Socialist Society*[21] can be seen as crucial contents of environmental management. *The Promotion Law* of *Cleaner Production* was put into implementation in July 2002 in China. In the same year, *The Environmental Impact Assessment Law* was also announced. In 2005, *The Renewable Energy Law* was enacted. Moreover, the 16th National Congress of the Communist Party (2002) introduced a 'new road of industrialisation' and point out the development direction of industrialisation that it should be characterised by industries of high technology, excellent economic benefits, low resource consumption and low environmental pollution. Jia (2013) suggested that this 'new road of industrialisation' coincide with 'the 3rd industrial revolution'. At the same time, in order to achieve ecological industry and circular economy[22] in practice, EIPs were built as trial implementation by the national state in 2003. From 1999 to 2014, there are 25 approved national EIPs (Ministry of Environmental Protection). EIPs were not only newly built, but based on the regeneration of existing industrial areas. In 2004, the State Council published *Advice On the Transformation and Upgrading of National Development Zones* that the green transformation of existing DZs is encouraged. The current president of China, Xi Jinping, is also well known for his emphasis on environmental performance during the modernisation process. The most representative concept is *Two-Mountain* which was proposed in 2006. Jinping (2015) explained that the *Two-Mountain* concept refers to lucid waters and lush mountains which are invaluable environmental assets that can be harnessed to strengthen ecological agriculture, ecological industry and ecological tourism.

Based on the transformation into the green economy starting in the late 2000s, the Chinese state translated environmental concerns into practical strategies. In order to attempt to achieve the sustainable development goals set in the 9th and 10th FYP, the 11th FYP (2006-2010) introduced the strategies of 'circular economy' and Cleaner Production (CP). *The Law to Prevent and Control Water Pollution* was issued in 2008, and *The Law to Promote Circular Economy* was published in 2009. The 11th FYP set the goals that, before 2010, the energy consumption per unit of GDP should reduce 20%, the total emission of major pollutants should decrease 10%, and the utilisation rate of industrial

[20] Scientific Outlook on Development refers to the development that adopts people-oriented, complete, coordinate and sustainable concepts (Report of the 17th CPC National Congress, 2007).

21 Harmonious Socialist Society describes the society defined by harmonious relationships between people (production) and the environment (Summary of Mao Zedong's Theories, 2010).

22 Circular economy here refers to the implementation of resource-saving and reusing, cleaner production, and the development of environmental industries (NDRC, www.china.com.cn).

solid waste should be improved to more than 60%. Under the binding targets, China received positive progress on energy conservation and emission reduction (Institute of Industrial Economics of the Chinese Academy of Social Sciences, 2011). According to the data from *The Chinese Statistical Yearbook on Environment* from 2005 to 2017, the energy (coal) consumption per 10,000 yuan of GDP reduced 53.2% from 2006 (1.24 ten thousand tons of coal per 10,000 yuan of GDP) to 2016 (0.58). The total volume of industrial wastewater discharge also decreased by 22.4% from 2006 (240.2 one hundred million tons) to 2016 (186.4). The total volume of industrial waste gas emission kept rising from 2005 to 2014, but it declined by 1.3% from 2014 to 2015. The total amount of industrial solid waste production still maintained an upward trend that it increased 2.18 times from 2006 to 2015. However, the total volume of industrial solid waste discharge decreased from 1302.1 (ten thousand) tons to 55.8 tons from 2006 to 2015, since the reutilisation rate was largely enhanced. Although data shows that China had a great achievement on the controlling of industrial wastes, it is not balanced across regions. During this period, a large number of resource-intensive industries were moved from east to central and west for the development strategies of *Rise of Central China* and *Great Western*, but it also created a certain amount of pressures on environment in central and western areas (Dou and Shen, 2014; Cheng and Zhao, 2015). In order to alleviate the environmental pollution caused by industrial transfer from the east to central and western China, State Council issued *The Guidance for Central and Western Areas to Undertake Industrial Transfers from the East* in 2011, and regulated environmental issues during industrial transfers. Until 2019, there were ten national demonstration IAs designated for the undertaking of industrial transfers.

All initiatives stated in the 12th FYP (2011-2015) can be summarised by a key word – transformation (Ifeng-News, http://finance.ifeng.com/news/special/zgzx/). Strategies to impel environmental performance during economic growth not only focus on regulation/incentive policies and marketing approaches, but also pay more attention to the conversion of (environmental) governance mode and economic/social growth pattern. Firstly, the 'Ecological Civilisation' concept was put forward and implemented. 'Ecological Civilisation' is the profound reflection of the industrial civilisation, and it seeks the harmonious development of economy, society and environment (Zhou, 2009). A large number of papers present the close relation between Ecological Civilisation Initiative and EM Theory (Chen, 2010; Wang, 2014; Bo and Zhao, 2018). The 'Four in One' strategy (i.e. coordinated construction of economy, politics, culture and society) issued in the 11th FYP was updated to the 'Five in One' strategy as the objective of the construction of Ecological Civilisation was added. The implementation of Ecological Civilisation was involved in the assessment mechanism of governmental leaders' career achievements. Implementation of Ecological Civilisation requires the green transformation of both production and living (Huang, 2015). In March 2014, the State Council

published *The Planning of New-style Urbanisation (2014-2020)*. This plan (2014) defines the New-style Urbanisation as the urbanisation with industrial interaction, energy-saving, intensive and ecological-liveable features. By 2016, there were 188 cities to be designated as part of the national pilots of the New-style Urbanisation (NDRC Report). Secondly, the 12th FYP also presented the transition/switching of economic growth pattern. Within it, economic growth should be driven by technical progress, improvement of labours' qualities, innovative governance mode, and synergistic effects of the primary, secondary and tertiary industries, but instead of resource consumption just like before (Wu and Huang, 2010). For example, the GDP contribution and employment proportion of tertiary industries surpassed both primary and secondary industries in round 2011 (see Figure 6.2).

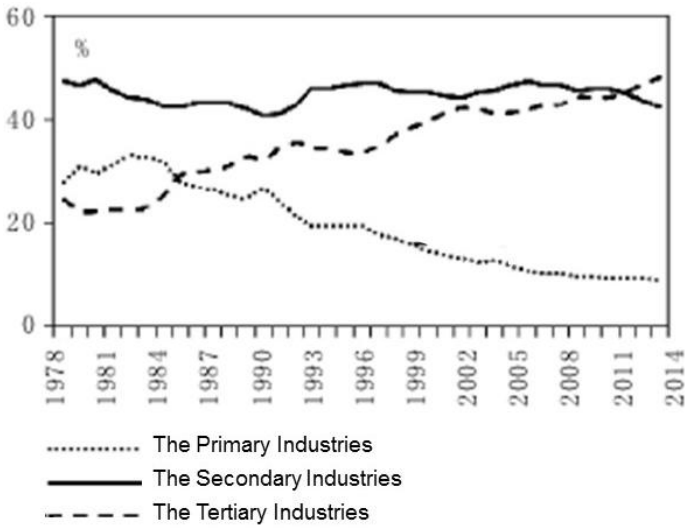

Figure 6.2 The GDP contributions of primary, secondary and tertiary industries, from 1978 to 2014

(Data Source: China Statistical Yearbook in 2015)

Moreover, *The Decision on Major Issues Concerning Comprehensively Deepening Reform* (中共中央关于全面深化改革若干重大问题的决定), which published in 2014, proposed a new action of "promoting modernisation of governance system and governance capabilities". 'Governance' was mentioned 24 times in this decision (2014) and 9 times in the communique of the Third Plenary Session of the 18th Central Committee of the CPC. From government to governance, it showed the sublimation and transformation of the governing idea and the strategy of running a state in China (http://theory.people.com.cn/n/2013/1126/c107503-23652511.html). The adjustment of environmental governance mode was considered by the state during the modernisation process. e.g. *Pathways for the Public to Participate in Environmental Protection* (2015), The Central Supervision to Local Environmental Performance (2016), *Guidance for the Vertical Reform of Sub-national Environment Governance* (2016).

During the 13th FYP (2016-2020), 165 major engineering projects[23] were launched under the guidance of *The Advice of Major Engineering Projects for the 13th FYP* published by the NDRC in 2016. Those projects seek to implement the 'Five Development[24]' concept, and illustrate a way to achieve technical advance, upgrading of industrial structure, environmental improvement, improvement of people's welfare, and spatial expansion and development (http://www.xinhuanet.com/politics/2016lh/2016-03/06/c_1118248006.htm). Increasing efforts were paid into the green development of IAs. Such as, the transformation projects of resource exhausted areas (project 90), the revitalisation of areas with industrial decline (project 91), transformation of areas of serious ecological degradation (project 92), the construction of demonstration areas of green mining (project 100), circular economy projects (project 101), treatment of air, water and soil pollutions (project 103-105). Those projects are collaborations of multi-industries including both environmental treatment projects and projects with sustainable concepts. They facilitate the development of environmental intensive industries and green development of other fields of industries. Under the guidance of central government, governments and non-state actors in locals took the key role to put projects into effect. This is because, on the one hand, most projects demanded the specific plans in region/local and cooperation of different administrative regions and departments; on the other hand, major projects cannot live without the support (e.g. investments and technologies) from the public. Environmental problems are improved by the joint forces from a variety of organisations (i.e. state and non-state organisations) at various scales (i.e. central and local).

6.1.1.3 Transformation of National Environmental Policies

From the evolution of the politico-economic system and national environmental initiatives in China, there are mainly two stages characterised by 'win-win' policies from 1979 to the late 2000s, and the transformation of institutions from the late 2000s to the present.

In the first stage, before the late 2000s, central government noticed the 'win-win' potential of economy and environment, and initiated lots of strategies to improve the environmental performance during production and consumption. While, during the second stage from the early 2010s onwards, the central government focused on the transformation of the development pattern and social institutions for sustainability. Main changes during those two stages were as follows:

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[23] The full list of those 165 major engineering projects can be found in *The Outline of the 13th Five-Year-Plan* published by the NDRC (2016) and online (http://img00.hc360.com/fire/201708/201708211013368532.doc).

[24] The *Five Development* Concept outlines a development strategy based on the core ideas innovation, coordination, sustainability, openness and sharing. This concept is designed to facilitate building a 'moderately prosperous society in all respects' by 2020 (Fifth Plenary Session, 2015).

- During the first stage, the central government government was more concerned with the advancement of (environmental) technology while during the second stage more attention was paid to the adjustment of social institutions, e.g. *The Central Supervision to Local Environmental Performance* (2016), *Guidance for the Vertical Reform of Sub-national Environment Governance* (2016).
- At the second stage, environmental protection was regarded as an evolution of human civilisation, e.g. ecological civilisation.
- During the second stage, governments provided great impetus to the development of tertiary industries and high-tech industries with lower levels of resource consumption. Transformations of the development mode were also announced, including the transformation of drivers, pattern and structure of industrialisation and urbanisation.
- Moreover, non-state actors for environmental protection (mainly environmental intensive companies and environmental NGOs) were involved in increasingly at the second stage, e.g. *Pathways for the Public to Participate in Environmental Protection* (2015), *Guidance to Facilitate the Cooperative Model of Government with Social Capital for Public Service Field* (incl. environmental protection) (2016), and *Public Participation of Environmental Impact Assessment* (2018).
- In the second stage, more spatial tools (e.g. spatial planning) were adopted for the environmental performance of industrial areas, e.g. *The Suggestion for Recycling Transformation of Industrial Areas* (2012), and *The Reform Plan of Traditional Industrial Areas* (2013-2022).

Both stages share the objective of sustainable development in China. And it seems that national policies were transformed from adopting weak to strong understandings of EM. However, although EM policies in China focused increasingly on the strong perspective during the second stage, the EM strategies in weak version were still in operation, e.g. the Environmental Impact Assessment Law first released in 2003 had two corrections in 2016 and 2018. This indicates that, strong version is a necessary tendency of EM development that it brought deeper dimensions, but it could not replace the role of EM strategies in weak version.

6.1.2 Local Practices of the ET of IAs in China: Two perspectives

Practices and activities made by regional and local actors (incl. governmental agencies and non-state actors) are crucial ways to embody and coordinate national initiatives. China is a country with vast territory and a large population, so it is necessary to empower local authorities to localise central policies and strategies (Policy Document, 1993)[25].

From the above discussion, it becomes clear that the Chinese state paid more and more attention to the environment during modernisation, and even had the tendency to promote strong EM since the 2010s. Within the guidance of national government, local officials also published a series of policies and strategies in practice. By organising, the local policies/strategies for the ET of IAs coincided with

[25] Policy documents of *The Decisions for the Improvement of Socialist Market Economy System* published by the Central Committee of the Communist Party in 1993.

the two perspectives that this thesis aims to focus on Chinese EM: governmental/organisational perspective and spatial perspective (Table 6.2).

Table 6.2 Local Policies and Strategies for the ET of IAs in Two Perspectives

Perspective	**Local Policies and Strategies for the ET of IAs**
Governmental/organisational Perspective	Vertical Reform of Sub-national Environmental Department; Environmental Protection Across Administrative Boundaries; Environmental PPP Projects; Public Participation on Environmental Protection
Spatial Perspective	Transformation (Inc. relocation and closing down) of Polluting Industries; Regional Renewal of TIAs as Urban Areas; Adjustment of Industrial Structure in Space; Integration of Industrial Areas with Cities

Regarding section 2.2.2.5, local governments had struggled for local environmental protection and EM for a long time. Nevertheless, that circumstance was observed before the 2010s. Whether those strategies initiated by local governments for the ET of IAs (in Table 6.2) were positively implemented by local agents and whether those are effective for local environmental performance and economic growth will be further analysed in this thesis together with the effectiveness of local strategies and how they have been affected by the national policies published in the 2010s.

6.2 Analytical Frameworks for the Researches in CZT

For better understanding of changes of IAs in organisational and spatial perspectives that local governments in CZT made for green development, this section applies the analytical frameworks built in chapter 3 to the context of CZT.

6.2.1 Organisational Analysis in CZT

This section aims to provide a specific structure for the case study analysis in CZT, building on the analytical framework for the rescaling research of environmental governance during the ET of IAs in China derived from Andonova and Mitchell's (2010) structure (Section 3.1.4.1).

Using China's hierarchy for the division of administrative organisations, there are five scales for the case study in CZT (shown in Table 6.3). These comprise the Chinese central government, Hunan provincial government, Municipal government of Changsha, Zhuzhou and Xiangtan City, District and county level governemnt in CZT (incl. 6 districts and 3 counties in Changsha, 6 districts and 4 counties in Zhuzhou, and 2 dsitricts and 3 counties in Xiangtan), Township level government in CZT.

Moreover, since governmental organisation at the urban agglomeration level was built in China for environemtnal governance across administrative bountries, governmental organisations in CZT urban agglomeration is also included in this analytical framwork.

Moreover, according to the policy context research in section 6.1, the ET of IAs was guided not only by multi-scalar, but also by multiple departments. So, this thesis not only inloved in the analysis about environmental departments in different scales, but also Communist Party Committee and People's Governemnt since the policy that 'party and government take the same environmental responsibilities (党政同责)', and other departments (e.g. Urban and Rural Planning Bureau, Science and Technology Bureau) in different scales. The Offices for 'Two-Oriented Society' in CZT and three cities were also investigated.

Table 6.3 Vertical Scales in CZT for the Case Study

		Scale of China's hierarchy division of administrative organisations	Scale for case study in CZT	Specific governmental sector for case study in CZT
National		National	Central government in China	State Council; National Dvelopment and Reform Commission (NDRC); Ministry of Environmental Protection
Sub-national	Regional	Provincial	Hunan provincial government	Hunan Provincial Communist Party Committee; Hunan Provincial People's Governemnt; Hunan Provincial Environmental Department; Other Hunan Provincial Department
		(Urban Agglomeration)	Organisation in CZT urban agglomeration level	Office for 'Two-Oriented Society' in CZT
	Local	Prefecture	Municipal government of Changsha, Zhuzhou and Xiangtan City	Municipal Communist Party Committee; Municipal People's Governemnt; Municipal Environmental Department; Other Municipal Department; Offices for 'Two-Oriented Society' in Changsha, Zhuzhou and Xiangtan city
		County	District and county level governemnt in CZT	Communist Party Committee; People's Governemnt; Environmental Department; and Other Department of districts and counties in CZT
		Township	Township level government in CZT	Environmental Organisations of Townships in CZT

Excepting scales and orgnisations in governmental domain, multiple non-state actors also participated in the environmental governance in China, and also in CZT. This thesis would investigates private sectors including industrial companies (both state-owned and private), platform

companies, pollution treatment companies; and civil societies including two local environemtanl NGOs in CZT. To protect the interviewees, the names of each organisations were anonymised.

In order to measure how powers for environmental governance in CZT rescaled among government (incl. different scales of governmental organisations), private and civil societies in CZT for the ET of IAs, this thesis will focuses on how did the powers (i.e. environmental responsibilities, obligations, roles and influences, duties and functions) for decision-making and policy-making, leadership (personnel/budgetary allocation), environmental supervision and environmental monitoring shifted among scales. On the one hand, responses of regional and local governments in Hunan and CZT for central policies and strategies reallocating powers for environmental governance (e.g. decentralisation of environmental responsibilities since the mid-2000s, *Vertical Reform of Local Environment Governance* (垂直管理) implemented in 2016, Central Supervision of Local Environmental Protection Project (中央环保督察) in 2016, and the Public-Private Partnership mode since 2014) would be illustrated.

On the other hand, this thesis understanding rescaling process of environmental governance in CZT through interviews with related stakeholders, e.g. leaders and insiders of related organisations listed in the above (the full list of interviewees is in section 4.2.1.1). How power actually rescaled among them could be understood through questions like: how you understanding your relationship with government/private sectors/civil society? how you understanding your role during green development of industrial areas or cities? how did your duties/influences change during these decades? how you cooperated with them? Besides, the effectiveness and remaining problems during rescaling practices would also be investigated.

6.2.2 Spatial Analysis in CZT

In terms of the analysis about the spatial changes of IAs in CZT during the ET process, according to the framework built in section 3.2.2, this thesis studies two perspectives: the movement of polluting industries in three TIAs (i.e. Pingtang TIA, Qingshuitang TIA and Zhubugang TIA) in CZT; and the spatial restructuring of eleven selected IAs (both TIAs and DZs) in CZT.

Regarding the analysis about the movement of polluting industries in three TIAs in CZT, this thesis collected and discussed data from five approaches: policies and strategies guiding the polluting industrial transfer in three TIAs; governmental records of this industrial transfer; interviews through stakeholders (e.g. industrial companies in TIAs, spatial planning agencies for the spatial planning of TIAs, governmental organisations guiding the movement of TIAs, platform companies for the development of TIAs, and environmental NGOs concerning TIAs); field visits (in different time

periods) in three TIAs; and participant observation in a Platform Company in Zhuzhou city which in charge of the development of Qingshuitang TIA. Moreover, this thesis focuses on not only how polluting industries moved from TIAs to other areas, but also the drivers, influences, effects and remaining problems of this movement.

For the spatial restructuring analysis of IAs in CZT, according to the framework built in section 3.2.2, firstly, the spatial distribution and area sharing of secondary and tertiary industries in CZT will be explored. Here, IAs in CZT for secondary industries refers to areas containing manufacturing industries, areas identified as TIAs and economic and technological development zones (ETDZs). Tertiary IAs in CZT refer to areas containing hi-tech industries, knowledge industries, information industries, areas identified as hi-tech industrial development zones (HIDZs), creative industrial parks or central business districts (CBD). The data came from the comparison between urban comprehensive/detailed spatial plans taken before and after 2010 of three cities—Changsha, Zhuzhou and Xiangtan—in CZT that were released by the local urban planning agencies.

Secondly, spatial density of industrial companies in IAs in CZT will be illustrated. Governmental statistic data in CZT and related policies and strategies for land-use mode (e.g. *Advices for Further Strengthening of Intensive Land Use in Hunan Province*, 2016) in CZT after 2010 will be used to show the changes. Thirdly, changes of spatial relationships between IAs, spatial relationship of IAs with other functional areas, and spatial relationship of IAs with landscapes in CZT are be analysed. Driving policies are important data source for analysis, besides, the interviews with stakeholders and field visits in those areas are crucial. Besides, participant observation in the Strategy Planning Department of a Platform Company (as the land developer of IAs) in Zhuzhou city also offers the author useful information about changed land-use mode of IAs in CZT.

The changing roles of each stakeholders and how they cooperated with each other during the polluting industrial transfer and spatial restructuring process are also a good response to rescaling studies.

6.3 Summary

From the analysis of national policy context and local policy practices in China for the ET of IAs in section 6.1, we can predict that Chinese EM entered into a new era after around 2010.

On the one hand, since the early 2010s, national policies/strategies have been characterised by strong EM. It involves the transformation of the politico-economic system, industrial structure, social institutions, governance mode and spatial structure.

On the other hand, regarding the practices of local governments, section 2.2.2.5 illustrated the challenges to environmental governance and the struggles of local governments for EM in China mainly before 2010, whether those obstacles still existed and limited local governments' performances on environment protection still need further analysis in this thesis. In the 2010s, since the relationship among central government, local government and non-state actors was reconceptualised for better environmental performance in China (e.g., the adjustment of cooperation modes for environmental projects and the distribution of the responsibilities and duties of each participant for environmental governance), this thesis assumes that local agents' attitudes towards EM has changed. Local governments indeed published a series of policies and strategies for the implementation of ET of IAs in the 2010s, but whether and how these are put into practices and how and what problems are being is investigated in this thesis using the examples of CZT urban agglomeration.

Next, section 6.2 provided the analytical frameworks for the research in CZT. Section 6.2.1 applies the rescaling and spatial analytical framework which built in chapter 3 (section 3.1.4.1) into the studies in CZT. Scales and specific organisations in CZT for analysis were clarified. According to the spatial analytical framework built in section 3.1.4.2, section 6.2.2 adapted it into the context in CZT. Here, multiple data source for analysis were mentioned, e.g., secondary data (incl. policy documents and governmental records), interviews, field visits and participant observation. Those methods used for the study will be further presented and justified in next chapter.

Chapter 7 The Rescaling of Environmental Governance for EM in China

After the late 1990s, EM theory in the west no longer merely promoted technological upgrading and market approaches, but focused on transforming the institutional and economic structure of society by incorporating ecological concerns. There are discussions in the literature as to whether China considered social institutions during EM and whether Chinese EM can be considered as a weak or strong version. The relationship between government, private enterprises, and the public in terms of EM remain an essential topic for further exploration in this thesis. Moreover, EM analysis tends to lack an understanding of power (Berger et al., 2001; Gibbs, 2006). To understand EM adaptation in the Chinese context, attention should be paid to how powers are allocated for environmental governance—that is, 'who is in control, who sets agendas, who allocates resources, who mediates disputes, who sets the rules of the game' (Wilbanks 1994, 544).

This chapter applies the analytical framework on the rescaling of environmental governance during the ET of IAs to the case study of CZT (see section 6.2.1) with a particular focus on how powers are allocated during rescaling process of environmental governance for ET of IAs in CZT urban agglomeration as the case, so as to understanding the adaptation approaches of EM in Chinese context in institutional perspective.

Section 7.1 discusses the drivers, characteristics and consequences of rescaling-down processes of environmental governance in China from 1979 to 2015. Section 7.2 presents how the rescaling-up of environmental governance after 2015 been adopted in China. Section 7.3 explores the participation processes and engagement levels of non-state actors (private entities and civil societies). Section 7.4 presents a summary of this chapter.

7.1 The Rescaling-Down of Environmental Government

Chinese government made a considerable effort to roll out EM through institutional reform. One key approach to this has been environmental decentralisation where local authorities have been endowed more powers for local environmental governance. It needs to be emphasised that the rescaling-down or decentralisation of environmental governance in China is not taking the same form as political empowerment in federalist countries that Chinese decentralisation is not a 'de facto decentralisation' but endows prior responsibilities and duties to local authorities (Gong and Lei, 2010).

7.1.1 Stages for Environmental Decentralisation

There was little agreement on a specific starting period of environmental decentralisation in China during interviews. Some interviewees (interviewees 14, 18 and 17) pointed out that the environmental decentralisation came along with the fiscal decentralisation after 1979. However, other interviewees (interviewee 6 and 12) thought it didn't start until local departments' environmental responsibilities were clarified during the mid 2000s to the early 2010s and the introduction of 'Ecological Civilisation' through The Third Plenary Session of the 18th CPC Central Committee (2013).

From the different answers about the start of Chinese environmental decentralisation, two different stages of environmental decentralisation characterised by different elements can be identified: (1) a first stage after 1979 until the end of the 2000s and (2) a second stage from the mid-2000s to the early-2010s.

7.1.1.1 Stage 1: Impacts of the Fiscal Decentralisation after 1979

During the first stage from 1979, as interviewee 14, 18 and 17 indicated, the fiscal decentralisation which had been put into practice after the establishment of the market economy system in 1979 can be seen as one of the crucial drivers for environmental decentralisation. Based on the data from National Data (http://data.stats.gov.cn/), the proportion of total investment made by local governments was less than the central government, but until 1975 (the reform and opening-up policy), the total investment made by local governments (50.1%) firstly exceeded the amount made by central government (49.9%). After the transformation from the planned economy to the market economy, the investment of local authorities increased year by year and also resulted in an increased proportion of investment compared to central government. On November 1993, the Central Committee of the Communist Party published the *Decision for the Improvement of Socialist Market Economy System* (中共中央关于建立社会主义市场经济体制若干问题的决定) and initiated the decentralisation strategy of finance and taxation.

According to this Decision (1993), there were two main reasons for the implementation of fiscal decentralisation in China. Firstly, China is a country with vast territory and a large population, so it is necessary to empower local authorities to localise central policies and strategies. Moreover, the implementation of fiscal decentralisation is to mobilise local authorities and to boost local economic growth, since economic growth was profoundly suppressed by the planned economic system and centralised fiscal system in China. Within it, the main objective of fiscal decentralisation is to establish the conditions conducive for markets to take root and active local economy (Mertha, 2017).

Indeed, it successfully promoted the great spurts of the economy in China and locals to a degree (Zhang and Zou, 1998; Lin and Liu, 2000) (e.g. Fig 7.1).

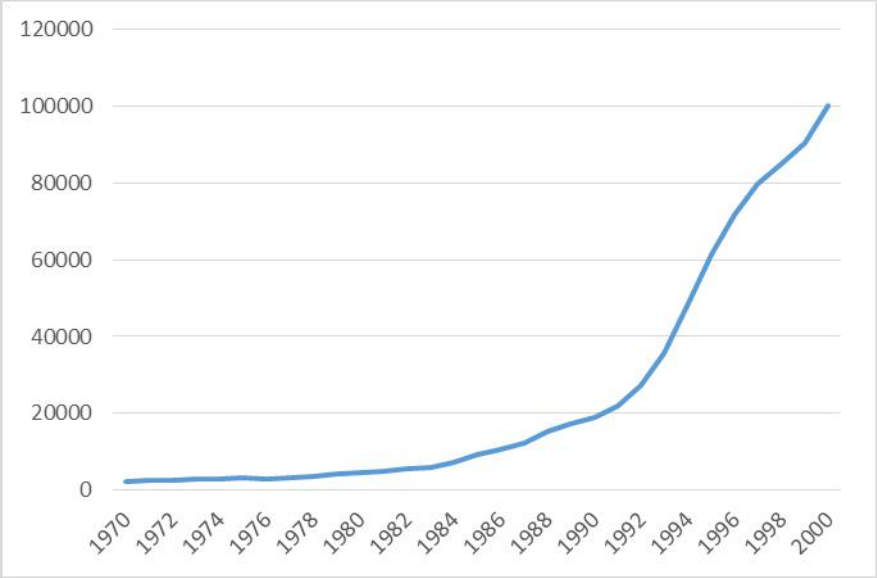


Figure 7.1 Annual GDP in China from 1970 to 2000

(100 million yuan/year)

(Source: National Data, http://data.stats.gov.cn/)

Oates (1999; 2002) claimed that environmental decentralisation is rooted in fiscal decentralisation. This thesis indicates that the engagement of local authorities in environmental protection was driven indirectly. Firstly, the powers, capacities, qualities, flexibility and funds of local governments were improved after fiscal decentralisation, which provided admirable conditions and resources for local authorities to engage in local environmental protection:

> "financial decentralisation gave local governments more flexible powers for decision-making and management of local finances […] local authorities have more capabilities and money to deal with local environmental pollution."
>
> ---- Interviewee 14

Secondly, albeit fiscal decentralisation process boosted local economy, it exacerbated the possibilities of pollution. However, misfortune may be an actual blessing. It also intensified the motivation of some local authorities to undertake the due obligations and responsibilities for local environmental treatment and protection.

As a result, as one of the fundamental driving forces for local governments to invest into EP, fiscal decentralisation provided resources and capabilities (e.g. funds) to local authorities to tackle local

environmental problems. Nevertheless, because of the absence of specific regulations at this stage, and also because of the emphasis on local economic growth, the engagement of local government for local environmental protection was weak and showed appalling regional differences. Local governments with lower economic prosperity levels struggled to address environment issues reflecting the common restriction that environmental performance has often been neglected when conflicted with economic growth during this period as illustrated in the following quotes (Interviewee 14, 17 and 18).

> "For a long time, local governments' primary task is to develop the local economy. To address this, they [local governments] even quests for profits at the cost of environment qualities. There are countless pieces of anecdotal evidence about it. For example, in 2014, the director of a local environmental protection department in Hunan province was removed from his post. Pollution problems of two ferroalloy industrial companies in Zhuzhou city were concealed by local government for economic gain."
>
> ---- Interviewee 17

> "If we [local government] pay attention to the environment, but other cities or provinces don't, then lots of private investments and chances for local economic growth would be lost […]. Besides, the assessment of officials' performance was centred on local economic growth, which limited our efforts for the environment."
>
> ----Interviewee 18

The fiscal decentralisation provided crucial conditions for local governments to protect the local environment. And some local governments started to be concerned about the environmental performance during economic development. Fiscal decentralisation is necessary but not enough, nation-wide strategies (incl. regulations and incentive strategies) to enhance local governments' environmental responsibilities are important. During this stage, it could be stated that environmental decentralisation has began, but not under adequate and stable conditions.

7.1.1.2 Stage 2: Strengthening of Sub-national Authorities' Environmental Responsibilities since the mid-2000s

Some interviewees (interviewee 6 and 12) indicated that local environmental departments received increasing powers (incl. funds, responsibilities and duties) through local environmental governance since the mid-2000s, as the central government reformed the fiscal system (the tax system reform in 1994) and strengthened local governments' environmental responsibilities. This is also the time period when the Chinese central government started to adopt strong EM concept (details in section 6.1).

The Third Plenary Session of the 18th CPC Central Committee (2013) pointed out the importance of rescaling of political mechanisms for local environmental protection with environmental decentralisation being regarded as the key to solve environmental problems. Based on evidence from interview material and government documents of relevant policies and regulations, I found that the Chinese state applied three main tools to promote the systematic environmental decentralisation during the mid 2000s: (1) establishing the local environmental responsibility system and punishment system; (2) adding environmental indexes into the political performance assessment system of local officials; and (3) constructing the local institutional mechanism for environmental monitoring and supervision.

Firstly, the central government emphasised local authorities' environmental responsibilities through coercive methods, such as laws, regulations and mechanisms to introduce and enforce responsibilities, supervision and non-compliance. An array of regulations for local environmental responsibilities were released (see Table 7.1). All those regulations represented the rescaling-down of environmental duties to locals, and more governmental sectors were involved in. Not only local environmental departments but also other departments and two highest-ranking officials of local governments and party committees (i.e. mayor and municipal party secretary) are in charge of responding to local environmental degradations. In 2006, the Central commission for discipline inspection and supervision department and Ministry of Environmental Protection jointly issued the *Punishment Method for Violations of Environmental Laws and Disciplines,* environmental responsibilities of local officials were enhanced further.

Table 7.1 The Responsibility System during Decentralised Environmental Governance

(Source: The author organised from relevant policy documents including The Environmental Protection Law of the People's Republic of China, 2014; Environmental Protection Regulation of Hunan Province, 2013; The Environmental Responsibilities of Officials in Party and Governments, 2015)

Responsibility Principle	Meaning	Achievement
'responsibilities in places within their jurisdiction (属地管理，分级负责)'	Local governments in charge of the environmental qualities in their areas (incl. staff and funds)	Local environmental governance decentralised to local authorities
'who decides who is responsible (谁决策，谁负责)'; 'Who supervises who is responsible (谁监督，谁负责)'	The responsibilities of actors in every step (e.g. decision-making and supervision) for environmental governance were considered and clarified; while, it also guaranteed the environmental decentralisation	
'one position has two duties (一岗双责)'	Not only the environmental department, but departments in other fields should pay attention to the environmental effects when performing their functions	It motivated more state-actors in a variety of fields to take part in local environmental governance; it also provided the basis for cooperative environmental governance
'party and government take the same responsibilities (党政同责)'	Both Peoples' Governments and Communist Party Committees should be in charge of local environmental protection	The involvement of local top cadres keeps the implement of local environmental policies and strategies
'lifelong liability for the environment (环境责任终身制)'	Regardless how long they have served, officials should hold a lifelong responsibility of their behaviours for the environment	It intensified the environmental duties for local officials in their tenure

Secondly, central authorities supplemented more environmental-related indexes into the appraisal system of officials' performance as an approach for the rescaling-down of environment governance. Both the *Decision for Scientific Outlook of Development and Environmental Protection* (关于落实科学发展观加强环境保护的决定) (2005) and the *Assessment Method for Local Officials' Political Performance Based on the Scientific Outlook of Development* (体现科学发展观要求的地方党政领导班子和领导干部综合考核评价试行办法) (2006) issued by central government introduced the Green GDP (Green GDP = Regional Gross Domestic Product - Energy Consumption - Environmental Pollution Loss - Ecological Resource Loss) for the performance assessment of local leaders. Since 2007, local authorities published their own assessment method for local officials' works about local environmental protection successively. In 2013, Hunan Province executed the Green GDP Appraisal System in CZT urban agglomeration. In 2017, the Research Group of Green GDP Performance, *China Social Sciences Press* and the periodical office of *Chinese Social Sciences* joint released the *Report of*

Green GDP Performance in China (2017) ranking Hunan Province amongst the top 10 out of a total of 31 provinces in 2015.

The economic losses caused by environmental pollution and natural resources degradation were taken into account in the algorithm to calculate the GDP. Local leaders were recruited and allocated by superiors strictly based on results of performance assessment. The contents and proportion of assessment indexes, hence, directly influence the behaviour of local officials. As a result, under the green appraisal system, "local officials no longer only care about economic growth but also the win-win of economy and environment" (Interviewee 6).

Thirdly, local agencies' powers (i.e. duties) for local environmental governance was also strengthened by the construction of the local institutional mechanism for environmental monitoring and supervision. Based on the discipline of 'responsibilities in places within their jurisdiction (属地管理，分级负责)', local environmental qualities were monitored and supervised by organisations controlled by local governments.

In sum, environmental decentralisation is necessary and it has been put into effect by central government in China. Furthermore, the rescaling-down process of environmental governance could be divided into two stages: fiscal decentralisation after 1979, and the environmental decentralisation since the mid 2000s. Both of them enhanced the engagement of local authorities for environmental protection in their areas indirectly and directly (see Fig 7.2).

During the first stage, fiscal decentralisation offered capabilities (i.e. funds and financial approach) and pressures (from citizens and increasingly severe environmental pollution) for local agencies to pay attention to local environmental qualities. However, the engagement of local government for local environmental protection was labile and showed regional differences. The behindhand nature of China's economy (see Section 2.2.1) and the prime objective of economic growth determined by the central government limited the motivation of local officials for EM during the first phase. Environmental decentralisation during this phase began indirectly but with inadequate support structures.

During the second stage (from the mid-2000s to the early 2010s) increasing policy statements and legislation were introduced to reassign the environmental responsibilities of local governments to promote the environmental performance at the local level. Powers (e.g. decision-making, monitoring, supervision, and law enforcement) were decentralised from central to local governments. This could be regarded as complete environmental decentralisation where power is not just endowed from the

central to the local scale, but accompanied by the introduction of responsibility and punishment mechanisms.

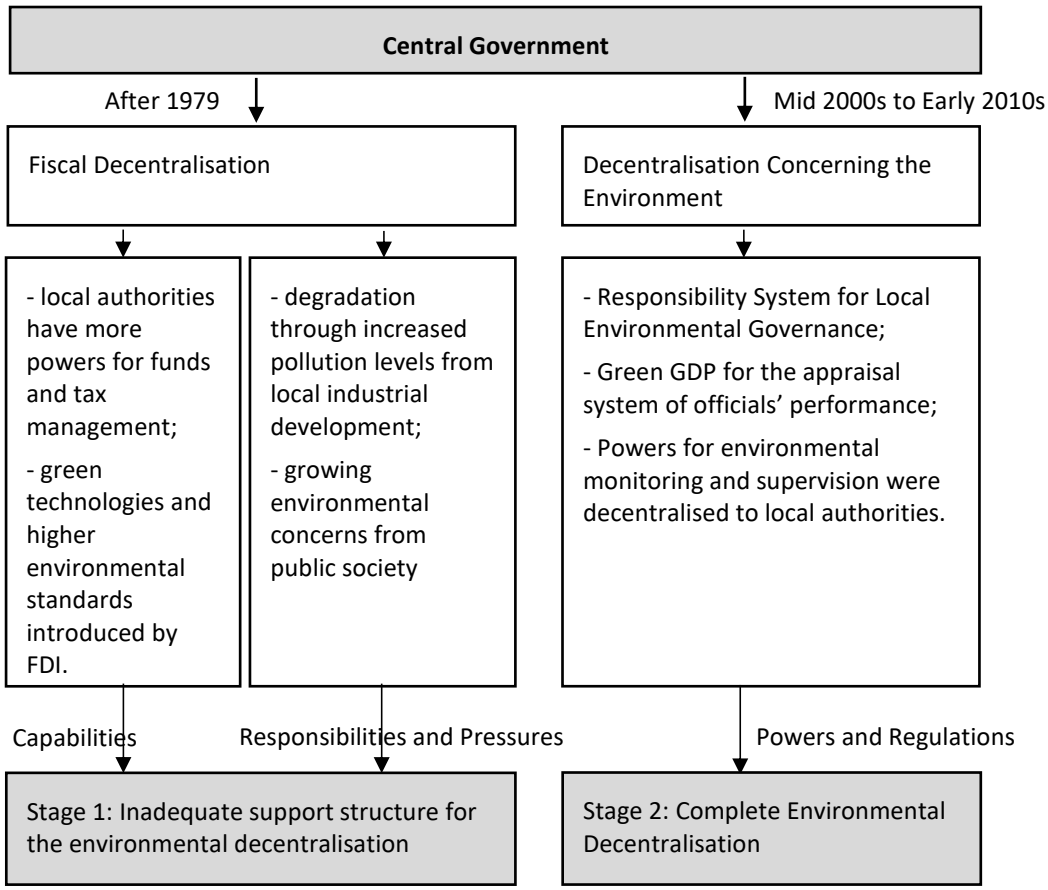


Figure 7.2 Two stages for environmental decentralisation mode in China

(Source: interviews)

7.1.2 The Decentralised Environmental Governance Mechanism for the ET of IAs

Under decentralised fiscal and environmental governance in China, local agencies in Hunan Province were empowered more resources, capabilities, responsibilities and duties to execute environmental projects, with one critical project being the ET of IAs.

Through the responsibility system during decentralised environmental governance (see Table 7.1), the decentralised environmental governance mode facilitated the involvement of two governmental organisations – the People's Government and Communist Party Committee – and governmental departments from various fields on one regional to three local levels (i.e. provincial, prefecture, county and township level). In order to understand how the ET of IAs has been implemented by those different local governmental actors during environmental decentralisation, this section explored each local governmental actor's roles, responsibilities and duties for ET of IAs in CZT.

Moreover, it focuses on how local authorities at different levels and different cities cooperated with each other for ET of IAs.

7.1.2.1 Leaders of Sub-national Environmental Protections

Since party and government take the same environmental responsibilities (党政同责), top officials of People's Governments (e.g. provincial governor and majors) and Communist Party Committee (e.g. secretaries of party committee) at five levels (i.e. national provincial, prefecture, county, township)[26] are in charge of industrial pollution and green industrialisation. Interviewee 14 explained this with an example:

> "For example, if the water supply polluted generated by a industrial project in our city, both major and the secretary of the municipal party committee have the responsibility for the accident, regardless of whether they took part in the project or not […] a secretary of a party committee in our province was dismissed as he neglected his environmental responsibility."
>
> ---- Interviewee 14, Environmental Protection Department of Hunan Province

The main reason why top leaders of these two organisations took part in environmental governance is to ensure the running of environmental policies and projects, and avoid the works of environmental departments were neglected by other departments (Interviewee 18). Moreover, the absolute powers (comparing to other local agencies) and 'business scope' of top officials in People's Governments and Communist Party Committee made them have this capability to tackle environmental problems in a region.

> "Only they (top leaders of party and government) have this ability to guide and mobilise all affiliated departments' behaviours, and bring people together."
>
> ---- Interviewee 18, Environmental Protection Department of Hunan Province

As a consequence, both Local Government Administrations and Local Communist Party Committees were involved in the governance of the ET of IAs regionally, and the top leaders of two organisations (rather than local environmental bureaucracies) became the leaders for local environmental reforms and activities. Their leading roles are shown in several ways.

Firstly, local highest-ranking political leaders established the environmental council which consists of other local political leaders and a diversity of departments. They held joint conferences between

[26] The relationship of Communist Party Committee and People's Governments: the former one mainly in charge of party affairs; while, the later one is an administrative body and take charge administrative affairs. Later one is guided by the former one.

environmental council as host for the delivery, coordination, negotiation and cooperation of environmental policies/strategies and projects regionally. For example, the Major and Secretary of the Municipal Party Committee (as directors) in Changsha established a municipal environmental council (Fig 7.3), the joint conference of this environmental council was held at least every six months by two municipal cadres for the studies, strategic planning, negotiation and coordination of regional environmental decisions and operations (Fig 7.4).

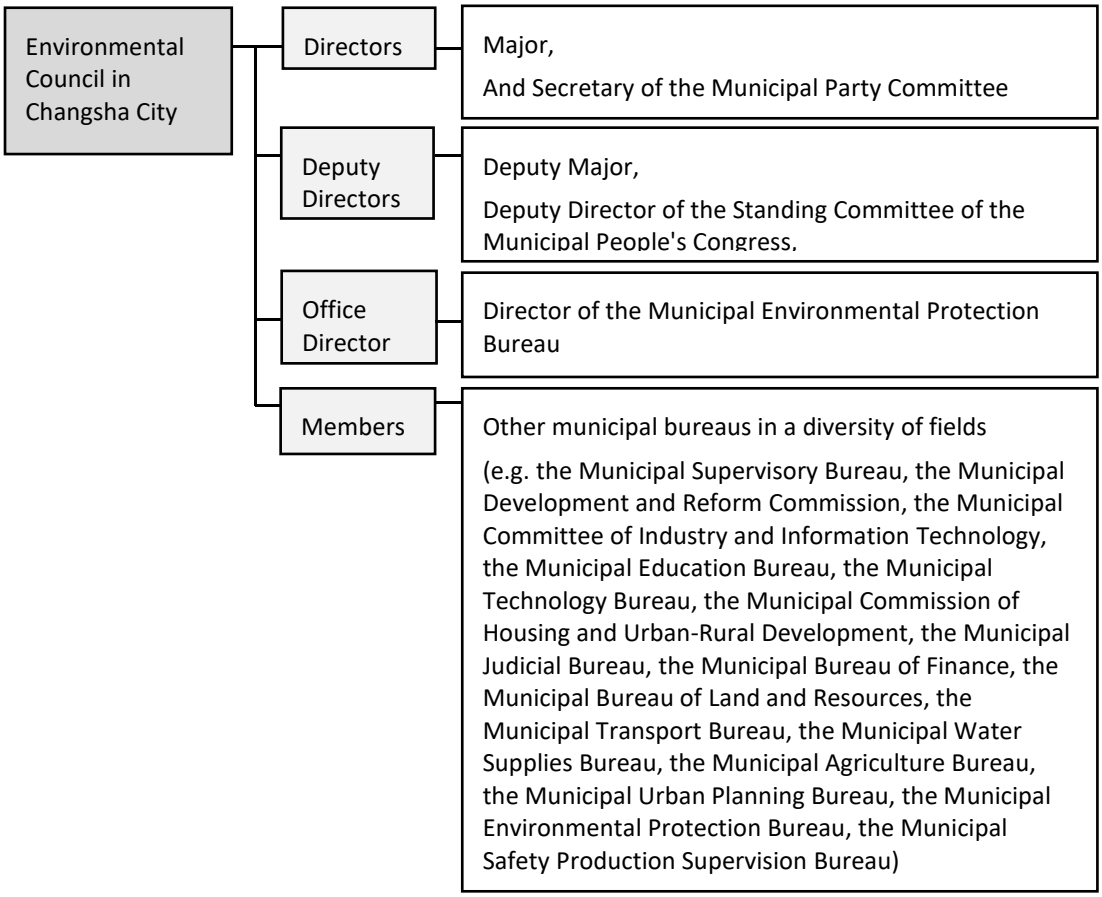


Figure 7.3 The Organisational Structure of the Environmental Council in Changsha City

Figure 7.4 The 2nd Annual Meeting of the Environmental Council in Changsha organised by the Major in June 2015

(Source: http://www.hbj.hunan.gov.cn/wap/xl.jsp?id=53843)

Secondly, top leaders of party and government are the representatives of the Regional Environmental Summit Meeting and guide the decision-making, negotiation, and cooperation of environmental governance across regions. For example, Secretaries of Municipal Party Committees of three cities (i.e. CZT Urban agglomeration) successively act as the directors of the Summit Alliance and hosts of Summit Meetings (e.g. Fig 7.5). During the meeting, key instructions about environmental projects of CZT urban agglomeration were announced by top leaders at the provincial level. Before the announcement, transregional environmental projects (such as, the 'Two-Oriented Society' project and the 'Green Heart[27]' project among three cities during ET of IAs) would be discussed and negotiated by mayors and Secretaries of Municipal Party Committees of the three cities.

Figure 7.5 The Secretary of Provincial Communist Party Committee is giving key instructions during the Summit Meeting of CZT Urban agglomeration held in 2018.

(Source: https://www.sohu.com/a/270325649_99900119)

Last but not least, top local officials were appointed as the main principals of many regional and trans-regional environmental projects. One such is the *River Chief Mechanism* proposed by central government in 2017 which is a crucial project of the ET of IAs since the treatment of the heavy metal pollution caused by industrial areas along Xiang River is significant for the ET of IAs in Hunan Province. *River Chief Mechanism* (2017) designates top local leaders as River Chiefs to take charge of the environmental qualities of the stream segments within their administrative boundaries. For example, the Provincial Governor of Hunan Province is the Director who is responsible for the

[27] The 'Green Heart Area' Project was introduced by the 18th National Congress of the Communist Party of China in 2012 for the purpose of environmental protection and green development in China. The green heart area locates in the centre of three cities in CZT, and accounts 528.32 km^2. In 2020, the forest coverage rate in CZT will be 56%, which will make CZT as one of the greenest urban agglomerations in the world.

environmental qualities and treatment of whole stream segments of Xiang River within Hunan Province. The lists of principals were announced by billboards along the stream segments they're in charge, which seeks for public scrutiny (Fig 7.6).

Figure 7.6 Principals and their duties for the stream segment from Majiahe Street to Longchuan Town in Zhuzhou City are listed on the billboard along the river

(Source: Author, December 2018)

As illustrated by Interviewee 18, top local officials, as River Chiefs, mobilise not only local departments, but also citizens. The public could contact the chiefs and report environmental problems through hotlines, official APP, official WeChat account, official website (www.rednet.cn), letters, and visits (citizens could go to visit the River Chief Office through a certain procedure). Taking the message board of River Chief in rednet.cn as example, from August 2018 to November 2019, 1107 messages were posted by citizens and 803 of them received responses from the River Chief Office (some messages posted by citizens are repetitive). Until now (November 2019), this message board was viewed 3.3 million times and ranked the first place comparing to other local departments by visitor numbers. Further, some citizens (volunteer) were recruited by the government as the folk river chiefs since 2017. Folk river chiefs also divided into scales, for example in Xiangtan city, by 2019, there are 15 folk river chiefs in prefecture level, 67 in county level, 8458 in township level. From 2017 to 2019, folk river chiefs in Xiangtan city reported 1900 pollution problems along the river (source: official website of Hunan provincial government, http://www.xiangtan.gov.cn/109/171/172/content_798214.html).

In sum, under the rescaling-down of environmental governance, top leaders of party and government are playing the leading role in local environmental governance. They are the decision-makers of local environmental policies, the directors of the regional environmental council, the person chiefly in charge of local environmental protection projects, and the representatives of their

regions to attend environmental cooperation meetings with other regions. Under their leadership, regional and trans-regional environmental issues are cooperatively managed by a range of local departments and non-governmental actors, which will be further discussed in the following section.

7.1.2.2 Cooperation Mode ---- Leading Group

As 'one position has two duties (一岗双责)', not only environmental departments, but all governmental departments need to consider the environment performance within their original responsibilities.

This thesis found that there are eight core sub-national departments participating in the environmental governance during the ET of IAs: Development and Reform Commission, Science and Technology Department, Department of Industry and Information Technology, Finance Department, Department of Natural Resources, Department of Ecological Environment, Department of Housing and Urban-Rural, Water Resources Department. Based on governmental documents and interviewee's descriptions, the main duties of these five provincial departments in Hunan Province for ET of IAs are listed as follows.

The main duties of the **Provincial Development and Reform Commission** are to enact the comprehensive development strategies, annual and long-term plans for Hunan Province and some crucial IAs, for example, the development plan of industrial clusters and new-type of industrialisation. This department determines the development directions and priorities of industrial areas. Hunan Provincial Department of Development and Reform established the affiliated Industrial Office and Office for Resource-Saving and Environmental Protection which are to research, promote, coordinate, organize and participate in the policy-making of ET of IAs projects (such as circular economy, energy-saving, resource-saving, CP, sustainable development, watershed pollution treatment, and the transformation of old industrial areas/cities) in the Hunan Province.

The **Provincial Science and Technology Department** is in charge of the advancement of technology (including green technology) in the region. This department also takes the responsibilities of organising, coordinating and participating in the policy-making and fund-support for industry-university-research cooperation in Hunan Province for the environmental technique upgrading and the transition to high-tech with benefit for the environment.

The responsibilities of the **Provincial Finance Department** are to publish relevant guidelines for regional environment protection by financial means. The marketisation of the environment and ET of IAs has led to increased participation of private actors.

The **Provincial Department of Industry and Information Technology** (established in 2018, from 2014-2018 the Council of Industry and Information Technology) is involved through policies concerning energy-saving, CP, integrated use of natural resources, and the development of green technologies with other departments.

The **Provincial Department of Housing and Urban-Rural** in charge of spatial planning, engineering construction, architecture, real estate and infrastructure. As part of the ET of IAs, it undertakes duties for green architecture construction, emission reduction and waste disposal (including water and solid wastes). Moreover, the integrated spatial planning of industrial and other urban areas, the spatial planning and construction of industrial areas during and after transformation are also the primary responsibility of the department.

To sum up, the Department of Development and Reform mainly undertakes the decision-making of over-all plans and development directions, and then, other departments assist the policy-making in their specific field and execute specific strategies for the ET of IAs.

The question arises how those local authorities in different fields cooperated with each other for the ET of IAs? This research finds that a project-oriented cooperation mode was employed through the establishment of 'Leading Groups (领导小组)'. A Leading Group is an organisational mode and working mechanism for governments, especially in the Chinese context. Usually, it is launched by local governments and party committees for particular projects or problem-solving.

> "They (Leading Groups) are supplements to the regular governance mode in China. They possess coordinative powers across administrative boundaries which it is hard to see usually […] most of them are periodic and temporary according to projects […] they are not even formal institutions […] however, they made a significant effort in practical governance in China."
>
> ---- Interviewee 14, Environmental Protection Department of Hunan Province

There are numerous Leading Groups established in Hunan Province for ET projects of IAs (Table 7.2). As shown in Table 7.2, Leading Groups were established at different levels (i.e. national, provincial, prefecture, county, and township levels), this is a response to problems and projects in different spatial scales. For example, the Leading Group for Moving and Transformation Projects of the Qingshuitang TIA is in the prefecture level as it is established by the municipal government and party committee and including municipal departments as group members. Furthermore, if problem affects not only one administrative region, Leading Groups would be established in a diversity of levels, such

as the leading groups for the environmental protection and treatment of Xiang River, these were launched in provincial, prefecture and county levels.

Table 7.2 Some Leading Groups at Different Levels for ET of IAs in Hunan Province

(Source: Author's compilation based on governmental documents and news articles on the establishment of each leading group)

Level	**Name**	**Time**
Provincial	Leading Group for Environmental Protection and Heavy Metal Pollution Treatment in Xiang River	2013
	Leading Group for Energy Conservation and Emission Reduction	N/A
	Leading Group for New-type of Urbanisation	Updated in 2014
	Leading Group for Environmental Supervision	2016
Municipal	Leading Group for Environmental Protection and Treatment of Xiang River in Zhuzhou City	N/A
	Leading Group for Moving and Transformation Projects of the Qingshuitang TIA in Zhuzhou City	2014
District	Leading Group for Environmental Protection and Treatment of Xiang River in Lusong District, Zhuzhou City	2015
	Leading Group for Environmental Protection and Treatment of Xiang River in Tianyuan District, Zhuzhou City	Updated in 2017

For further studies, the cooperation mechanism of the Leading Group of Relocation and Transformation Projects of Qingshuitang TIA in Zhuzhou City was analysed in detail (Fig 7.7). Similar to other Leading Groups, it consists of top leaders, division leaders and project executors. Boundaries among departments are diminishing during cooperation so that one department could be the leader of those involved from other departments for one specific assignment. The cooperation mechanism was constructed by problem-centred and mission-centred, but not by absolute hierarchical organisation.

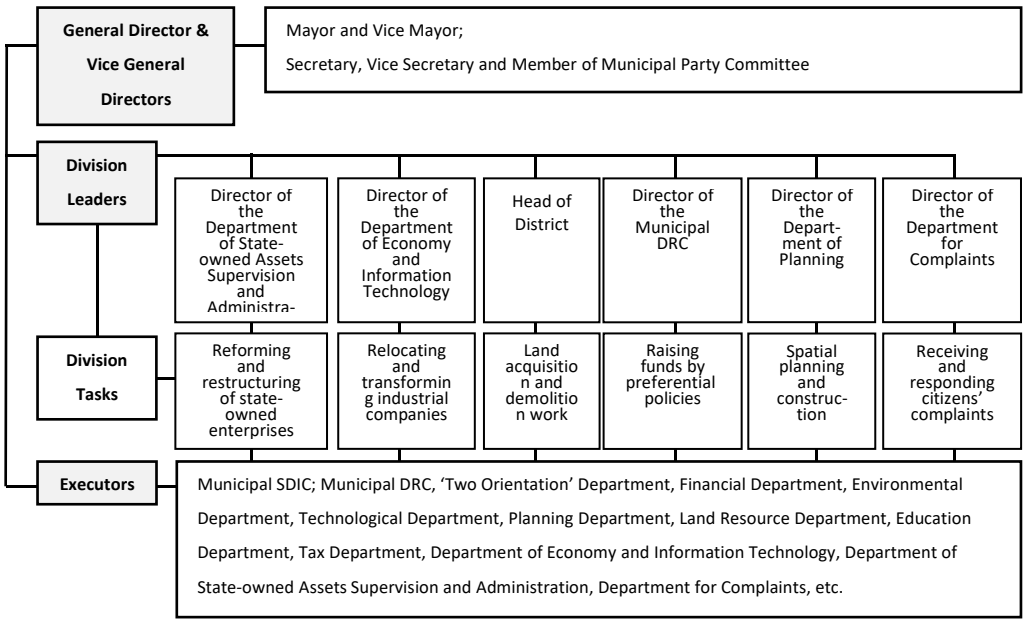


Figure 7.7 The Cooperation Mechanism of the Leading Group of Transformation Projects of Qingshuitang TIA in Zhuzhou City

Moreover, there is a tendency that the cooperation mechanism of the leading group transferred from a 'linear' structure to a 'matrix' structure (Fig 7.8). In the 'matrix' structure, diverse departments cooperate with each other on the same project, and every department has the opportunity to be the group leader to guide and delegate jobs to other departments at the same level. For example, for the Leading Group for Environmental Supervision in Hunan Province which was set up in 2016, the Director of the Provincial Department of Environmental Protection acts as the deputy director. However, what remains is that leading departments still take orders from top leaders of the government and party.

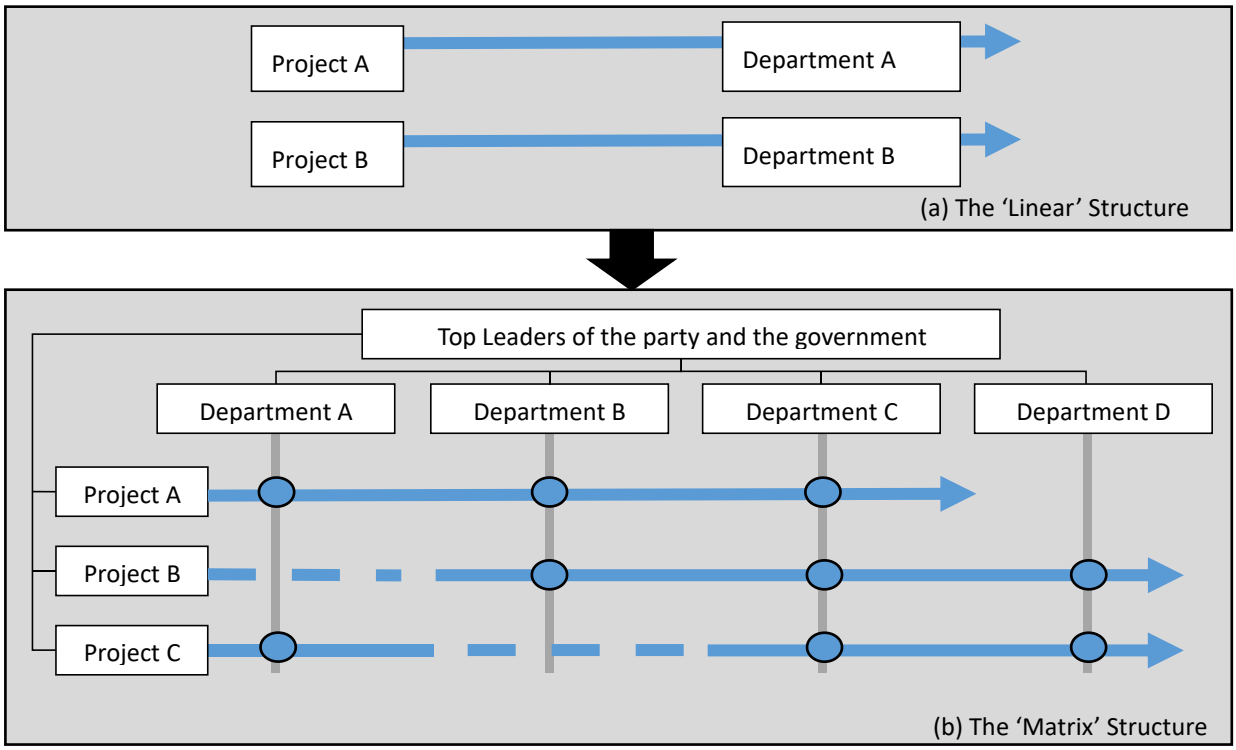


Figure 7.8 The Innovation of Administrative Mechanism

This innovation of the administrative mechanism brought plenty of benefits. By this project-oriented cooperation mode, boundaries between departments have started to fade.

In sum, under the decentralisation of fiscal and environmental governance, a series of transformation occurred in Chinese institutional structure in sub-national level, e.g. the leading role of highest-ranking officials of the party and the government, and the project-oriented cooperation mechanism between departments. As a consequence, not only the powers and enthusiasms of sub-national authorities for environment protection were facilitated, but the cooperation platforms and mechanisms also were constructed gradually. Absolute pyramid hierarchy mechanism has been mingled with linear and matrix structure that more open and efficiency form of governance mode been promoted. The participation of the public also promoted by this decentralised environmental governance mode.

However, there were still some remaining problems to be solved. Almost every governmental organisation has the environmental responsibilities, which generated duplication and contradiction of efforts. Top leaders of the party and government aim to establish policies, guide the sustainable development, coordinate the cooperation of regions and supervise subordinate bodies, meanwhile, the primary duties of local departments are to enforce the environmental law, and supervise and monitor companies' environmental performance and cities' environmental qualities. So, they will

not generate overlapping or contradiction theoretically. But in practice, the responsibilities related to some environmental issues still are not very clear (Interviewee 9). Besides, top leaders of the party and the government hold director posts of many leading groups simultaneously, which may diffuse their energies and reduce the efficiency (Interviewee 15).

7.1.3 Challenges for Sub-national Authorities

Previous literature (Li and Lang, 2010; Qi et al., 2014) illustrated that, central government published a series of environmental policies/strategies since the 1990s, but local governments had gone through a period of struggle to put these into practice (details in section 2.2.2.5). However, those comments only focus on the situations before the 2010s. What is the circumstance in the 2010s since the adoption of strong EM by the central government? This section investigates the practices of local authorities during complete environmental decentralisation following the mid-2000s to the early 2010s.

Based on previous analysis, sub-national governments have capabilities and powers (or responsibilities and duties) for local environmental governance. However, it must be mentioned that there are still some obstacles for local authorities to engage local environmental protection in practice.

On the one hand, regional protectionism and data fabrication are even more severe under the decentralised environmental governance mode. Some local officials (interviewee 6, 8, 14 and 18), environmental NGOs (interviewee 12 and 13) and insiders from private sectors (interviewee 4 and 5) indicated that there are a number of reasons: (1) “The tenure period of one position usually is four-five years. In order to get the most political performances for the next promotion, some complicated and big environmental projects which would take a long time were ignored or pushed back […] and this is also one of the reasons for the late start of some moving and transformation projects of TIAs” (Interviewee 9). (2) The concerns about the environment were easily ignored by sub-national officials due to their own political interests, and even though top leaders are directors/supervisors of most environmental projects and environmental leading groups, they cannot control all details in person. “Top leaders’ energy is limit, they cannot see all the realities, especially the thing other people trying to hide” (Interviewee 12). (3) The supervision mechanism to top leaders is also relatively weak. From a mass of malpractice cases of environmental performance, persons who were removed or punished mostly were leaders (incl. top leaders and leaders of local environmental agencies).

On the other hand, directors of centrally owned enterprises rank above all sub-national officials, so sub-national officials find it difficult to supervise, punish or manage polluted centrally owned enterprises. According to interviewee 4, 5 and 18, there are plenty of centrally owned enterprises situated in Zhuzhou city, such as the Minmetals Zhuye Group Co., Ltd, Zhuzhou Chemical Group Co., Ltd and Huayin Zhuzhou Electricity Co., Ltd in Zhuzhou City. "These enterprises polluted for a long time, but we [provincial environemtnal department] are unable to solve it if without support from central government" (interviewee 18). Sub-national authorities still do not have the right to carry out daily environmental supervision and environmental law enforcement for central government-owned companies.

In sum, barriers limiting effective environmental performance in practice results from the unique Chinese context: the behindhand nature of the economy, the political performance assessment system, tenure mechanisms, the legacy of the planned economy, and the centralised regime in China. As a conclusion, to just copy EM path (i.e. environmental decentralisation) in western countries is not possible for China. China should find its own path and strengthen of sub-national governments' performance on the environment is primary consideration. The intervention of central and superior levels for regional/local environmental governance maybe the solution.

7.2 The Rescaling-Up of Environmental Governance

Since 2015, to address the problems linked to decentralised environmental governance, the Chinese central government initiated a succession of institutional reforms for environmental governance. Most of the policies led to the upscaling of powers along the vertical scale ---- this thesis defines it as the rescaling-up process of environmental governance.

This section explores what and how powers of local and regional environmental governance have been centralised after 2015 through three main political strategies of recentralisation: *The Central Supervision to Sub-national Environmental Performance, Vertical Reform of Sub-national Environment Governance*, and the *Programme for Resource-economical and Environment-friendly Society (Two-Oriented Society)*.

7.2.1 Pathways and Instruments for Rescaling-Up

7.2.1.1 Path 1: From the Sub-national to Central Level

Through the rescaling-down of environmental governance, environmental monitoring and supervision were both decentralised to the region and local scale. Environmental qualities in the region and local scale were monitored by regional and local authorities (incl. governments and third-party organisations). The central government could only access the second-hand data reported from

regional and local actors, which led to subsequent problems, such as data fabrication, regional protectionism, and a weakening of central government power. Then, not only the environmental supervision to polluting enterprises, but the supervision to local authorities' environmental responsibilities also should be paid attention to (Interviewee 14).

To address these problems under decentralised environmental governance, the central government enhanced the supervision of sub-national authorities' environmental responsibilities through one critical project: the Central Supervision of Sub-national Environmental Protection Project (中央环保督察) in 2016. In 2016, the Central Supervision Committee of Local Environmental Protection (renamed to the Central Supervision Office of Sub-national Environmental Protection in 2018) was established and managed by the Ministry of Environmental Protection (renamed to the Ministry of Ecological Environment in 2018). It co-operated with the Central Commission of Discipline Inspection and the Organising Department of Central Committee of Communist Party of China (CCCPC) and formed the Central Supervision Office for the Central Supervision of Sub-national Environmental Protection Project.

By 2019, two rounds of the Central Supervision of Sub-national Environmental Protection Project have been put rolled out. The first round was carried out from January 2016 to September 2017. The second round was started in 2019 and aims to finish in 2022 (https://www.sohu.com/a/284317904_683333). Based on interview material (Interviewee 14 and 18) and relevant governmental documents, the two projects proceeded in the following steps:

- Firstly, the Central Supervision Office of Sub-national Environmental Protection delegates groups to supervise and exam different regions.
- Secondly, during their stay of usually 1-2 months, the central supervision group would try to find important environmental problems by talking to regional leaders (i.e. leaders in the Secretary of Party Committee and People's Government) and the leaders in the relevant departments (mainly environmental departments). Additionally, they reached out to NGOs and citizens as important and central way to identify problems. The public could contact central bodies by email, hotline and visiting.
- Thirdly, central bodies would go on field visits to research and confirm identified problems in person (without informing any local authorities).
- Fourthly, central agencies would classify those problems and write a report to the central office for review, and then, the further actions (i.e. how to respond to and punish any misconduct of sub-national officials) and advice (i.e. how to solve the environmental problems) would be announced by the state. The final report and decisions from the central government authorities would be disclosed to the public as well.
- Finally, the 'Re-Examine (回头看)' programme would be carried out where central agencies returned to sub-national governments to ensure identified problems were being resolved.
- Problems identified during central supervision and sub-national government's attitudes toward problems were recorded by the central government authorities which would be used as an essential reference in the assessment and appointment of local officials.

Based on this procedure, we can see that "there is no place for sub-national governmental authorities" (Interviewee 14).

> "Sub-national governmental authorities can't participate in any steps during central supervision. Even though when a city is examined, provincial officials can't get involved."
>
> ---- Interviewee 14

During the central supervision, the Central Office directly collects first-hand documents and data from the public and during field visits without informing and accompaniment of any sub-national officials and authorities. The powers for environmental governance were rescaled back up from the sub-national to the central level.

7.2.1.2 Path 2: From Local to Provincial Level

The rescaling-up from sub-provincial governments to provincial governments for environmental governance was also adopted. This upward rescaling happened among environmental departments both in regional and local scales that "we [environmental bureaus] play a more vital role in local environmental governance than before" (Interviewee 18).

In 2016, the General Office of the CPC Central Committee and the State Council published the *Guidance for the Vertical Reform of Sub-national Environment Governance* (垂直管理). In order to impel this reform in the whole country, the National Leading Group for Environmental Vertical Reform was established. It is made up of the Ministry of Environment, the State Commission Office of Public Sectors Reform, the Organization Department of the CPC Central Committee and the State Development and Reform Commission. The objectives of this Vertical Reform of Sub-national Environment Governance is to strengthen the independency of environmental departments, and avoid the interventions from other power authorities (especially superior authorities) to environmental departments' work for environmental protection.

Based on the guidance and under pressure from the central government, provincial authorities (i.e. Provincial People's Governments and Provincial Party Committees) published corresponding implementation plans reflecting their specific situations. In May 2019, Hunan province published the *Implementation Plan for the Vertical Reform of Sub-national Environmental Governance*.

Different from the Central Environmental Supervision which was mentioned in path 1, this is a radical and permanent institutional restructuring of sub-national authorities (concretely, sub-national environmental departments) for environmental governance. As part of this vertical reform,

the hierarchical relationship between sub-national environmental organisations has been changed in that some powers (such as, environmental supervision and monitoring powers, appointments and removals powers) were upscaled (1) from county level to prefecture or provincial levels; (2) from the prefecture level to provincial levels. The Vice Director of the National Leading Group for Environmental Vertical Reform estimated that this vertical reform would affect a total of 170,000-180,000 sub-national officials (50,000 from local administrator for environmental issues, 59,000 from local environmental monitoring organisations and 63,000 from organisations for environmental supervision and law enforcement), among them, 74% from county levels and 26% from prefecture levels
(http://paper.chinaso.com/detail/20160923/1000200032978261474586803235822296_1.html).

7.2.1.3 Path 3: From Local to Urban Agglomeration Level

Environmental problems are not confined to administrative areas. They often need to be solved through the cooperation between governments from a number of administrative districts. During decentralised forms of environmental governance, the cooperation of authorities in urban agglomeration coordinated by provincial organisations, however, no organisations were established at the urban agglomeration level.

In 2015, a governmental office was established at the urban agglomeration level for environmental governance in CZT ---- the Office for 'Two-Oriented Society' Construction in CZT (see Fig 7.9). This organisation is peculiar to CZT urban agglomeration as CZT was identified as the National Pilot of the 'Two-Oriented Society' by the central government in 2007. The new office was established to manage the policies and strategies for the development of the 'Two-Oriented Society' in CZT and renamed from the Office for Economic Integration in CZT which was founded in 1998. "Different from the previous office (i.e. the Office for Economic Integration in CZT Urban agglomeration), more emphasis is placed on win-win approaches involving the economy and the environment" (Interview 18).

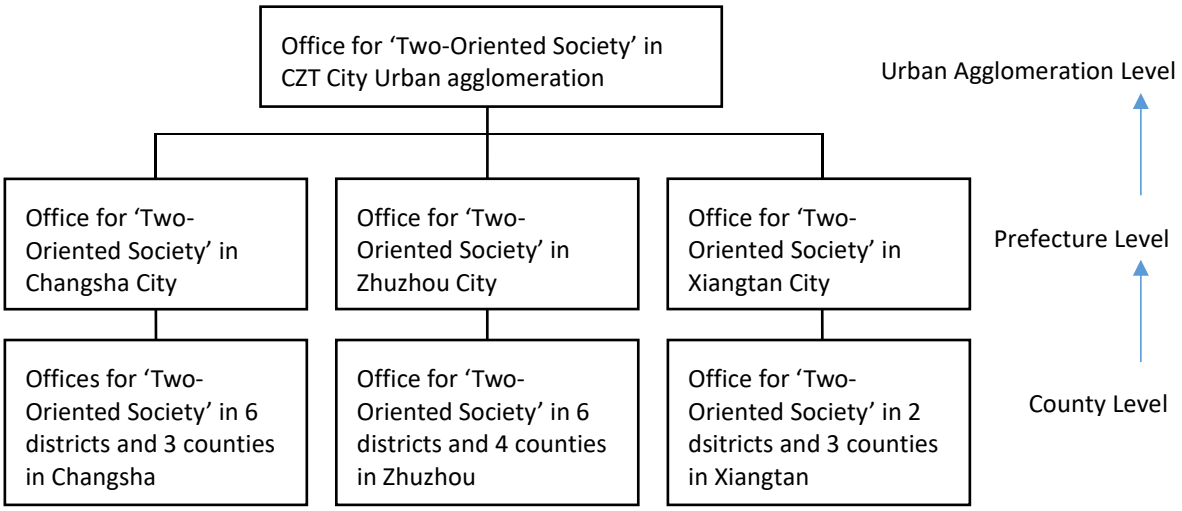


Figure 7.9 The Rescaling-up of Environmental Governance to CZT Urban agglomeration Level

Important environmental regulations and plans in CZT were jointly released by the 'Two-Oriented' Office of CZT. Table 7.3 lists the role and duties of this office during the policy-making process of some significant environmental regulations and plans in CZT. We can see that the 'Two-Oriented' Office of CZT plays a leading role in guiding, organising, coordinating and supervising regional planning and development strategies in CZT to realise the 'Two-Oriented Society'.

Table 7.3 The Role of the 'Two-Oriented' Office of CZT in delivering significant environmental regulations and plans for CZT

(Sources: Interviewee 14 and 18 and Governmental Documents of Each policy)

Time	**Policy**	**The Role of the 'Two-Oriented' Office of CZT**
2008 (Revised in 2014)	Regional Plan for CZT Urban agglomeration (2008-2020)	Under the approval of the Provincial Government, the 'Two-Oriented' Office of CZT plays the leading role during policy-making process, and entrusts the China Institute of Urban Planning and Design to do the spatial planning
2010	Development Plan for Cooperative Environmental Management of CZT Urban agglomeration (2010-2020)	Department of Environmental Protection of Hunan province
2010 (Revised in 2018)	Regulatory Planning of the 'Green Heart Area' in CZT (2010-2030)	Municipal governments organise the regulatory planning by themselves, but before forwarding to the provincial government (i.e. Housing and Urban-Rural Development), the regulatory planning should be examined and approved by the 'Two-Oriented Society' Office of CZT
2010	Protection Regulation of 'Green Heart' Project in CZT	The draft of this regulation is protocolled by the 'Two-Oriented' Office of CZT
2018	Supervision System for 'Green Heart' Project (trial)	Released by the 'Two-Oriented' Office of CZT

The CZT Two-Oriented Society office is the first organisation established at the urban agglomeration level in China concerned with a synergistic relationship between the environment and economy. To achieve this, powers from different prefecture governments were scaled upward to a newly created space for environmental governance ---- the urban agglomeration. As the urban agglomeration is not an administrative unit, the CZT Two-Oriented Society office promoted the management of a non-administrative space at the urban agglomeration level. Although, the CZT Two-Oriented Society office is still managed by the provincial government (i.e. Hunan Provincial DRC), it has different connotations compared to the provincial department.

Interviewees 4, 5, 6, 14, 17 and 18 suggested that upscaling happened at the urban agglomeration level but not in other geographical areas because: (1) cities in the CZT urban agglomeration have already established a close relationship with each other in areas, such as, transportation and economic development which provided a good foundation for further environmental cooperation. (2) Serious environmental degradation occurred in the CZT urban agglomeration due to the rapid growth of the economy, authorities in CZT urban agglomeration have the responsibilities for environmental treatment and protection. (3) Because of the closely relations of cities in CZT urban agglomeration, they are in the same ecological system and face similar environmental problems. Solution of environmental problems cannot leave the joint efforts of authorities in three cities in CZT. For example, the serious heavy-metal pollution of the Xiang River resulted primarily from industrial areas within CZT. Effective pollution management of the river requires concerted efforts involving all three cities in CZT.

7.2.1.4 Summary

To sum up, in order to address the subsequent problems of decentralised environmental governance, environmental responsibilities and duties were rescaled upward taking three paths (Fig 7.10): path 1 and 2 were realised along established vertical hierarchical scales, while path 3 shifted environmental governance from established administrative units to a newly established administrative space (i.e. urban agglomeration), and this is the creation of a new scale of governance.

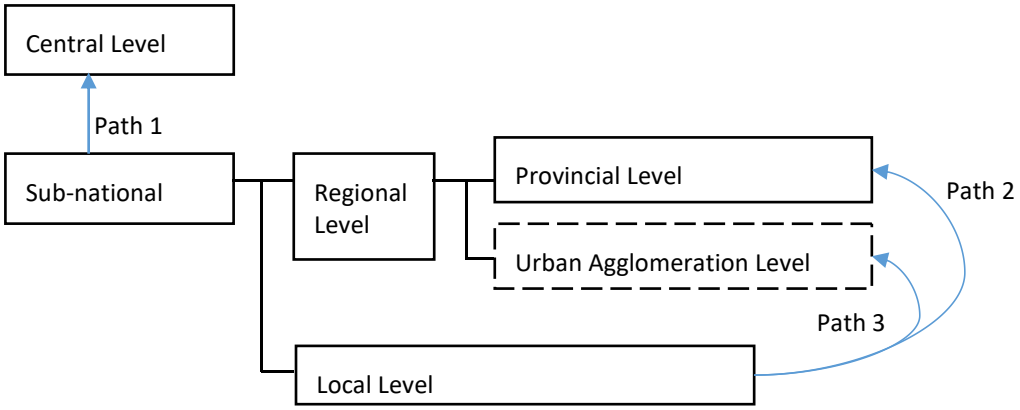


Figure 7.10 The Trajectories for the Rescaling-up of Environmental Governance in China

Both central and local governments applied a series of instruments and tools to drive the rescaling-up of environmental governance including accrediting central organisations to government sub-national, policies and national projects implemented by central government, and institutional reform, cooperative platform and regional plans adopted by sub-national authorities (Fig 7.11).

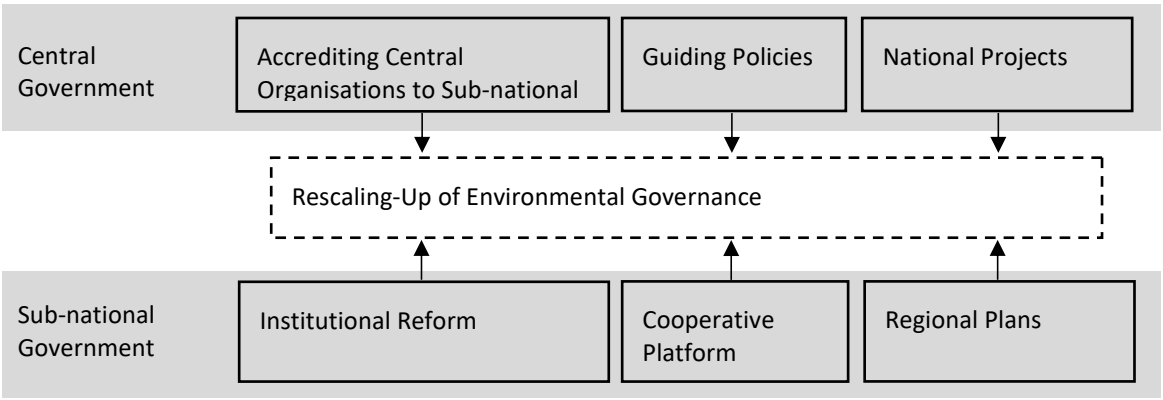


Figure 7.11 The instruments and tools for rescaling-up of environmental governance from central and sub-national levels

7.2.2 Upscaled Powers and Achievements

This section examines the extent to which powers have been upscaled to which level.

From the policy documents and practical implementations of the central supervision, vertical reform and 'two-oriented society' construction, four main aspects of powers been rescaled upward to higher levels (Fig 7.12): (1) powers for the personnel/budgetary allocation (incl. official appointment) of sub-national environmental departments were rescaled upward; (2) powers for the local environmental monitoring were recentralised; (3) powers for the local environmental supervision were rescaled-up; (4) powers to draft regional plans (Inc. development plans and spatial planning) in the purpose of 'Two-Oriented Society' were rescaled up to the urban agglomeration level.

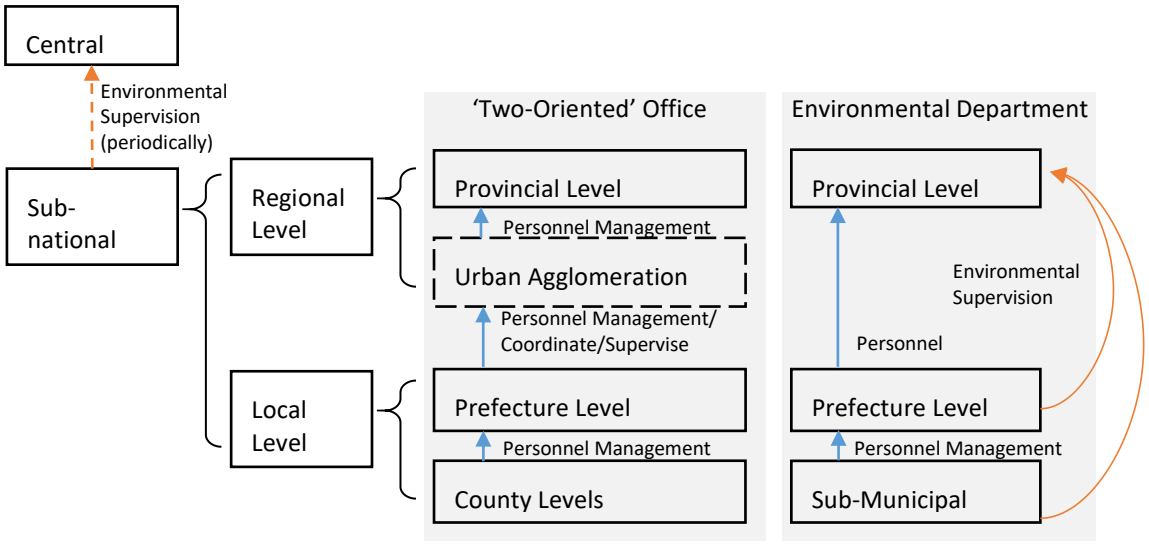


Figure 7.12 The rescaling-up of powers for environmental governance

7.2.2.1 Rescaling-up of leadership (personnel/budgetary allocation)

The leadership relationships and professional relationships between sub-national environmental departments and aub-national governments have been changed so that higher environmental departments play a more significant role to lead lower environmental departments than sub-national governments (Vertical Reform Policy, 2016). For instance, after rescaling-up, Municipal Environmental Departments are still the subsidiary bodies of both Municipal People's Government and Provincial Environmental Departments due to the 'Dual Leadership[28]' principle of the 'Tiao-Kuai[29]' system in the Chinese political regime. However, the leading governor is no longer the Municipal People's Government (Kuai) but the Provincial Environmental Departments (Tiao). The county level shows more remarkable change that county level of environmental departments directly becomes the sub-offices of the prefecture environmental department and no longer controlled by county level of government ---- "all the members and funds are charged by the prefecture environmental department" (Interviewee 18) ---- the 'Tiao-Kuai' system which deep-rooted in Chinese regime had some changes that the 'Tiao' relations have been reinforced and environmental departments could stay away from the intervention of people's governments.

The rescaling-up of leadership also means that the power for personnel/budgetary allocation of local environmental departments was rescaled upward to environmental departments in superior level (Vertical Reform Policy, 2016). In other words, the recruitment, allocation and performance

[28] 'Dual Leadership' describes the Chinese system where one department/organisation is led by two superiors involving the people's government at the same administrative level and the same department at a higher level.

29 The 'Tiao-Kuai' System is the administrative management system in China. 'Tiao' means the vertical/hierarchy management in specific fields; 'Kuai' represents the parallel management within one level spanning all fields (areas of responsibilities or sectors).

assessment of officials in local environmental departments are managed by environmental departments at a higher level. Interviewee 18 explamed that:

> "after the vertical reform, leaders in the prefecture environmental department are appointed by the provincial environmental department, prefecture people's government could provide advices but don't have the decision-making power."
>
> ---- Interviewee 18

As a consequence, coinciding with the views of interviewee 14 and 18, this reform also enhanced the role and independence of environmental departments in all scales (Tiao).

> "The role of environmental departments was enhanced and they became more independent […] it enables environmental problems easier to be solved than before."
>
> ---- Interviewee 18

7.2.2.2 Rescaling-up of environmental supervision

Environmental supervision within recent rescaling refers to the inspection of regional and local environmental qualities taking the form of patrols or visits. Powers for sub-national environmental supervision have also been rescaled-up.

On the one hand, by the Vertical Reform (2016), powers for environmental supervision both in prefecture and county level were upscaled to provincial environmental department since all the local organisations of environmental supervision are governed by provincial environmental departments as affiliated agencies. Staffs and funds for environmental supervision are borne by provincial environmental agencies. The rescaling-up of environmental supervision not only focuses on companies but also governmental authorities ---- the efficiencies of local environmental departments to perform environmental responsibilities, regulations, standards, policies and plans are supervised by the provincial environmental bureaucracies.

On the other hand, environemtnal supervision power is rescared up from sub-national to central level during the Central Supervision. As the central supervision implements every two-three years a time, so this is a periodically upscaling process.

The 'localisation management' principle was implemented during decentralised environmental governance putting sub-national governments in charge of the environmental qualities in their areas (incl. staffing and funds). This principle enhanced local government's responsibilities regarding the local environment. However, where environment qualities were solely supervised by sub-national

governments, risk of regional protectionism and data falsification increased. Both rescaling-up processes of sub-national environmental supervision responded and sought to restrain problems of regional protectionism and data falsification to a degree. Moreover, pollution problems of centrally owned enterprises which cannot solve by sub-national authorities could now be solved by central bodies during central supervision (Interviewee 4).

7.2.2.3 Rescaling-up of environmental monitoring

Environmental monitoring here refers to the measurement (full-time or periodical) of regional environmental qualities (Inc. water, air, and noise) by setting monitoring stations or devices. After the vertical reform, all the sub-national monitoring organisations for environmental qualities are no longer controlled by the environmental departments at the same level, but are managed by environmental departments at the higher level, i.e. from county to prefecture level; from the prefecture level to provincial level (Vertical Reform Policy, 2016). That means, regional and local environmental qualities are no longer monitored by the organisations at the same level but at a higher level.

Through the clarification of interviewee 8, 12, 14 and 18, the rescaling-up of monitoring jurisdictions for the regional and local environment guarantees the data validity to some degree.

> "Before, local environmental departments are not only the 'athlete' but also the 'referee' […] the validity of environmental monitoring data was insured to a degree by the vertical reform."
>
> ---- Interviewee 8

7.2.2.4 Rescaling-up of regional plans

The authorities to draft regional plans (incl. plans of development and spatial planning) for the purpose of 'Two-Oriented Society' were recentralised to the urban agglomeration level by the establishment of 'Two-Oriented Society' Office in urban agglomeration level. This office enacts the overall-plans for the CZT urban agglomeration and it also holds the rights to coordinate, supervise and review the performance of prefecture and county agencies for 'Two-Oriented Society' objective (Interviewee 11 and 18).

7.2.3 Rescaling-up for Stronger Leverage of the Central government?

The fiscal decentralisation after 1979 weakened the central government's power, which made central government hard to control and manage development direction in region and local. To address this, central government initiated the reform of the financial system (in 1994) and environmental regulations to strengthen its power (Qi et al., 2014). Whether the recentralisation

and upscaling of environmental governance after 2015 is also a 'self-strengthening' of central government?

From the above, during the rescaling-up procedure of environmental governance, powers originally embedded in subordinates were shifted upward to higher scales of governments. The intervention of the central government has been enhanced to a degree. However, after the detailed investigation about what power was rescaled to which level in section 7.2.1 and 7.2.2, I define this rescaling-up strategy of environmental governance after 2015 in China as the 'soft recentralisation'. The term 'soft recentralisation' is developed from Mertha's studies (2005) about the recentralisation process of fiscal governance in China, but given the differences between fiscal recentralisation and environmental decentralisation, this thesis recognised this 'soft recentralisation' of environmental governance have broader implications.

Firstly, Mertha (2005) identified fiscal recentralisation as 'soft recentralisation' is because: "although these bureaucracies are centralised from the township/country to the provincial level, they remain decentralised between the centre and the provinces (that is, governing the relations between the provincial bureaucratic offices and the provincial governments)" (Mertha, 2005:792). This is consistent with my observation about the recentralisation of environmental governance. We can see clearly in Figure 7.12 that powers for leading, monitoring, supervision, personnel management were all rescaled-up from local governments to provincial levels; meanwhile, the upscaling across administrative boundaries to the urban agglomeration is ultimately also controlled by provincial levels. Although many environmental powers were rescaled upward, most powers were remained in regional levels.

Secondly, this is a partial upscaling as some original powers embedded in the local level did not change, such as executive powers, the funds for execution also the responsibility of local governments (Interviewee 18). Besides, the rescaling-up of powers for local environmental supervision, local environmental monitoring, and personal and budgetary management of local environmental agencies, are all for the sake of the effectiveness and performance of local authorities for local environmental protection. It is a strengthening of local authorities for environmental responsibility, but not for the central government.

> "Even though partial powers are given to superiors, it does not mean lower-tiers of authorities have no or fewer duties and powers for local environmental protections. On the contrary, this vertical reform is applied to enhance the effectiveness of environmental decentralisation."
>
> ---- Interviewee 14

Thirdly, although central agencies possessed the leading role for environmental supervision and "there is no place for sub-national governmental authorities" (Interviewee 14) during the Central Supervision, the main objective of this recentralisation project is to withstand the local protectionism caused by decentralisation, the strengthening of central leverage is a tool but not the final purpose. The final 'winner' during Central Supervision is citizens that their powers for environmental governance are taken seriously.

> "The Chinese state does not need to strengthen itself at this stage […] Central government's leading power is 'down to the bone' and it is hard to be shaken […] the reform [upscaling] of environmental governance is only to promote the environmental performance of local authorities."

---- Interviewee 18

As a consequence, the upscaling of environmental governance adopted through multiple trajectories and ways promoted both by central and local governments in China after 2015 is an environmental 'soft recentralisation'. It is not for stronger leverage of the state, on the contrary, it intensified forces of sub-national authorities and non-governmental actors for environmental governance.

7.2.4 Challenges and Remaining problems

From the above, interviewees all confirmed the effectiveness of this rescaling-up process of environmental governance after 2015. Some interviewees (e.g. interviewee 14 and 18), however, pointed out that there are still some problems and challenges in practice, which need further studies and adjustments.

Firstly, many powers were rescaled upward, but some powers still remained at the local scale, e.g. the permit system of pollutant discharge. Interviewee 14 argued that:

> "If powers of environmental monitoring and supervision are all controlled by provincial authorities, the pollutant discharging licenses also should be issued at the provincial level."

---- Interviewee 14

Secondly, during the Vertical Reform of Sub-national Environmental departments, lots of powers were rescaled up to provincial environmental departments for more independent role of environmental department. But leaders of provincial environmental department are still selected and appointed by provincial government and not the Ministry of Environment in national level, so there is still doubt about whether the independence of environmental departments was successfully

achieved by vertical reform or not. Moreover, as lots of powers were owned by provincial environmental departments, and the supervision to provincial environmental departments is not as strict as the ones for prefecture and county levels. Interviewee 18 worried that provincial environmental departments may have the opportunity to abuse powers and corrupt. However, interviewee 14 maintained a positive attitude and he believed that most political failures have happened at local level, the probability of provincial departments to abuse powers and corrupt was seen to be very low. In practice, the former deputy director of Hunan Provincial Environmental Protection Department (2003-2013) and the Hunan Provincial Housing and Urban-rural Development Department (2013-2016) were arrested for bribery in 2018 (http://www.gov.cn/xinwen/2018-04/17/content_5283432.htm?cid=303).

Thirdly, during the vertical reform of sub-national environmental department, superior environmental departments, instead of people's government become the main leadership of lower environmental departments. However, the inevitable link between the local government with the local environmental department may make the vertical reform (i.e. prior power of superior environmental departments) exist in name only. On the one hand, environmental problems usually cannot be solved only by environmental departments, but joint efforts of multiple departments. So, local environmental department still need government's support which made local environmental department cannot stay independent (Interviewee 14). On the other hand, although officials in local environmental department were appointed and assessed by superior environmental department, but they live and work in local areas and cannot stay out of surroundings (Interviewee 18). Moreover, there are lots of people outside the authorised personnel quota who are still retained and managed by the original local environmental agencies (Interviewee 18). The original meaning of vertical reform was lost.

7.3 Rescaling-Out of Regional Environmental Governance in China

Regardless of downward or upward rescaling processes of environmental governance, the importance of non-state actors for local environmental qualities and EM has increasingly been recognised by Chinese governments. Therefore, although China is a centralised bureaucratic state without a democratic voting system, opportunities to include both the private sector and civil society in regional and local environmental governance were encouraged and led by central and sub-national authorities through several political instruments.

The rescaling-out process of environmental governance (i.e. involvement of non-state actors for environmental governance) has been seen as a route for 'good governance' and it is an effective way

in addressing complex environmental management problems (MacLeod and Goodwin, 1999; Pierre and Peters, 2000; Jessop, 2002; Bulkeley, 2005; Marshall, 2008; Reed and Bruyneel, 2010;).

However, because of the different political regime and different status quo of China compared to advanced federal democratic western countries, scholars highly interested about how and in what degree does the rescaling-out process of environmental governance conduct in China. Therefore, in this section, mechanisms to engage and practice of collaboration with non-state actors is examined below focusing on two types of non-state actors: the private sector and environmental NGOs. They are the main non-state participants of environmental governance during the ET of IAs in CZT.

7.3.1 Rescaling-out of Environmental Governance for Private Sectors

As Chinese government placed increasing emphasis on the relationship between the market with environmental governance, then, around 2014, they positively explore cooperate ways of governments and private sectors for regional and local environmental governance. This section aims to understand the changing cooperation mode between governments with private enterprises during ET of IAs in the CZT.

7.3.1.1 Public-Private Partnership Mode

In 2014, the Ministry of Finance proposed the *Guidance for the Cooperation between Government with Private Sectors.* In this guide, the concept and procedures of Public-Private Partnership (PPP) were formally initiated. According to *The Government Work Report (2015)*, PPP is a way for governments to absorb public investments (incl. funds, resources and technologies) in big municipal engineering projects. PPP was conceived to alleviate governments' financial pressure, and help to accomplish big municipal engineering projects more efficiently.

In order to strengthen the practice of PPP, in 2015, the State Council, the Ministry of Finance, the State Development and Reform Commission and People's Bank of China jointly released the *Guidance for Financial Innovation and Social Investment for Key Field* and the *Guidance to Facilitate the Cooperative Model of Government with Social Capital for Public Service Field*. In 2015, the critical fields for PPP were identified as the construction of public infrastructure and governmental services, such as, the construction of transportation, communication infrastructure and architecture. In 2018, the State Council put forward the *Guidance to Enhance Environmental Protection and Pollution Prevention and Treatment*, more and more PPP projects focused on environmental projects. According to the data provided by the Executive Director of the E20 Environment Platform (https://www.sohu.com/a/271567323_100018791), in 2018, environmental engineering became

one of the main fields for PPP model with environmental PPP projects accounting 30%-40%, and ranking second behind transportation PPP projects.

For example, in Hunan Province, according to the PPP data reported by Hunan provincial government every year since 2014, the PPP projects for the environmental field increased from 7 projects (23%) in 2014 to 39 projects (28%) in 2016, placing Hunan Province fifth nationally in 2016. Moreover, the specific areas of those environmental PPP projects are mainly link to infrastructure for waste disposal (incl. sewage and solid waste), pollution treatment (mainly pollution treatment of water and soil) and brownfield development (e.g. ecological parks in industrial areas). The investments of wastewater treatment (incl. living and industrial wastewater) accounted for the highest proportion (50%) in 2016.

There are three reasons why the sewage treatment projects account for the highest proportion of environmental PPP projects in Hunan Province (Interviewee 1, a staff of a private company for environmental protection and energy saving). Firstly, the focus results from the political focus on water pollution treatment in Hunan province. The pollution treatment of Xiang River is the 'Primary Project (一号重点工程)'' in the Hunan province (*Tree-year Plan for The Pollution Treatment of Xiang River*, 2013), due to the high pollution levels of the river that have a substantial impact on the drinking water and living environment of citizens. A series of environmental policies focused on the pollution treatment of Xiang River were published by both national and sub-national government, which led to more projects for sewage treatment infrastructures seeking PPP investments. Secondly, the substantially rise in sewage treatment fees adjusted by governments also encouraged more investments from the public in this area. Both reasons show the role of top-down governance.

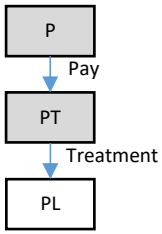
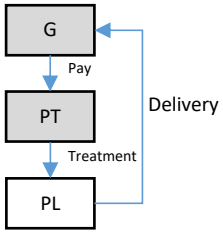
The third reason is that the investment into wastewater disposal facilities provides a stable income that companies can rely on making it a sector for PPP investment. This is supported by Interviewee 17, who also argues that "some unsuccessful PPP projects were mainly because of the break-off/suspension of money flow during the later period". Therefore, not only a top-down approach, a bottom-up approach for rescaling-out also exists and impacts on cooperate fields and ways between private sectors and governments. However, according to Interviewee 1, governments still play a vital role in the development direction of environmental PPP projects.

> "According to regulation, although PPP projects could be instigated by both governments and private enterprises, governments are still the leading force."
>
> ---- Interviewee 1, Office Staff of Environmental Protection and Energy Saving Private Company

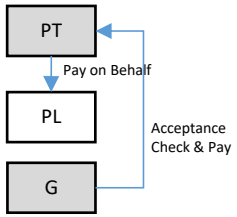
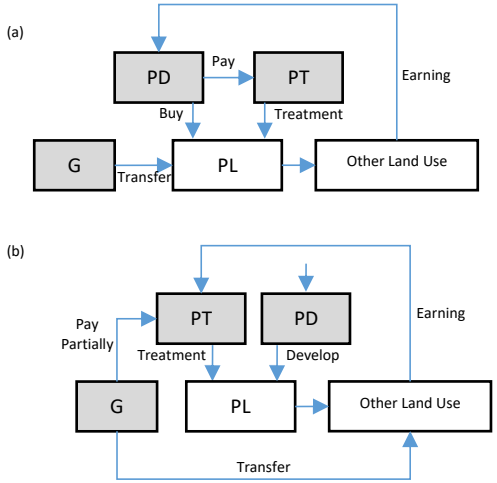
Regarding PPP, this thesis identifies six main kinds of cooperation modes for ET of IAs: (1) Polluter Pays Mode, (2) Local Government Pays Mode, (3) Treatment Company Pays on Account Mode (also called BT Mode), (4) Beneficiary Pays Mode, (5) Engineering Procurement Construction (EPC) Mode, and (6) Yuetang Mode (Table 7.4). These cooperation modes were introduced over time with the latter ones seeking to overcome limitations of previous approaches. But since each mode has its merits, all of them are still in use (with different proportion) at present.

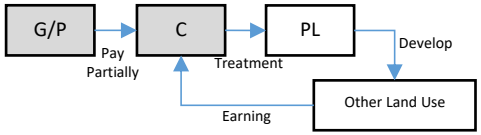
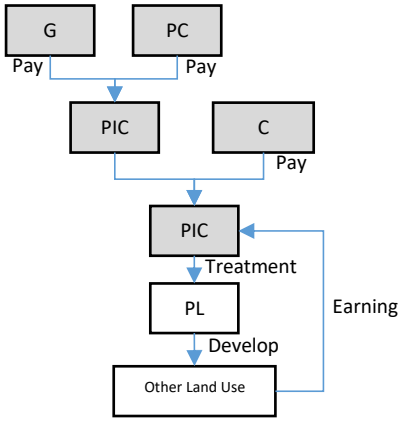
Table 7.4 Comparison of Different PPP Modes for the ET of IAs[30]

(Interviewee 1, 8, 9, 14, 18)

Cooperation Mode	Relationship of Government and Private Actors		Private Partici-pation	Private Invest-ment	Integrated Service for the ET of IAs	PC Partici-pation	Advantage	Disadvantage
	Flow Chart	Procedure						
Polluter Pays		Polluter pays the fee to professional private companies for environmental treatment	√	√			Involved in private actors and solved governments' financial burdens; also motivated the development of environmental industries	Sometimes it is hard to defined polluters, or polluters can't afford the costs
Local Government Pays		Local Government pays the fee to professional private companies for environmental treatment, then lands owned by governments after treatment	√				Solved the defining problem of polluters	Local Governments suffering from huge financial burdens

[30] The ET of IAs here mainly refers to the relocation-based transformation of TIAs (more details in section 7.1).

Treatment Company Pays on Account (BT Mode)		Private pollution treatment company pays on behalf of local government, then local governments would make payment after treatment	√				Solved the defining problem of polluters, and also remitted governments' financial pressures in a degree	The financial pressures for local governments still existed
Beneficiary Pays		The development of lands after environmental treatment be involved, then the private developer participated in. PD and PT in charge of their own parts. Government do not pay or pay partially, the most cost paid by PD/PT. Then, the earnings of lands after development would give to PD/PT.	√	√			Solved the defining problem of polluters, and governments' financial pressures	Higher demands for supervision, and governments can't control the directions of land development

Engineering Procurement Construction(EPC) Mode		All projects (treatment and land development) of the ET of IAs are committed to one private company, then private prime contractor generated. Local government only pay partially, and most of the fee paid by C. Then, earnings after treatment and development would belonging to C.	√	√	√		Excepting advantages of previous modes, it benefits for the linkage between works in different stages; and it realises the efficiency of costs and progress; moreover, it is clearer for governments to find the people who take charge of	Governments can't control the directions of land development
Yuetang Mode (PPP project for the heavy-metal pollution treatment of land during ET of Zhubugang TIA[31] in Yuetang District of Xiangtan City)		Both local government and private prime contractor make the payment, but in the form of the project investment company. The earning after treatment and development would also return to them via PIC.	√	√	√	√	Excepting advantages of previous modes, the controlling of governments for land development was reinforced	Middle-small companies are hard to be involved in; besides, the transformation of PC is urgently needed for the extensive application

31 Zhubugang TIA is a TIA (1.74 km2) which has been established in the 1960s and is located in Yuetang District, Xiangtan City. Regarding the pollution treatment plan for the Xiang River basin, 28 polluting chemical enterprises in Zhubugang TIA have been closed down or removed for eco-transformation in 2014. After pollution treatment, the area will be developed into a new ecological urban district.

(P: Polluter (i.e. industrial company), PT: Private Company for Pollution Treatment, G: Government, PD: Private Company for Land Development, C: Private Company as the Prime Contractor, PIC: Project Investment Company, EPC: Engineering Procurement Construction, BT: Build & Transfer.)

From Table 7.4, PPP projects tend to managed by a prime contractor, e.g., EPC mode and Yuetang mode. The private prime contractor has been involved in and in charge of both environmental treatment in the earlier stage and land development (Inc. infrastructure construction, industrial/business introduction, property management) in the later stage. This strategy benefits for the efficiency between works in different stages, and also, it realises the efficiency of costs and progress, e.g., it could facilitate the circulation of resources and materials in different stages (Interviewee 8).

> "After pollution treatment, soils were reused to construct the roadbed."
>
> ---- Interviewee 8, Official in Xiangtan City

The similarities of EPC and Yuetang Mode are: 1) private prime contractor was involved in; 2) sub-national government still provides partial funds, and prime contractor could get benefits from land development; and 3) developed lands would returned to sub-national governments after certain period. However, in the EPC mode, most of the costs are paid by the private prime contractor, so that earnings from land development would be given to the private prime contractor. Land development only implemented by private prime contractor that local governments cannot control the development directions of lands. In Yuetang mode, PCs have been involved in (as a prime contractor) and all financial issues been managed by PICs. The controlling of sub-national governments to the land development was reinforced, while, the participation of private sectors did not be cut down.

> "Platform companies have an inextricable relationship with local governments […] as shareholders of PPP projects, they can partake in the decision-making and daily operations of these projects, which ensured the controlling of governments."
>
> ---- Interviewee 17, Secretary of the board of a PC

As this advantage of Yuetang mode, the PPP project for the eco-transformation of Qingshuitang TIA also adopted this mode (Interviewee 4).

> "In 2017, we [Zhuzhou Circular Economy Investment Development Group] and the Zhuzhou City Construction Development Group jointly invested and established the Qingshuitang Investment Group. We invested 49%, and the Zhuzhou City Construction Development Group invested 51%. As the Zhuzhou City Construction Development Group is fully funded by prefecture government, then, the Qingshuitang Investment Group we built is a kind of PC with corporate management under the guidance of prefecture level of government […] This new investment group will participate in the PPP project for the eco-transformation of Qingshuitang TIA which is about to start in 2019 or 2020."

---- Interviewee 4

However, if PCs would like to participate in PPP projects, it should unhook with local government and transform to a private company. After 2014, a large scale of transformation of PCs for the participation of PPP projects was adopted by policies. The next section will analyse this transformation and the adaptation of PCs for the PPP project.

7.3.1.2 Transformation of PCs

The sub-national state-owned companies (i.e. PC) for investment and financing was officially defined by the Ministry of Finance, State DRC, People's Bank of China and China Banking Regulatory Commission in 2010 that:

> "The local state-owned companies for investment and financing (PC) is an economic entity which is established and fully funded by the sub-national level of government. It has a dependent corporate status. Usually, it has been nominated as Investment Company/Group, Construction Development Company, Investment Development Company, Holding Company for Investment, State-owned Asset Operation Company, State-owned Capital Operation and Management Centre or Industrial Investment Company, and so on."

---- The Inform of Regulation of PC, 2014

Actually, PC was facilitated by the fiscal decentralisation around 1993 in China, sub-national governments launched PCs to absorb investments for regional and local economic and social development.

> "We (PC) play a significant role in regional and local infrastructure constructions and tackling the international financial crisis."

---- Interviewee 4, Vice General Manager of a PC

However, PCs exacerbated the potential debt burdens of sub-national governments (Interviewee 15). Then, increasing regulatory policies (Table 7.5) have been released to demand the transformation of PC to unhook with governments and make a market-oriented reform for transformation. This transformation also enables PCs participate in PPP projects (Interviewee 15).

Table 7.5 Regulatory Policies for the Transformation of PCs

Year	Organisation	Policy
2014	Ministry of Finance	*Instruction for the Cooperation Model of Government and Social Capital* (政府和社会资本合作模式操作指南)

2014	Ministry of Finance	*Instruction for the PPP Contract* (PPP 项目合同指南)
2015	State Council	*Advice about the Cooperation Model of Government and Social Capital in Public Service Area* (关于在公共服务领域推广政府和社会资本合作模式的指导意见)
2017	Ministry of Finance	*Management of the local government's loan and financial behaviour* (关于进一步规范地方政府举债融资行为的通知)
2017	Ministry of Finance	*Advice about State-owned Capital for Public Welfare Industry* (关于国有资本加大对公益性行业投入的指导意见)
2018	Provincial Party Committee of Hunan Province	*Advice about Governmental Debt Management* (关于严控政府性债务增长 写实防范债务风险的若干意见)
2018	Leading Group of governmental debt management in Hunan Province	*Management of PC* (关于清理规范政府融资平台公司管理的通知)

Based on the above policies and interview material (Interviewee 15), the unhooking of PCs from sub-national governments mainly refers to the following:

- PCs can no longer absorb investments and financing on behalf of sub-national governments;
- Debts generated by PCs can no longer be paid by sub-national governments, but by PCs themselves;
- Sub-national governments are no longer the guarantee of PCs' loans.

As a result, all PCs in Hunan Province have already transformed or are about to transform (Interviewee 18). For example, Geckor Group (a PC in Zhuzhou City) has already transformed. A modernised management system was established, and local governments participated as the shareholder as outlined in Fig 7.13.

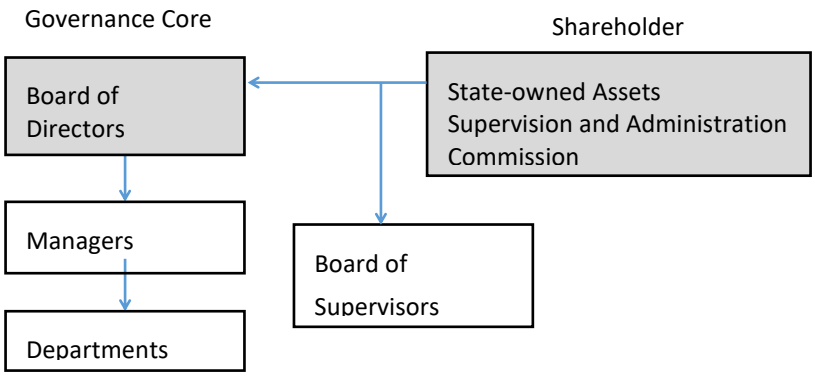


Figure 7.13 The Organisational Structure of Geckor Group after Transformation (Interviewee 17)

Previously, leaders in Geckor Group held additional posts as sub-national government officials so that PC was totally controlled and managed by the sub-national administrative committee. After the transformation, the board of directors was established and all directors comprise full-time positions from which officials are excluded.

However, even though the relationship between PCs with sub-national governments was officially ended by the transformation, "platform companies have an inextricable relationship with sub-national governments" (Interviewee 17). On the one hand, "All top leaders in PCs were designated by sub-national governments […] most of them originally worked in governments, and after a few years in PC, they would be re-employed by governments as well" (Interviewee 18).

On the other hand, a new position in PCs was established by sub-national government ---- representatives of state-owned property rights. Representatives are selected and trained by the sub-national government. They are assigned to the broads of PCs as a natural person, and also as representative of SASAC.

After transformation, PCs are allowed to participate in PPP projects as private companies, private prime contractors or as shareholders to invest and manage PPP projects (such as the PPP project in Yuetang, section 7.3.1.1). According to interviewees 15 and 17, PCs are proper organisations for PPP, and the participation of PCs could improve the success of PPP projects. Firstly, PCs have more comprehensive capabilities for big projects than most other private companies. For example, within governmental backgrounds, PCs have more qualifications and conditions for land development and financial behaviours.

Secondly, PCs are different from other private enterprises. They are not only economically oriented but also the organisations following governments' concepts and assignments. Then, PCs can solve the problems and disadvantages of private enterprises during PPP. For example, the private sector prefers projects with higher profit margins and ignored public welfare projects. But PCs would more prefer livelihood projects.

> "Some livelihood projects, such as environmental protection and infrastructure construction, still need the facilitation and participation of governments."
>
> ---- Interviewee 14

Moreover, PCs can guarantee the implementation of governmental policies and strategies, and also regional or local governments' ownership and management of land (Interviewee 15).

> "At previous, governments directly sold the lands to private developer, which led to many attribution problems of lands. The participation of PCs in the ET projects of IAs ensures governments' ownership of lands. Governments no longer sell lands, but only rent it or provide the land usage right to private sectors."
>
> ---- Interviewee 15

In the Chinese context, transformed PCs play the role of an intermediary agents between governments and private actors during PPP projects for ET of IAs. Transformed PCs fit right in the market-led approach for environmental governance. Furthermore and due to its links to governments, PCs solved the problems and disadvantages of private enterprises for environmental governance. Chinese governments are positively adjusting their institutional systems and cooperation modes to adapt themselves to these market demands during rescaling-out of environmental governance.

7.3.2 Rescaling-out of Environmental Governance for Civil Society

EM development considers not only government actors but multiple non-state actors, e.g. civil society and the private sector, as crucial to environmental policy making and governance processes. As part of EM, China recognised the importance of public participation and published numerous policies and strategies to involve civil society. However, the degree to which civil society engages in environmental governance in China is much lower than in western countries - the government is still the leading force in China (Mol, 2006; Chen, 2010). At present, whether the engagement of civil societies is still in low degree and whether it is an obstacle to Chinese environmental performance needs further discussion.

Drawing on document analysis and interview data from two regional environmental NGOs in CZT, this section discusses drivers, approaches, and changing roles of regional environmental NGOs for environmental governance, especially during the ET of IAs.

7.3.2.1 Drivers and Instruments for the Participation of Environmental NGOs

The engagement of environmental NGOs in environmental governance was not only facilitated by 'top-down' but also by 'bottom-up' approaches.

7.3.2.1.1 'Top-down' Approach

Following the classification of political instruments by Chinese state (The National Meeting for 'Fang-Guan-Fu' Reform, 2016 ;Li and Rong, 2016), the political instruments for rescaling-out of environmental governance for civil societies are explored in three dimensions known as the 'Fang-Guan-Fu (放管服)' framework which includes empowerment (Fang), regulation and command (Guan), as well as service and environment construction (Fu) (Table 7.6).

Table 7.6 Political Instruments for Rescaling-out of Environmental Governance for Civil Societies

Category	Year	Policy	Strategy
Empowerment (Fang)	2006	*Environmental impact assessment for public participation (trial)*	Environmental impact could be assessed by public organisations
	2015	*Pathways for the public to participate in environmental protection*	Providing many pathways for the public to attend the environmental governance
	2015	*National Environment Protection Law (Revised Version)*	Initiated the environmental public interest litigation model
Regulation and Command (Guan)	2016	*The Registration and Management of Social Organisations (trial)*	Social organisations and foundations have to register with a regional or local governmental department for a official certification
	2018	*Credit Information for Social Organisations*	Building credit system of social organisations to regulate their behaviours
Service and Environment Construction (Fu)	2012	*Central Fiscal Support for Social Organisations to Participate in Social Services*	Funding support from the state
	/	/	Established new governmental organisation ---- Service Centre for Social Organisations
	/	/	Established new governmental website ---- Service Platform for Social Organisations in China
	/	/	Setting training courses for social organisations

In Table 6.6, we can see that the public participation for environmental governance in China was started in the 2000s, but until the 2010s, it was widely facilitated by overall political instruments. Social organisations were given more responsibilities and rights, and offered more political support and funds, however, a series of regulations also was released to govern and guide the development of NGOs.

Interviews in CZT urban agglomeration indicate that there are two main reasons why the participation of environmental NGOs was fostered by governments. First, governments needed independent organisations to scrutinise the environmental performance of companies and also governments. The involvement of civil societies during Central Supervision (see section 7.2.1.1) and River Chief Project (notably, the Folk River Chief Project) which were interpreted in earlier sections are good examples. NGOs are non-profit organisations and have no vested relationship with governments and companies. As such, they do not have constrains that some officials may have, and are not restraint to tell the truth unscrupulously (interviewee 12). This

local environmental NGO disclosed the list of polluting state-owned companies in Hunan Province in Mar 2018, and they have received seven companies' responses by the end of 2018 (NGO's Report).

Second, NGOs can provide professional, organised, targeted and methodical public participation in environmental governance (Interviewee 12 and 13). Sometimes, even though some public want to do some for the environment, they don't know how to do. Environmental NGOs have passions, experiences and funds, they are the professional organisation that consists of human capital holding a range of expertise. They can provide the public with professional advice, and get people organised and orderly public activities is also appreciates by local government (Interviewee 13).

7.3.2.1.2 'Bottom-up' Approach

The participation of civil society in environmental governance is also facilitated from the bottom-up. Increasingly citizens' health and living environments are impacted by severe environmental degradation. Environmental concerns about environmental problems and threats to health and people's livelihoods have led to increased support for environmental NGOs.

> "Our organisation [an environmental NGO] established by a group of local people who ardently love their cities. […] When we officially registered in 2011, we only have 3 staffs in total. But now (in 2017), we have 22 full-time employees as core members, and 500-600 part-time volunteers only for one project."
>
> ---- Interviewee 12

Citizens promoted the development of environmental NGOs, while the development of environmental NGOs also improved the public participation of environmental governance resulting in a mutually reinforcing relationship. NGOs generally benefit from volunteers with different backgrounds, knowledge, skills and resources. For example, interviewee 12 said that their committee contains lawyers, entrepreneurs, media workers, experts in environmental fields, people working in governments, and so on. They have a democratic committee where all committee members can express their own views and suggestions. Proposals with full approval could be implemented. And they have at least three broad meetings each year.

One respondent also suggested that the growth of private foundations, especially the foundations focusing on environmental performance, contributed to the growth of environmental NGOS through financial support. Interviewee 12 said that they received more

than 0.2 million for just one project yearly from the SEE Foundation which contributed a lot for their development.

Under the support from both the government and the public, environmental NGOs are getting more and more sophisticated, which provides a robust basis for the public participation of environmental governance.

7.3.2.2 Intervention Approaches of Environmental NGOs for ET of IAs

During the interview, a member of environmental NGO B (Interviewee 13) tried to describe the role of environmental NGOs as:

> "More like a representative of citizens concerning local environmental qualities. It [NGO] aims to involve wider public participation, and build a bridge between governments and companies."
>
> ---- Interviewee 13

Based on the description of environmental NGOs' role and also the projects that two NGOs produced, the main approaches of intervention by environmental NGOs for regional environmental governance (especially ET of IAs) are shown in Fig 7.14 and will be further clarified in the following.

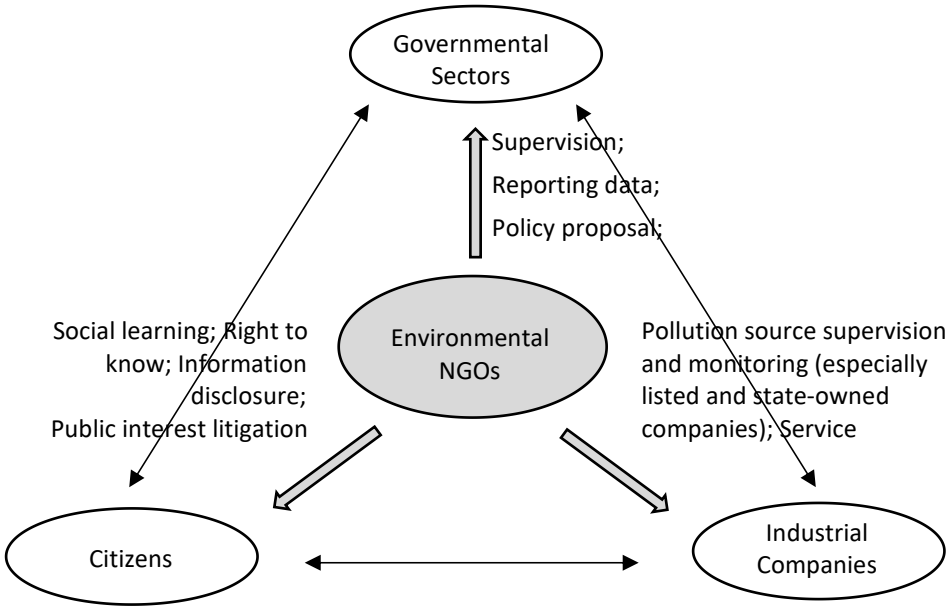


Figure 7.14 The intervention approaches of environmental NGOs for ET of IAs

7.3.2.2.1 Activities to facilitate social learning and public engagement

The environmental NGO which I interviewed carried out a series of activities to facilitate social learning and public participation after their establishment in 2011 (Table 7.7).

Table 7.7 Main Activities that environmental NGO implemented toward local citizens

(source: NGO's official website, work reports and Interviewee 12 and 13)

Activities/Projects	Contents	Purposes
'Water Source Discovery', 'Haze Reduction Activity', 'Green Pedestrianism Challenge Match', 'Bench-land Cleaning Activity'	Large-scale activities to absorb the public's participation and stimulate them to know the local pollution situations via playing. Activities across administrative regions were also carried out with the cooperation with NGOs in other areas	Motivating locals to know and participate in local environmental issues
Salons and seminars	Salons and seminars focusing on particular local environmental problems (such as, discussions about Dongting Lake and Xiang River pollution, or garbage problems in CZT)	Providing a communication platform for people from different fields (Inc. experts, journalist, environment pioneers, volunteers)
'Natural University'	Everyone could be the keynote speaker or initiator of any courses concerning the environment	Providing an equal platform for the public to teach and learn any environmental topics systematically
Improvement plan of youths' capabilities about environmental protection	Few potential youths have been selected and provided funds and training to promote their capabilities (Inc. abilities of cognisance, leaning and execute)	Attracting young people's attention about local environmental protection and enhancing their capabilities
'Watchman of (Xiang) River System'	Hundreds of local volunteers participated as a watchman to make an inspection tour along Xiang River (especially, sewage draining exits and water intakes) and disclose pollution problems regularly	Constructing 'bottom-up' monitoring and supervision network for local environment qualities which started from the river system
'Annual Top Ten Environmental Events of Hunan Province', 'PITI result of 14 cities in Hunan Province'	Citizens vote for the top ten local environmental events; NGO cooperated with social media to disclosure the local environmental monitoring results (for example, in 2011, NGO cooperated with Tencent company and around 20 million local people received the news)	Advocating public participation and their right to know; Giving more public pressures to governments
Public interest litigation of environmental issues	In 2015, this NGO help local citizens prosecuted a quarry in Changsha since illegal mining and seriously environmental disruption. This is the second environmental public interest litigation in Hunan Province	Helping citizens to protect their environmental rights by legal means

From Table 7.7, we can see that environmental NGOs provided a range of approaches to engage the public in local environmental protection, such as provision of information and education, voting, supervision, monitoring, learning (from training class or offline activities), teaching, receiving and spreading information. Moreover, citizens from different backgrounds

and ages could find suitable places, for example, “families prefer to attend lively activities” (Interviewee 12), ambitious youths could participate in training plans and leading their own course/projects, experts could provide professional knowledge for volunteers in many ways, and media workers could help for information disclosure. More importantly, NGOs help to protect locals’ environmental rights, such as the rights to know and public interest litigations, which enhanced the publics’ powers in local environmental governance.

7.3.2.2.2 Environmental supervision and monitoring

Regarding the industrial companies, environmental NGOs made efforts to monitor polluting companies (especially listed and state-owned companies). For instance, the ‘Watchman of (Xiang) River System’ project mentioned earlier consists of a network to supervise and monitor industrial pollution caused by industrial companies along the Xiang River system. In addition to this, pollution information of companies was disclosed by NGOs, especially, information of listed companies and state-owned companies. One respondent (Interviewee 12) suggested those large-scale companies have more responsibilities and influence on regional and local environmental performance.

On the other hand, NGOs also offered services and cooperated with some companies. More specifically, environmental NGOs provide companies with professional environmental knowledge and techniques. Moreover, NGOs cooperate with companies to solve pollution problems (Interviewee 13).

7.3.2.2.3 Impacting the decision-making and policy-making

Under increasing opened political environment that governments provided, environmental NGOs have more powers and diverse ways to influence the decision-making and policy-making of local environmental issues.

> “We (environmental NGO) communicate with regional and local governments very often, such as hearings or forums […] we also directly report monitoring results, publics’ complains, draft proposals or strategies to corresponding governmental departments […] normally, we’ve got positive responses from governments.”
>
> ---- Interviewee 12

For instance, in December 2014, this environmental NGO participated in a public hearing about *The Air Pollution Control Rules of Hunan (Draft)*, and offered suggestions on the rules of ‘public participation’ and ‘information disclosure’ (Interviewee 12). In 2015, this environmental NGO submitted 22 suggestion letters (including legislative proposals, proposals for NPC&CPPCC conferences and policy suggestions) to the governments (including national, provincial,

prefecture level of governments), suggestions included public participation, prevention and control of water pollution, and air pollution control (Data source: NGO's Reports).

> "At the end of some offline activities, we (environmental NGO) also let children or youths draw or write down their thoughts about the local environment as a letter to the Mayor. We pack all letters and deliver them to Mayor once a year […] Mayors in Changsha, Changde and Yiyang Cities all had written back to us."
>
> ---- Interviewee 12

7.3.2.3 Changing Roles of Environmental NGOs

From the above section, within the increasing tolerant policy environment and self-strengthen of NGOs, the self-positioning and roles of environmental NGOs are changing as well. From empirical studies about the environmental NGOs in Hunan Province, I found that the roles of environmental NGOs are changing mainly in three dimensions (Fig 7.15).

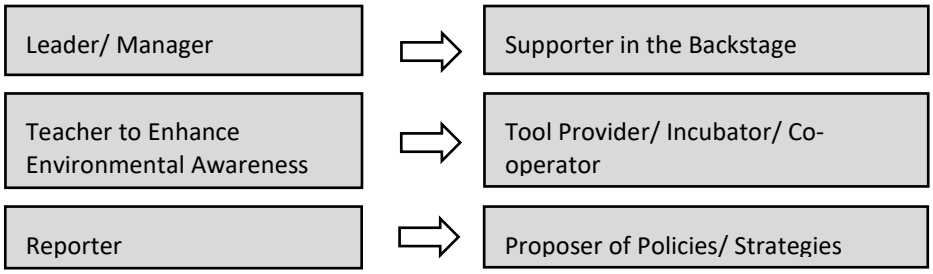


Figure 7.15 The Changing Roles of Environmental NGOs

Firstly, environmental NGOs no longer want to be leaders or managers of environmental activities, sometimes, the public are the leading pioneers. As an organisation, NGOs cannot represent all citizens who are suffering from pollutions in-person. Nowadays, environmental NGO more prefer to hide in the backstage and give support to the public. "The pioneers for local environmental protection should be the public but not us" (Interviewee 12, a staff in an environmental NGO). Environmental NGOs encourage citizens who are suffering from pollution in-person to reflect problems directly to governments, and this is also required by the procedure of environmental public interest litigation. If citizens don't know how to do, environmental NGOs' always there to help, such as, providing advises, ideas and even funds.

Secondly, environmental NGOs were transformed from facilitators of environmental awareness to tool providers, organisation incubators and co-operators.

Taking the 'Watchman of Xiang River' project as an example. By 2015, there were 271 river supervisors, 20 key groups, 18 stations, and 12 action groups in 52 cities and counties in Hunan province (the total number of cities and counties in Hunan province is 122). From Fig 7.16,

participants were uniformly distributed in Hunan province along the Xiang river system. Many volunteer teams developed rapidly and environmental NGOs don't have enough financial and human resources to afford them. So, they encourage them to launch independent NGOs (Interviewee 12).

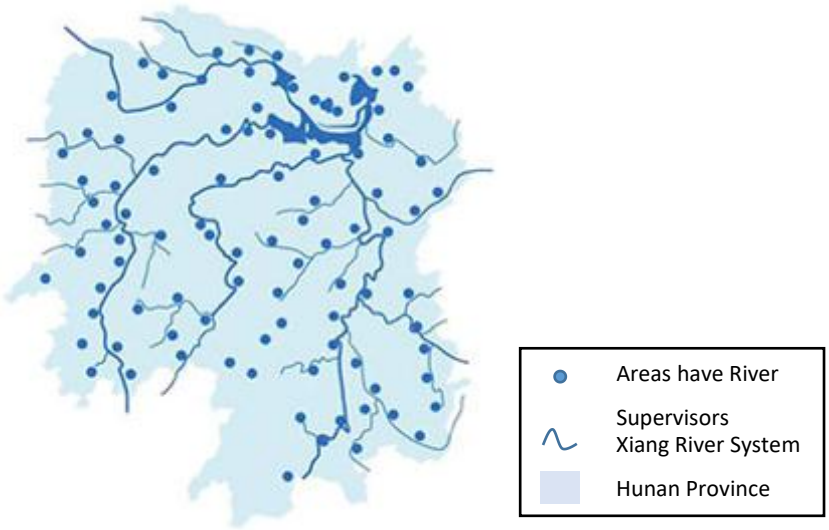


Figure 7.16 The Spatial Distribution of the 'Watchman of Xiang River' Project

(Source: NGO's Report, 2016)

In 2016, the headquarter of this environmental NGO no longer the only centre of this project, volunteers in other areas built their own centres (Fig 7.17). Resources (e.g. relations between lawyers, officials and social media), partial funds and professional skills would be provided to new organisations. Following this strategy, the 'Watchman of Xiang River' project could expand to the whole Yangzi River System, and even to the whole river system in China in the future (Interviewee 12). Interviewee 12 stated that:

> "We're very happy to see this, and it is one of our objectives. […] We don't think it may threaten our position, every NGO may have its own focus. Competitors are also facilitators for us."
>
> ---- Interviewee 12

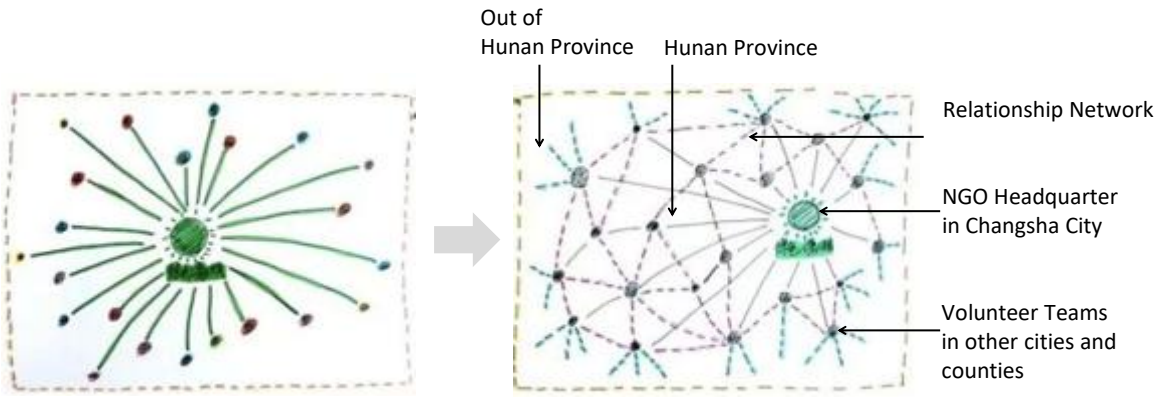


Figure 7.17 The changing role of environmental NGO during the 'Watchman of (Xiang) River System' Project

(Source: NGO Report, 2016)

Thirdly, regarding regional and local governments, environmental NGOs not only provide supervision and monitoring results to governments, but also positively hand in draft proposals and resolutions to corresponding governmental departments with the aim to influence the policy-making process.

7.3.2.4 Controversies and Consensus

During interviews, sub-national government and sub-national environmental NGOs expressed their opposing views on some regulations issued by governments for environmental NGOs.

Regarding some regulations for environmental NGOs, NGOs and governments have contradictory ideas, such as three stipulations of *The Registration and Management of Social Organisation* (2016) listed as following:

- NGOs have to register with a sub-national governmental department for a formal role, and this governmental department possesses direct and comprehensive powers to manage registered NGOs;
- NGOs of the same focus are not allowed for registration in the same area;
- NGOs are confined to the registered areas and their activities cannot across specified area boundaries;

Sub-national governments (Interviewee 18) state that those stipulations could make NGOs more manageable. Local government encourage all locals to participant in environmental protection, but all actives of NGOs should be reasonable and lawful. Also, local governments have this responsibility to keep society stable and harmonious. "We have more things to consider despite the environment" (Interviewee 18, a governmental official).

However, NGOs think those stipulations restrict their development and independence (Interviewee 12 and 13). Those regulations are obviously stricter than in western countries (i.e. UK). In China, the survival and development of NGOs are closely related to the government's

attitudes, but that is an unstable factor. The limitation of location and theme prevent us (environmental NGOs) to compete with each other. But competition could help to select the superior and eliminated the inferior (Interviewee 13).

Both answers are reasonable, but they only reflect single perspectives. Under this situation, environmental NGOs put forward two solutions to reach a consensus. On the one hand, NGOs tried to find a new way which also conforms to stipulations. Such as what Interviewee 12 said:

> "When we decided to register, we didn't choose an environmental department as our governing body, but the science and technology association. If we managed by environmental department, we can't implement the supervision to environmental department. Also, there were few environmental NGOs register with the science and technology association, so we don't have to worry about overlapping with other NGOs."
>
> ---- Interviewee 12

On the other hand, NGOs now seek to position themselves as the 'co-operator' of governments, instead of 'competitor' or 'replacer'. The 'co-operator' here does not refer to the complete compromise of environmental NGOs to governments. Environmental NGOs would focus on the problems which may be easily overlooked by governments, and do some small-scale of experiments to find solutions. If it works, they could absorb more investments from public and governments, and put the strategy into practice in larger scale. Eventually, it may affect relevant policies (Interviewee 13).

Environmental NGOs willing to cooperate with governments is because they believe that governments also care about the environment and they are in the same goal currently. But, if governments do something harmful to the environment, NGOs would also express their thoughts and try to make changes as well. Such as actives did by environmental NGOs to object to three dams which built by the governments in CZT in 2008 (details in section 8.1.3.1). Interviewee 12 stated the reason that:

> "We have our fund resources and technologies, even though we have to register with governmental sectors, but governments also need us so they gave us more spaces now, we have the same goal ---- local environmental protection and improvement […] We care the government's support, but if governments ignore environment protection at some points, we will also do our best to make sounds and changes legally […] these years, I think NGOs largely promoted the attention of governments about environment indirectly. I felt our actions for environments are more and more professional and wider […] other means here I refer to forces of public opinion, pressures of central government and policies, and so on."
>
> ---- Interview 12

7.4 Summary

Based on the analytical framework about rescaling of environmental governance presented in section 6.2.1, the rescaling processes of environmental governance for ET of IAs in China were explored in this chapter (Fig 7.18).

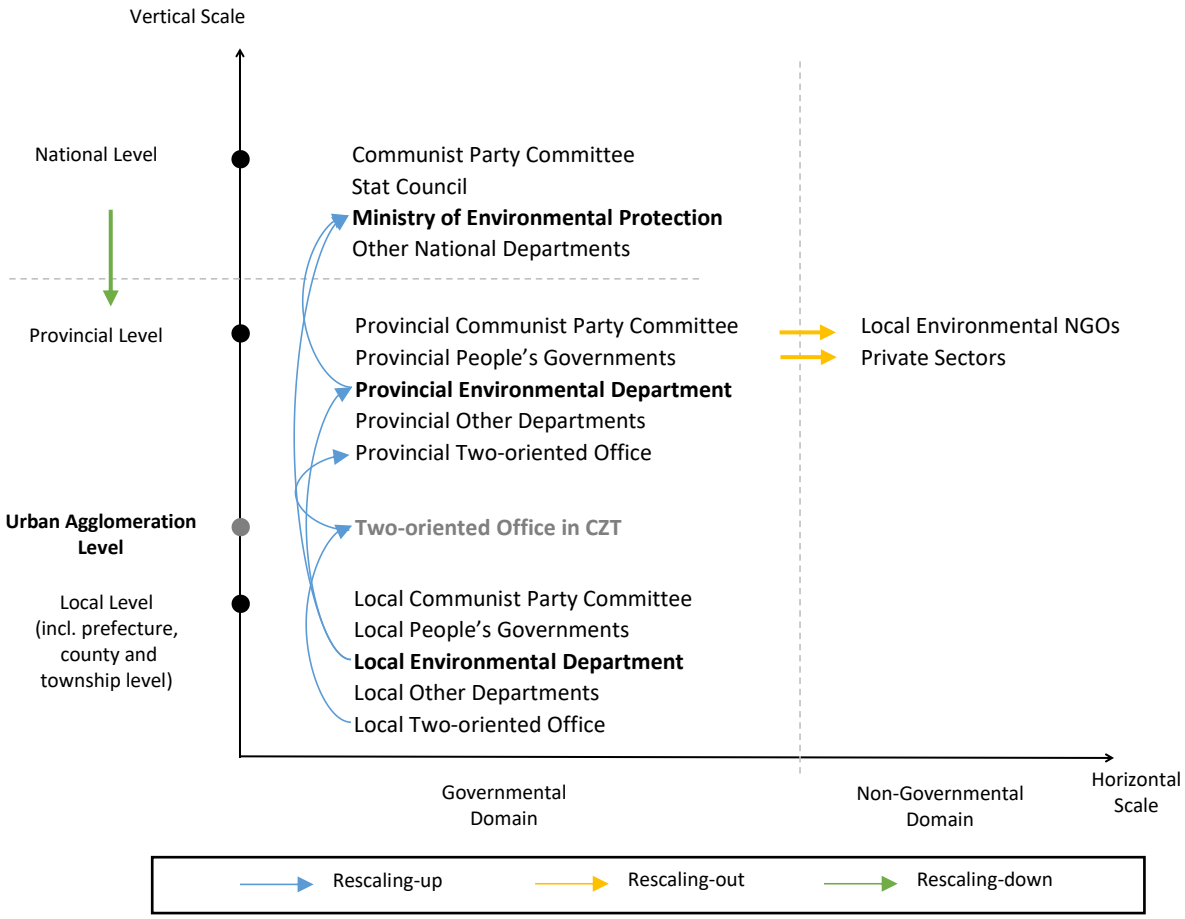


Figure 7.18 Rescaling Structure of Environmental Governance for ET of IAs in China

Regarding ET of IAs, powers shifted in vertical (rescaling upward and downward) and horizontal (rescaling outward) scales, i.e. decentralisation and rescaling-up (incl. 'soft recentralisation') of environmental governance, and increasing actors/stakeholders were involved in regional and local environmental governance. During the two stages of environmental decentralisation, responsibilities and powers for regional and local environmental governance were scaled down to sub-national level. Instead of sub-national environmental departments, top officials of two kinds of governmental organisations (i.e. People's Government and Communist Party Committee) were involved as the leading force of regional and local environmental governance. Top leaders in different scales led the environmental council and environmental protection projects in their region or local areas, cooperation across regions also coordinated by them. Moreover, the cooperation of various

governmental departments for environmental governance was facilitated so that not only environmental departments but departments in other fields had to address environmental considerations. The cooperation mode broke the conventional 'pyramid' hierarchy mechanism, by mixing with 'linear' and 'matrix' structures. In sum, in order to adapt the decentralised mode, sub-national governments positively adjusted their institutional mechanism for better performance. However, there were still some subsequent problems affecting the environmental performance in the region which couldn't be solved through decentralisation, such as, inadequate motivation, regional protectionism, data falsification and management problems of centrally state-owned industrial companies. Those problems impacted the expected performance of the decentralised environmental governance mode. For EM development, it is good to use the experience of other countries for reference, but it shows that the way in which western countries adopted EM is not directly transferable to the Chinese context. Concerning the regime and institutional mechanism in China, the intervention of central or superior levels of governments was required. To address this, a round of rescaling-up (incl. recentralisation) process proceeded after 2015 in China.

During the rescaling-up of environmental governance and 'soft-recentralisation', partial powers were rescaled from sub-national to national, from local to provincial and urban agglomeration levels through different pathways. New organisation (i.e. two-oriented offices) and new spatial units (i.e. urban agglomeration level) were created and included in environmental governance. This power-based adjustment between governments was not for the purpose of self-strengthening of the central government. On the contrary, it intensified the mobilisation of sub-national authorities for regional and local environmental protection. Problems generated during decentralisation have the potential to be solved by this rescaling-up and soft recentralisation process. However, there are still some challenges and remaining problems during practice, more details should be considered carefully.

Through the rescaling-out of environmental governance, non-governmental stakeholders (Inc. private sectors and environmental NGOs) increasingly got involved in environmental governance. The involvement of non-government stakeholders was promoted by both 'top-down' and 'bottom-up' approaches. Chinese government is positively adapting its institutional mechanism for more efficient cooperation mode with the private sector and NGOs, vice versa, private sectors and environmental NGOs also changed their roles and participation ways to adapting Chinese context. Non-governmental organisations got more and more opportunities, intervention approaches and essential roles for environmental governance. However, public participation in environmental governance is still a new thing for China. Both governments (sub-national governments in particular) and environmental NGOs still need more time to

learn, attempt, running-in and explore. Environmental NGOs also could pay more attentions to other means to influence local environmental policy agenda.

Comparison of extent of each rescaling process is difficult to undertake quantitatively, and in terms of the influence on environmental governance, it is hard to say which one has been more critical. All rescaling down, up and out dimensions are indispensable and they are not contradictory. But, for now, China seems paid more attention on the vertical rescaling than rescaling-out process.

The roles and relationships of three stakeholders (i.e. governments, private sector and civil society) kept changing which generated the shifting of environmental governance modes (Fig 7.19): vertically, a) mode of environmental governance shifted from centralised to decentralised mainly started in the mid 2000s; b) since 2015, the decentralised governance mode was combined with soft recentralisation; c) horizontally, the cooperative governance mode was started to form in the late 2000s and was gradually strengthened during the 2010s.

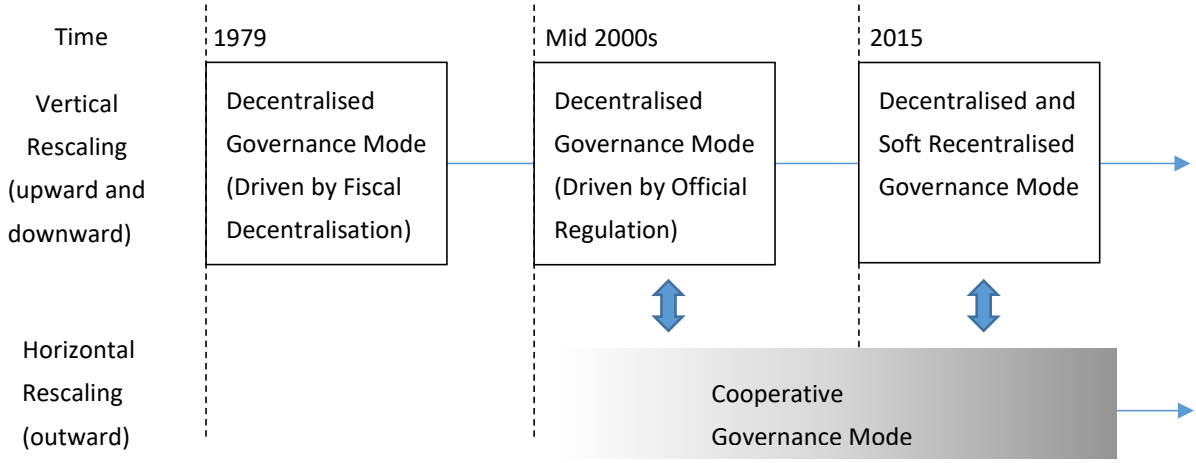


Figure 7.19 The Shifting Modes of Environmental Governance in China

Just like what Driessen et al. (2012) described that changes supplement and accumulation rather than replace existing governance modes. The development of soft-recentralisation and cooperative environmental governance modes didn't replace the decentralised environmental governance mode. Currently, in Chinese environmental governance mode, decentralised, soft recentralised, and cooperative environmental governance mode exist at the same time.

Moreover, this chapter also reveals the increasing concern about spatial dimensions of the rescaling and restyling of environmental governance in the ET of IAs in China. Firstly, many space-related governmental departments were involved in the environmental governance, such as the Department of Housing and Urban-Rural, the Department of Water Resources, the

Urban Planning or Designing Agencies and the land developer. Secondly, a new spatial unit across administrative boundaries for local environmental governance was established, such as the CZT urban agglomeration. Spatial management became a tool for Chinese EM. However, within the analytical framework rescaling of environmental governance, the relationship of spatial planning with EM development could not be investigated in detail. The next chapter draws on the framework constructed in section 6.2.2 to explore the spatial changes (incl. spatial movement and spatial restructuring) of IAs during ET process in CZT.

Chapter 8 The Spatial Practices/Tools of Environmental Governance for EM in China

The previous chapter explored the changes in terms of scales and modes of environmental governance. This chapter focuses on how industrial areas changed in terms of their spatial configurations during eco-transformation in China including the relationship between and functions of spaces for EM development in China. For those purposes, the spatial changes in IAs in CZT from the late 2000s to the 2010s are analysed in detail drawing on interviews with government officials, private enterprises, developers, spatial planners and residents as well as document analyses (incl. policies, spatial planning documents, newspaper articles, official reports and records). The analysis of spatial change distinguishes between two processes: the spatial relocation of IAs and the spatial restructuring of IAs.

The chapter is structured as follows: Section 8.1 describes the changes in the geographical location of the polluting industries of TIAs during the ET process. Three main TIAs in CZT were selected as cases (i.e. Zhubugang TIA in Xiangtan City, the Qingshuitang TIA in Zhuzhou City, and the Pingtang TIA in Changsha City). The local policy context, implementation process, driving forces, features, achievements and criticism of the relocation process of those three main TIAs in CZT are investigated. For further discussion, the relocation process of three TIAs is discussed in the context of industrial transfer and the neo-Fordist city: a comparative analysis with two previous industrial transfers in China (i.e. the international industrial transfer happened during 1970-1980s, and the domestic industrial transfer happened from early 2000s to early 2010s) and neo-Fordist urban development in Western countries (e.g. the UK and USA). Section 8.2 introduces the changes of spatial structures of IAs during the ET process. Spatial structure are analysed distinguishing between three dimensions: (1) the spatial distribution and the size of secondary and tertiary industries; (2) the density of IAs; and (3) the spatial relationship of IAs to other IAs in a urban agglomeration, the spatial relationship of IAs to other urban land uses, and the spatial relationship of IAs with the natural environment (incl. landscape features). The achievements and remaining problems of the spatial structural changes of IAs for environmental protection and local economic growth are illustrated as well. Section 8.3 summarises a spatial model of a urban agglomeration during the EM development in China according to the results of spatial changes of IAs during ET in CZT.

8.1 Relocation of Industries in TIAs through ET

Industrial transfer refers to the geographical movement or relocation of whole or partial industries from one place to another place (Wang and Zhao, 2003). In Section 3.2.1.1, three main industrial transfers in China since 1990s were presented:

1. the fifth international industrial transfer, circa 1990s, from advanced countries to developing countries;
2. the domestic industrial transfer between eastern, central and western China in the 2000s; and
3. the regional polluting industrial transfer of the 2010s.

The first two industrial transfers have been discussed in detail in the literature (Lewis, 1982; Vernon, 1996; Lu, 1997; Xia, 1999; Xing, 2003; Huang and Xiao, 2007; Tao, 2010; Zhou and Cao, 2010; Liu et al., 2014; Mees, 2016), but little attention has focused on the third one, and there is a lack of analysis from an EM and industrial transfer perspective. To address the gap, this section explores the relocation process of the third industrial transfer using the example of polluting industries in CZT urban agglomeration to investigate spatial strategies and changes in spatial relationships during the ET of IAs.

8.1.1 Local Policy Context

Since the late 2000s, the Chinese central government has strengthened environmental regulations with a tendency towards strong EM (as seen in section 6.1). Under the guidance of the central government, local governments enacted policies aimed at the ET of IAs, such as the relocation of polluting industries of TIAs. Table 8.1 lists specific local policies which led to the relocation of polluting industries in CZT urban agglomeration.

Table 8.1 Local policies for the ET of IAs in Hunan Province that drove the relocation of polluting industries

(Source: Author with data from relevant policy documents)

Focus	**Policy**	**Release Date**	**Governing Body**
Construction of 'Green Heart Ecological Area' in the centre of CZT Urban agglomeration	Plan of CZT Urban agglomeration (2008-2020)	2008	'Two-Oriented' Office in CZT
	Plan of 'Green Heart Area' in CZT (2010-2030)	2010	'Two-Oriented' Office in CZT
	Conservation Regulation of 'Green Heart Area' in CZT	2012	NPC Standing Committee
Pollution Treatment of Xiang River Area	The Implementation Plan of Heavy Metal Pollution Control of Xiang River in Hunan Province	2012	Hunan Provincial Government
	The First Three-Year-Plan for Heavy Metal Pollution Control of Xiang River (2013 -2015)	2013	Hunan Provincial Government
	The Second Three-Year-Plan for Heavy Metal Pollution Control of Xiang River (2016 -2018)	2016	Hunan Provincial Government
Air Pollution Control	Action Plan for the Prevention and Control of Air Pollution	2016	Hunan Provincial Government

Urban Renewal	Construction plan of Changsha Forerunner Area as the national pilot of 'two-oriented society'	2008; renamed as Xiangjiang New Area in 2015	Hunan Provincial Government
	Two cities of CZT (i.e. Zhuzhou and Xiangtan) have been designated as National Demonstration Pilots for the Transformation of Old Industrial Urban and Resource-Based Cities	2017	National Development and Reform Commission, Ministry of Science and Technology, Ministry of Industry and Information Technology, Ministry of Land and Resources, China Development Bank
Upgrading of Industrial Structure	Supply-side Structural Reform	2016	Hunan Provincial Government
	The Four-Year Plan of the Upgrading of Industrial Structure	2016	Hunan Provincial Government

Although policies listed in Table 8.1 focus on different perspectives and include different objectives, they all restrict the future development of polluting industries in TIAs. Although those policies focused on different objectives and were issued by different departments with different wording, i.e. they used their own vernacular to describe the moving or closing down of polluting industries in TIAs with terms such as 'relocate', 'clear out, 'weed out', 'shut down', 'replace', 'upgrade' and 'transform', they all addressed the relocation of polluting industries in TIAs.

Firstly, policies for the construction of the *Green Heart Ecological Area* in the centre of CZT urban agglomeration restricted the development of polluting industries in this area. It became a guide for the closure and relocation of polluting industries. According to the *Plan of CZT Urban agglomeration* (2008-2020) and the *Plan of the Green Heart Area in CZT* (2010-2030), the *Green Heart Area* is the central area of three cities of CZT urban agglomeration as delimitated by governments for environmental protection, and this area was divided into two classes with different development intensities: Zones with Controlled Development and Zones where Prohibit Development[32]. It covers an area of 522.87 km^2, including 58.46% of Changsha City, 15.74% of Zhuzhou City and 25.80% of Xiangtan City. *The Plan of Green Heart Area in CZT (2011:5)* defines the function of the Green Heart Area as "a public space providing ecological services, a pilot area for the construction of ecological space in the urban agglomeration, and a

32 The Chinese State Council issued The Spatial Plan of Main Functional Areas in 2010. This plan divided national land into four categories based on different carrying capacities of natural resources, existing development intensity and development potentials: Zones for Optimized Development, Key Zones for Development, Zones with Controlled Development and Zones where Prohibit Development.

demonstration for creative-use of ecological resources/capitals." For those purposes, secondary industries, particularly polluters, were forbidden to operate in this area any longer. By the end of 2018, about 350 polluting industries closed or moved away from the Green Heart Area of CZT. This included 290 industrial enterprises in Changsha City, 52 industrial enterprises in Zhuzhou City, and seven industrial enterprises in Xiangtan City (Government's reports).

Moreover, the closure and relocation of TIAs in CZT were also driven by pollution treatment policies for the Xiang River. *The Implementation Plan of Heavy Metal Pollution Control of the Xiang River in Hunan Province (2012)* stated that "the heavy metal pollution needs to be reduced by 50% through the closure, transformation and relocation of polluting industries of TIAs along Xiang River". *The 1st and 2nd Three-Year-Plan for Heavy Metal Pollution Control of Xiang River (2013; 2016)* selected seven TIAs — all located alongside Xiang River — as 'main battlefields' for relocation and transformation. Three of them were located in CZT urban agglomeration: Zhubugang TIA in Xiangtan City, the Qingshuitang TIA in Zhuzhou City, and the Pingtang TIA in Changsha City, which are all used as detailed case studies in this section.

Next, under the guidance of the *Action Plan for the Prevention and Control of Air Pollution* which issued by the provincial government in 2013, municipal governments in CZT published the annual action plans for air pollution control in their cities between 2014 to 2017. One strategy of those action plans was to demolish all coal-fired boilers and chimneys (which failed to meet environmental standards) in city centres, which helped drive the relocation of polluting industries in TIAs in the city centre as well.

In addition, policies on urban renewal and industrial upgrading in TIAs also led to the relocation of polluting industries in urban areas. To increase citizens living and working conditions, and to achieve win-win-win between the natural environment and urban and industrial spaces, polluting industries (e.g. resource-based industries) of TIAs in the city centres were advised to close or transition to greener industries (e.g. hi-tech, tourism, and logistics).

In response to the industrial relocation strategy promoted by policies in Table 7.1, local governments published specific implementation plans for TIAs where relocation was required, such *as The Implementation Plan for Transformation of Pingtang TIA (2008)*, *The Implementation Plan of Relocation and Transformation of Zhubugang TIA (2013)*, and *The Implementation Plan for Transformation of Qingshuitang TIA (2015)*. Obsolete industries, identified by local governments following central guidelines and taking into consideration local circumstances, were forced to close, and other polluting industries were ordered to relocate

and undertake a green transformation (Interviewee 14, an official of environmental department).

8.1.2 Implementation: Relocation-based Transformation of TIAs in CZT

In practice, the industrial transfer included the relocation and closure of polluting industries as well as a pollution treatment and land redevelopment plan (e.g. Fig 8.1) which is here defined as the 'relocation-based transformation' of TIAs in CZT.

Figure 8.1 A billboard, established by Qingshuitang Investment Company33 in Qingshuitang TIA during the transformation period, announced the plan of this relocation and transformation project to be to "clear space in three years [by industrial relocation and shut-down], and to create a new urban area in ten years, 2015-2025"

(Source: Author's own, image taken in Qingshuitang TIA, November 2019)

Then, first three sections (i.e. from 8.1.2.1 to 8.1.2.3) explore the practical circumstances of relocation or shutting down of polluting industries in three TIAs in CZT. Sections 8.1.2.4 and 8.1.2.5 address subsequent procedures such as pollution treatment and land redevelopment of three TIAs.

8.1.2.1 Scale and Time of Relocation and Shut Down

Based on local government records, there are an estimated 500 industrial enterprises in CZT urban agglomeration that have moved or closed (Interviewee 18, an official of the Environmental Protection Department of Hunan Province). Table 8.2 shows the schedule of these moves and closures, plus the total number of industrial enterprises relocated or closed in the three TIAs of the three cities of in the CZT Urban agglomeration.

33 Qingshuitang Investment Company is a platform company funded and established in 2017 by two local governmental companies (i.e. the Urban Construction and Development Group and the Cycle Group in Zhuzhou City). Its registered capital is two billion yuan. It is responsible for relocating polluting industries, pollution treatment projects, and redevelopment projects (including investment, construction and operation) of the core area (about 15.15 km^2) of Qingshuitang TIA.

Most of the relocations and closures were in the three TIAs. According to Interviewee 18, about 50-60% were completely shut down, such as the Zhuzhou Zhongyan Chemical Industry Company, the Jingyuan Fuel Factory, and the Sifangyuan Beneficiation and Pharmacy Company. Industries that relocated or shut down were mainly polluting industries and resource-based industries (e.g. industries centred on chemicals, nonferrous metallurgy building materials, paper, cement, glass, machine manufacturing, and mining).

Table 8.2 Information on Industrial Enterprises Which Moved or Closed in CZT

(Source: Governmental records, Interviewee 4, 9, 17 and 18)

City	TIA	Timeline for Closure or Relocation*	Total Number of Industrial Enterprises	Closed	Moved
Changsha	Pingtang TIA	2008-2010	47	-	-
Xiangtan	Zhubugang TIA	2011-2014	28	9	19
Zhuzhou	Qingshuitang TIA	2017-2018	172	102	70

(*This is the time line for most enterprises but not all of them. Some large-scale enterprises can take up to three years to move or close down, which made them exceed this time line.)

As shown in Table 8.2, the relocation or close down projects of three TIAs happened in different years. Further investigations of these three case studies revealed not only different practices in different sites, but also differed over time. When the author started interviews and field visits in 2017, the relocation and pollution treatment in Pingtang TIA was complete and it was in the medium stage of redevelopment. Zhubugang TIA had finished most of its relocation projects and was in the middle of its pollution treatment projects but with few tertiary industrial enterprises signing contracts with local government indicating they would like to settle in during the redevelopment stage. Qingshuitang TIA, however, was still in the initial stages of the relocations and closures (Fig 8.2), and the plans for redevelopment were issued. From 2018 to 2019, four interviews and several visits were undertaken for status updates in Qingshuitang TIA, and the author found that pollution treatment was underway in 2019 (details in section 8.1.2.4).

Figure 8.2 Taking three large-scale industrial enterprises as examples, polluting industries in Qingshuitang TIA have already been closed down and prepared for relocation. In the Zhuzhou Smelting Group (bottom photos), almost all production devices were fenced of with warning lines and parts were dismantled.

(Source: Author's own image taken in Qingshuitang TIA, 2017)

8.1.2.2 Spatial Features during the Relocation

Figure 8.3 presents a map of departure areas[34] (i.e. three TIAs in CZT) and receiving areas[35] during the relocation of industries in three TIAs.

34 Departure Areas: the original areas of industries before relocation.
35 Receiving Areas: the areas where originally polluting industries were relocated to.

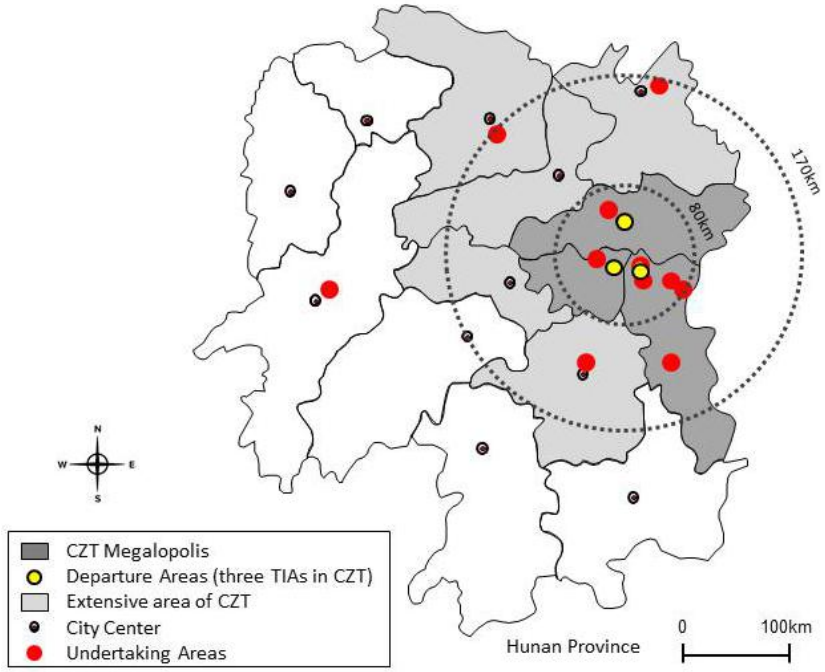


Figure 8.3 Map of the relocation processes of industries of three TIAs in CZT.

(The few industries that moved to neighbouring provinces, i.e. Jiangxi Province, are not considered here since they were a minority) (Source: Drawn by the author based on local governmental draft records36, Interviewee 1, 2, 4, 7, 8, 9, 14, 17, 18 and 19)

Most industries moved to areas within the extensive urban agglomeration and in the same province within a 170 km radius, or even in the same city mainly within an 80 km radius. Moreover, most of them moved from city centre locations to suburban areas. For example,

1. in 2016, the Hunan Jiangxi Xianglong Chemical Industry Enterprise moved to the Hengyang Songmu Industrial Park (about 120 km away from the centre of CZT, and about 10 km away from Hengyang city centre);
2. Zhuzhou Power Station moved parts of its production line to Youxian city (about 120 km away from the centre of CZT, and about 3-4 km away from Youxian city centre), but its office remained in the original place (i.e. Zhuzhou city centre);
3. A chemical industry company moved to the Wangcheng district of Changsha city (about 35 km away from the centre of CZT, and about 15 km away from Changsha city); and
4. four machinery processing and production enterprises moved to Liling city (about 55 km away from the centre of CZT).

The lower cost of relocating in proximity to the original location may be a factor (according to Interviewee 7) for the spatial relocation, but the main reason is the policy guidance set out in 'Transformation within City, Relocation within Province' which was released by local government (Interviewee 18). Both Hunan Provincial Government and local governments of departure areas and receiving areas offered a series of preferential policies and hosted many

36 Official government documents regarding the new location of some industrial sites were still work in progress. Local governments provided the author with draft records, which provided a valuable reference.

referral and marketing events to attract and guide the decision of relocation (Interviewee 19). As a result, taxes paid by relocating industries continued to generate profits for the same city or province, and it remitted the passive impacts of environmental projects on the local economy (Interviewee 18 and 19).

8.1.2.3 Receiving areas

During relocation, polluting industries did not move directly from departure areas to receiving areas as the eco-transformation process also required industrial upgrading, technological improvement and product modification for better environmental performance. This thesis defines the process as relocation-based transformations of TIAs.

Through relocation-based transformations, polluting industries moved from TIAs to EIPs and DZs. This was mainly due to the political strategy that sought to move all industries into industrial parks for integrated development which restricted industries from locating in other areas (Interviewee 14). This strategy also aimed at improving material recycling and reuse as well as centralised industrial waste treatment (Interviewee 18).

Two main pathways for relocation projects can be distinguished by the receiving areas. Firstly, most enterprises moved to EIPs (i.e. professional and green industrial parks that adopted IS comment). For example, some industrial enterprises (including Fuercheng Chemical Industry Enterprise, Yingdong Chemical Industry Enterprise and Jingyuan Chemical Industry Company) moved to the Hunan Petrochemical Industry Park, an EIP, in 2016 to 2017. Hunan Petrochemical Industry Park (Fig 8.4), also called Hunan Yueyang Green Chemical Industry Park, was extended from Yueyang Yunxi Industrial Park in 2012. It is located at the urban fringe of Yueyang city in Hunan province. By the end of 2016, 208 petrochemical enterprises were relocated there. The park was designated as a pilot park for the circular economy of Hunan province. It was planned to support the circular economy, and low-carbon and IS concepts.

Figure 8.4 The current site of the Hunan Petrochemical Industry Park

(Source: Official website of the Hunan Petrochemical Industry Park)

The Pingtang Iron Oxide Pigment Factory offers another example. This factory was established in 1965 in Pingtang TIA. It was renamed to Hunan Sanhuan Pigment Co. Ltd. In 2009 and relocated to Tongguan Circular Economy Industrial Base in Wangcheng county, 38 km from Changsha city (Fig 8.5). The Tongguan Circular Economy Industrial Base is an EIP which mainly accommodates fine chemical industries. It has strict environmental standards for industrial enterprises in its park. Hunan Sanhuan Pigment Co., Ltd. spent two years and 1,800 billion yuan on transformation and relocation costs.

Figure 8.5 Pingtang Iron Oxide Pigment Industrial Enterprise before relocation (left) and after relocation (right)

(Source: https://hn.rednet.cn/c/2014/06/24/3384796.htm, and Enterprise's official website http://www.shpigments.com/intro/1.html)

Secondly, some enterprises that had adopted innovative or green technologies were able to move into ETDZs in city suburbs or even in the HIDZs near the city centre. In February 2017, the author interviewed the chairman (Interviewee 2) and the technical director (Interviewee 3) of a laundry detergent manufacturer which is located in the Zhuzhou Lukou ETDZ in the suburbs of Zhuzhou city. The chairman used to be part of an unsustainable company (producing sulphite and perhydrol in Qingshuitang TIA) that has been closed down but since then started a new, environmentally friendly endeavour. The chairman and his new team upgraded one part of technologies in previous chemical company and developed a new product ---- reactive oxygen detergent. They opened a factory in Lukou ETDZ in 2010 and created a green brand to put the new product on the market. The products' ingredients are environmental-friendly and effective reducing the need for detergent to half of the amount of traditional detergent products. The detergent has the potential to reduce 50% of COD of traditional detergent products and was recognized among the first group of green products in China by the Ministry of Industry and Information in 2017.

> "If all detergents were replaced by our products, 2.3 million tons of chemical emissions and 1 million tons of COD could be reduced annually in China."
>
> ---- Interviewee 3, technical director of the chemical company that manufactures the green detergent

A plastic products company also a good example. According to Interviewee 7, this company invested three billion yuan to upgrade the production line (e.g. AI production line) and also changed the business direction (i.e. constructs a new green production base on Cu-Pb-Zn polymetallic ore). When the transformation was complete, the company moved into Tianxin Hi-Tech Park in 2017.

As illustrated, to ensure receiving areas would not carry excessive environmental costs from industrial activities after relocation, companies had to implement a green transformation before relocating in response to policies and environmental standards. At the same time, local government would also review and assess transformation processes of relocated industries in receiving areas (Interviewee 21).

However, Interviewee 7, the head engineer of a chemical industrial company in Qingshuitang TIA, stated that receiving areas were still suffering from pollution. During the central supervision in 2018, the Central Supervision Office in Hunan province had found that Hunan Petrochemical Industry Park suffered severe pollution problems by, for example, this industrial park occupied natural lake areas illegally for larger space, discharged water waste furtively, and operated under loose environmental management. Those environmental problems were attributed to governmental departments of water-related affairs, territory, planning and environmental protection both at the Yueyang municipal and Yunxi district levels.

8.1.2.4 Pollution Treatment after Relocation

After industrial relocation and before land redevelopment, polluted sites of TIAs were treated with the cooperation of the polluting industrial companies in TIAs, state and local governments, PCs, and private companies working in environmental detection and pollution treatment. Section 7.3.1.1 details this cooperation (PPP mode) and the role of the private sector in local environmental governance. Although private sectors played an increasingly vital role in local environmental governance, they are still under the guidance of government by the participation of state-owned companies, for example, PCs or state-owned companies took the vital role of the investment and development of urban construction projects, and representatives of state-owned property's rights were arranged into transformed PCs (see details in section 7.3.1.1).

When the author visited Qingshuitang TIA in 2019, there were about 100 small- and medium-sized private companies implementing pollution detection and treatment in cooperation with the Qingshuitang Investment Company, a PC, and the CCCC Third Harbour Engineering Co. Ltd., a state-owned company for urban investment and construction (Fig 8.6).

> "As general contractors, Qingshuitang Investment Company and CCCC Third Harbour Engineering Co. Ltd. in charge of pollution treatment and redevelopment in designated sites […] directly sign contracts with small and middle scale of private companies [for pollution detection, pollution treatment and infrastructure construction]."
>
> ---- Interviewee 21, the Director of a pollution treatment company

Figure 8.6 CCCC Third Harbour Engineering Co. LTD. is in charge of the relocation-based transformation of one part of the Qingshuitang TIA as a general contractor. Few private companies sign contracts and cooperate with it to implement pollution treatment.

(Source: Author, image taken in Qingshuitang TIA, 2019)

However, interviewee 21, the director of a private company for pollution treatment, stated that they also encountered some dilemmas. The objective of pollution treatment is to treat the water and soil and return it to its pre-industrialized state. However, there are no records and samples of pre-industrialized water or soil in CZT. Therefore, it is hard to determine what would qualify as the best (level of) pollution treatment right now. Local governments noticed this problem and started to record environmental quality before any land development or industrial production in 2017 (Interviewee 21). As a result, for now, pollution treatment, on the one hand, aims to eliminate pollutants (mainly heavy metals in CZT) that exceed the provincial environmental standard; on the other hand, it also aims to keep contaminates at a stable and controllable level (Interviewee 21).

8.1.2.5 Renewal of Old Urban Areas and Construction of New Ecological Urban Areas

After relocation and pollution treatment, the renewal of old urban areas (Fig 8.7) and the construction of new ecological urban areas are the main objectives of the ET of IAs.

Figure 8.7 A banner settled by the Leading Group of Renovation Projects of Shanty Areas in Qingshuitang TIA announce their objectives during the ET of Qingshuitang TIA as "remoulding old urban areas and building new homes."

(Source: Author, image taken in Qingshuitang TIA, November 2019)

All three TIAs relocated and resettled residents who suffered from high risks (e.g. severe environmental pollution, dangerous state of buildings and ground settlement). Residents of old buildings in shanty areas were also relocated. The spatial restructuring did not only address environmental problems, but also broader livelihood issues (Interviewee 14, an official of the Environmental Protection Department of Hunan Province).

> "In the past, people who lived around TIAs enjoyed the best welfare, but not anymore […]. Previously, they had higher salaries and allowances and they benefitted from housing, entertainment venues, sports venues and schools provided by factories […] but now, TIAs are the old town and the quality of life has fell behind that of other urban areas […]. We are delighted by the remoulding projects and most of us moved to better houses with better quality of life."
>
> ---- Interviewee 1, a staff member from a private company for environmental protection and energy-saving projects. Her family has lived around Qingshuitang TIA for about fifty years.

Fig 8.8 illustrates different generations of buildings and the evolution process of this urban renewal project of TIAs which improved the quality of living through modernised housing.

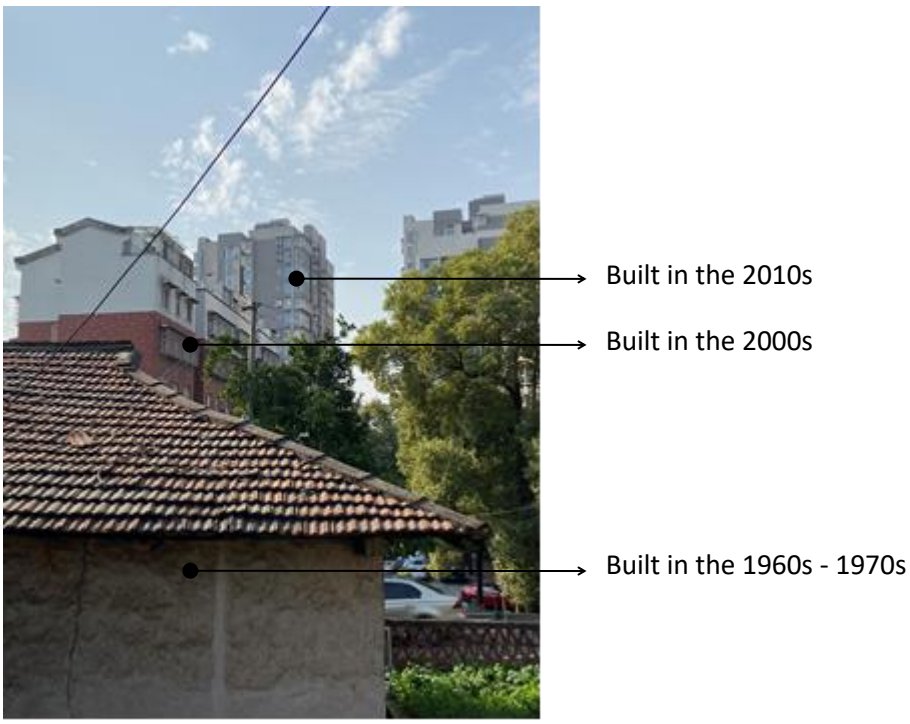


Figure 8.8 Residential buildings from three eras around Qingshuitang TIA

(Source: Author, image taken in Qingshuitang TIA, 2019)

However, since the industry left TIAs, a small part of young people moved out together with industrial companies, and most young people moved to other areas for new jobs (Interviewee 20). As the whole process of the ET of TIAs (including industrial relocation, pollution treatment and urban renewal) is time consuming, the provision of new facilities in old industrial areas are difficult to realise in short-term (at least ten years, see Fig 8.1). The behindhand facilities of this region were also one of the reasons for the movement of young person.

> "We moved to Tianyuan District, because Tianyuan District, as a new urban area, has better living qualities and education facilities than Qingshuitang TIA […] after the relocation of the industrial company my husband used to work for, we got a sum of money […]. We used this money for part of our new house […]. Our parents were unwilling to move because they've already got used to this living environment. They have old friends here [i.e. TIA region]."
>
> ---- Interviewee 1, a staff member of a private company for environmental protection and energy-saving projects. She is also the mother of a ten-year-old boy. Her parents both worked for an industrial company in Qingshuitang TIA.

In 2018, there were 49,000 permanent aging populations in the Shifeng District, which account for 18.86% of total permanent aging populations in the Zhuzhou city. The permanent aging populations in the Shifeng District expected to increase to 55,900, which account for 20.83% of total number in Zhuzhou City (Data Source: The Civil Affairs Bureau in Zhuzhou City).

During the ET process of TIAs, the problem of an ageing population emerged. When the author visited the residential areas around the Qingshuitang TIAs in 2019, the author only saw older people on the street. Although the infrastructure there was not as advanced as in other areas of the city centre, but their life was peaceful, leisurely and comfortable (Fig 8.9).

Figure 8.9 Elderly people chat, play cards, drink tea and exercise in the residential areas around Qingshuitang TIAs

(Source: Author, image taken in Qingshuitang TIA, 2019)

Local governments also introduced strategies to address the loss of young adults in this area. Some vacant plots after relocation (e.g. an air compressor factory in Qingshuitang TIA) were rebuilt as nursing homes by local government. Nursing homes could provide some positions for unemployed, and the rents could also remit the costs of relocation at a certain extent. Furthermore, many free job trainings and recruitment fairs were held by local government in this area (Interviewee 20). At the same time, local government also made their effort to introduce in large-scale industrial companies. At the end of 2019, Sany Heavy Industry signed a contract with the local government aiming to invest five billion yuan to build a research and development centre for petroleum intelligent equipment in this area (i.e. Qingshuitang TIA). The entrance of a large company like this is estimated to bring at least 10,000 jobs. And with jobs, the region could be revitalized (Interviewee 21).

According to development plans issued by local governments, three TIAs adopted different development directions based on factors such as distance to city centre, ecological resources

and ecological capacities. Pingtang TIA is not located in the city centre, hence, the local government of Changsha city developed it into a large-scale resort area. Both Zhubugang TIA and Qingshuitang TIA are located in city centre areas. The local governments of Xiangtan and Zhuzhou city planned to transform those two TIAs into new ecological urban areas with environmental-friendly and high-tech industries (e.g. logistic, commercial, machinery and rail traffic industries). All three redevelopment projects took into account the importance of landscape (both natural and artificial landscape) but in different ways, such as the Pingtang Ice World in Pingtang TIA and Qingshuihu Ecological Park in Qingshuitang TIA. These will be explored in detail in section 8.2.3.3 as a spatial restructuring process of IAs through ET. Advantages and challenges faced after redevelopment will be discussed in section 8.2.3.3 as well.

Regardless of the redevelopment direction taken, public participation during the spatial planning period of all three TIAs was inadequate. Interviewee 12, a staff member of a local environmental NGO, said that this is a common problem in Chinese territorial planning. Although local authorities made efforts to listen to opinions from the public, for example, they conducted field research when preparing the plan; held a review meeting about draft plans that some public representatives and experts attended; and announced draft plans on the website for the public to comment on (Interviewee 11, a designer of an architecture design institute). However, in practice, those strategies were mere formality that there were not mechanisms for the public to influence the plans. With respect to this phenomenon, interviewee 11, who is a designer at a spatial planning agency, stated difficulties of planning agencies and local government:

> "if this was a small-scale construction project, such as a small public park for surrounding residents, then public participation can be effective. However, as this is about large-scale construction of urban areas which influences not only surrounding residents but also the development direction of the whole city, individuals cannot consider the whole picture. […] But I don't deny that the public could provide some good ideas."
>
> ---- Interviewee 11

The willingness and capabilities of the public to participate in the large-scale spatial planning of city regions were doubted by authorities (Interviewee 11). Nevertheless, local authorities should make more efforts to enhance and stimulate citizen's awareness and participation in these projects.

8.1.3 Driving Forces

From section 8.1.1, we know that the relocation-based transformation of TIAs in CZT was guided by local governments. This section explores the different driving forces of relocation policies by representing the reasons why did local governments willing to make such big efforts to implement environmental projects, and why the relocation project was selected as the solution.

8.1.3.1 Environmental Incident

Xiang River is a crucial drinking water source for residents in CZT. But, there are floods in June and droughts in July every year, which influenced the citizens' water use to a large extent. In 2008, to address this problem, the local government built three dams on the Xiang River in CZT section. However, inherent pollution problems in the Xiang River became more severe due to those water conservancy projects (Interviewee 21).

> "Conservancy projects may slow down water velocity and reduce the river's self-purification capacity."
>
> ---- Interviewee 21, a director of a pollution treatment company

Irruptive environmental problems ignited public concern that the local government could no longer ignore. Before the dams had been in place in 2015, local environmental NGOs, some scholars and local environmental departments criticised the environmental performance of the projects and objected to them (according to Interviewee 12, a staff member at a local environmental NGO). In 2012, environmental NGOs and social media helped to expose the potential environmental crises caused by the water conservancy projects. The objection of those water conservancy projects became an environmental event. And the high attention level earned them a spot on the top ten list of environmental events in Hunan Province in 2012 by citizen's ballot (https://hn.qq.com/zt2012/hj/index.htm). With pressure from all sides, the original opening had been delayed until local government put forth policies and strategies for pollution treatment in the Xiang River. For example, the provincial government of Hunan Province issued the *Prevention and Control of Pollution in Dams Areas* in 2012. The relocation-based transformation of TIAs surrounding the Xiang River is also one of the strategies.

8.1.3.2 As a Comprehensive and Fundamental Solution

Before the relocation-based transformation of TIAs, the local government also considered other ways to solve pollution problems in TIAs. For example, the municipal government of Zhuzhou city published a report to promote remoulding IS chains and implementing circular economy among existing polluting industrial enterprises in the Qingshuitang TIA (Interviewee

4). This strategy is based on a national policy ---- *The Suggestion for Circulation Transformation of Industrial Areas* (2012).

In 2012, the National Development and Reform Commission and the Ministry of Finance published *The Suggestion for Circulation Transformation of Industrial Areas*, and this policy (2012) defines the 'Circulation Transformation of IAs' as:

> "The strategy following a circular economy concept […], reducing, recycling and re-using industrial wastes […], reconstructing the spatial distribution of each factory for resource recycling […], connecting or extending industrial chain [and] ultimately realising 'zero-emission' of wastes and sustainable development of IAs."
>
> ---- The Suggestion for Circulation Transformation of Industrial Areas, 2012:1

Regarding this policy, 50% of IAs in the national class and 30% IAs in the provincial class were ordered to implement circulation transformations from 2011 to 2015. Before the relocation strategy after 2015, the circulation transformation of IAs was a response to the direction of the central government and the increasing environmental problems of IAs. After 2010, many planning and research agencies provided detailed suggestions and reports for the implementation of circulation transformation at Qingshuitang TIA. For example, Deng (2010) claims that IS chains could be built in three levels in existing Qingshuitang TIA without relocation: (1) at the small scale through recycling chains in different departments within the same company; (2) at the medium scale through recycling chains involving different companies within the same industry; and (3) at the large scale through recycling chains involving whole industrial areas, such as the recycling of heating power, water and sulphur.

However, most local governmental sectors thought this circulation transformation was not suitable for the unique situations of TIAs in CZT (according to interviewee 4 and 5). TIAs had endured more than 50 years of industrialisation and pollution and didn't go far enough to fundamentally reduce serious pollution problems in the long-term. Circulation transformation couldn't solve the accompanying economic and urban problems either (e.g. declining industries and urban village problems of TIAs, see below) which triggered local governments to consider a relocation strategy instead of circulation transformation of TIAs.

Most people, including local government and some non-state actors, were pleased with the change in strategy towards relocation because they thought it would improve the regional environment. However, local governments still experienced pressure from some (higher level) officials, private industrial companies and the public before and during the plan's execution. Some government officials worried that this large-scale relocation project would use up a huge

amount of manpower, government funds, and time, as a large number of original workers and residents would also need to be resettled as part of the relocation. Some polluting industrial companies in TIAs also did not want to relocate. They knew the move would temperately stop production and generate only passive economic benefits. The arrangement of old workers and employment of new workers are also very complicated and time-consuming. “Workers who are unwilling to relocate with us [industrial companies] should be resettled and we also need to rehire and train new workers” (Interviewee 7). Some workers and residents were also worried that after relocation, they would lose their jobs and homes as most housing were provided by the industrial companies (Interviewee 20).

In 2013, the local government still persisted the relocation plan of in Qingshuitang TIA and started the preparatory work. They believed that only this strategy could solve such complex and fundamental problems in TIAs (Interviewee 8). The stance was illustrated by a banner that aimed to justify the short-term costs and challenges with the long-term benefits to be gained in Qingshuitang TIA (Figure 8.10). This banner just at the roadside and behind a bus stop. Banners like this one were commonly seen in the region. All of them were announcements presented by local government organisations. The intended audience are the non-government stakeholders such as industrial companies and the public of the region and city.

Figure 8.10 A banner slogan promoting industrial relocation in Qingshuitang TIA: “Short-term pains during the relocation project will achieve long-term development —Leading Group of the Comprehensive Environmental Treatment Project in Qingshuitang TIA [a local governmental agency].”

(Source: Author, 2017)

Regarding the different voices of the relocation project, local governments had positive negotiations with private companies, workers and residents. Although it is hard to make everyone happy, the local government endeavoured to hear everyone’s issues and provide a fast response (Interviewee 14 and 17). This position is also illustrated by a banner encouraging support and participation from multiple stakeholders (Fig 8.11). According to interviewee 20, a

former worker of a relocated industrial company, during communications with the government, people increasingly understood and agreed to these projects. People could see that the relocation of TIAs would benefit industrial companies as well as citizens (details in next heading). However, Interviewee 20 thinks he didn't get enough care during this project. "Employees' representative reach an agreement with local government on how to place us [workers] after relocation, but it didn't with our consent […] as the procedure was legal, we only passively accept the subsidy contract" (Interviewee 20).

Figure 8.11 Two banners issued by local governmental organisations to encourage the public's support and participation. The banner on the left reads, "It's my responsibility and honour to support and participate in the renovation of shanty areas —Leading Group of Renovation Projects of Shanty Areas in Qingshuitang TIA". The banner on the right reads, "Everyone is witness, creator and developer of a new era —The Party Committee and People's Government of Shifeng District, Zhuzhou City".

(Source: Author, 2019)

8.1.3.3 Concurrent Problems of Urbanisation and Industrialisation in TIAs

During 50 years of urban development and expansion in CZT, TIAs were gradually located in or near city centres due to urban expansion. The closing relationship of TIAs with cities made the pollution, economic and spatial problems of TIAs as problems of the whole cities, which highly restricted the continued development of cities.

Firstly, since the late 2000s, the economic output of TIAs in CZT was on the decline. Some backward industries and production lines faced closure. According to *Zhuzhou News* in 2017, the secondary industrial output value of Qingshuitang TIA fell from 26 billion yuan in 2007 to 15 billion yuan in 2016. That's a reduction from 30% of the entire city's output to just 4%.

Secondly, industrial companies located in TIAs were also interested in finding new locations with more substantial space for further development. Land prices surrounding TIAs rose quickly and were no longer available for industrial use in city centre land use plans. The corporate interest in, and demand for, land to build new production facilities is illustrated by this quote from Interviewee 7, a head engineer of a chemical company in Qingshuitang TIA:

> "Our company needed more space for new production lines but the space [in the TIA] was too constricted […]. Relocation to a new and more flexible space was a good choice for the future development of our company."
>
> ----- Interviewee 7, Feb 2017

More spaces also necessitated more equipment and facilities for waste disposal and resource recovery. New production lines and waste recycling facilities accommodated by larger spaces brought great economic benefits for industrial companies (Interviewee 9), so many industrial companies agreed with the relocation strategy.

> "Originally, the Pingtang Iron Oxide Pigment Factory [also called Sanhuan Pigment Co, Ltd.] had 14 mu [0.93 ha] of land in Zhubugang TIA. There was no space for environmental facilities, even though they had wanted one due to the increasing high environmental standards […] As part of the relocation, they moved to a place that occupied 150 mu [10 ha] of land […] They invested 70 million yuan into new production lines and 20 million yuan into environmental facilities [including wastes recycling facilities] in the new location […]. Profits increased by at least one million yuan a year just from recycling and reusing selenium, cadmium and solid wastes."
>
> ---- Interviewee 9, a director at the Geological Environment and Survey Office at the Municipal Land Resources Bureau

Thirdly, TIAs greatly reduced urban land value. City centres usually offer excellent conditions for commercial industries, real estate development and knowledge industries. The presence of resource-intensive industries in centrally located TIAs inhibited the continued economic and spatial development of city centres. Because of this, not only the environmental department, but also the department of urban and land resources, and the department of industrial and Information all endorsed the relocation projects.

Fourthly, the quality of life and the environment around workers and surrounding residents in TIAs fell well behind conditions in other urban areas. Urban infrastructures (e.g. education system, the quality and style of buildings, and green spaces for recreations) were not maintained. Workers and residents wanted to improve their living standard through the opportunity offered by relocation projects, so most of them welcomed these projects if they qualified for reasonable welfare payments from the government (according to Interviewees 7, 9, 14 and 20).

All of these factors contributed to the introduction and implementation of the relocation-based transformation of TIAs (e.g. Table 8.1). Excepting the heavy metal pollution control policies for watersheds, policies for the green development of urban area and industrial areas

published by the central government government also provided the basis and guidance for the relocation-based transformation of TIAs. As a result, the ET of TIAs not only focused on the environmental perspective, but also addressed the concerns around upgrading of industrial structures and the urban renewal of TIAs.

8.1.3.4 Regulation Needed for Spontaneous Activities

Although some industrial companies came together to protest relocation, a few industrial companies (mainly small-sized industrial companies) had relocated on their own before relocation policies came into effect, this is what the 'spontaneous activities' mean in this thesis. This is mainly because of the growing cost of the increasingly-strict environmental standards or due to the limited space for further development (according to Interviewee 8). However, these companies relocated without technological upgrades and without optimizing their facilities for better environmental performance, and most did not move to industrial parks. Pollution became a problem in their new locations (according to Interviewee 8). Then, supervisions and regulations were needed to ensure the relocation and transformation of polluting industries in an orderly manner.

8.1.4 Features and Trends in Industrial Transfers in China

The previous three sections presented general information about relocation-based transformations of TIAs in CZT urban agglomeration which this thesis defines as the third regional industrial transfer in China. The first transfer was the international industrial transfer that occurred in the 1970s-1980s which this thesis considers from a Chinese domestic perspective[37]; the second one is the regional industrial transfer between eastern, central and western China during the early 2000s to early 2010s (see section 3.2.1.1). For a deeper insight into this third industrial transfer, this section places it within the bigger picture of regional industrial transfers in China. It does so by comparing the time period, regional focus, lead industry, drivers, purpose, key actor and instruments which characterise the three regional industrial transfers in the Chinese context (Table 8.3). Core questions here relate to how the characteristics of the third industrial transfer compare to previous industrial transfers (e.g. industrial gradient transfer) or deindustrialisation processes of neo-Fordist cities.

37 From a Chinese perspective, industrialisation since the 1950s focused on the central part of China (according to the '156 Project' during the 5th FYP, and the 'Third-line Construction' policy published in 1964). However, after the international industrial transfer during the 1970s-1980s, development focus, preferential policies, funds, developable spaces and workforces for industrialisation shifted from the central part to the eastern of China.

Table 8.3 The comparative study of three industrial transfers in China

	Phase Ⅰ	Phase Ⅱ	Phase Ⅲ
Time Period	1970–1980s	Early 2000s – early 2010s	Late 2000s – late 2010s
Regional Focus	Central/western China → eastern China	Eastern Coastal China → Cities in the central & western regions	City centres → Suburban areas TIAs → Professional Industrial Parks/EIPs/DZs
Transfer Type	- International Perspective: the fifth international industrial transfer from developed countries to developing countries; Industrial gradient transfer; Deindustrialisation for neo-Fordist city - Chinese Domestic Perspective: shifting of the development focus, preferential policies, funds, developable spaces and workforces	- Regional industrial transfer - Shifting locational choice of FDIs - Industrial gradient transfer - Urban regeneration of eastern cities	- Regional industrial transfer - Relocation-based transformation of polluting industries in TIAs - Urban regeneration of cities in central areas
Main Transferred Industry	Resource-based, capital-intensive, labour-intensive and sunset industries in developed countries	Resource-based, capital-intensive and labour-intensive industries in DZs	Polluting Industries and Resource-based Industries (i.e. Chemical Industries, Nonferrous Metallurgy Industries, Building Materials Industries, Machine Manufacturing Industries, Cement Industries and Mining Industries) in TIAs
Drivers	- Reform and opening-up (especially, the economic opening-up policy of coastal cities) - Loose environmental standards in China - Low costs of workforce in China - Superior traffic location in the east - Good basis of education in the east	- Increasing cost of workforce/tax/environmental treatment in the east area - 'Rise of Central China' policy (2004) - 'West Development' policy (2000) - Industrial upgrading policies - 'Drawing Investors' policy in central and western areas - Good industrial bases built in the central and western to undertake industries from east	- TIAs had severe adverse impacts on surrounding drinking water, air and plant - Relocation-based transformation of polluting industries is a comprehensive and permanent cure of environmental recovery, sustainable development of industries and urban and improvement of citizen's livelihoods - Some industrial enterprise in TIAs also want to relocate for economic benefits: the development of enterprise in TIAs was restrained by limited spaces

Leading Actor	Central government	Central government	Sub-national government
Main Policy Instrument	Incentive Economic Policy	Incentive Economic Policy; Incentive Environmental Policy	Compulsive Environmental/Urban Planning/Economic Policies
Purpose	'Let a part of the region get rich first', participates global market, facilitates socialist modernisation, let east China become the economic centre nationally and internationally	'The rich first pushing those becoming rich later', then realising 'Common Prosperity' and balanced national development	Environmental treatment (especially, city centre and watershed), urban regeneration, livelihood improvement ('urban village' problem), industrial upgrading and transition/switching of economic growth pattern

(References: Chen, 1985; Song, 1994; Sun, 1999; Li and Miao, 2006; Feng et al., 2010; He and Liu, 2012; Interviews and governmental reports)

8.1.4.1 Industrial Gradient Transfer?

Two previous transfers were defined as industrial gradient transfers where industries gradually moved from advanced areas to less-advanced areas (i.e. developed countries to developing countries; Chinese eastern areas to central and western areas) (Zhou and Cao, 2010; Liu et al., 2014). However, whether or not the third industrial transfer fits the industrial gradient transfer remains to be seen.

On the one hand, the relocation process of polluting industries has some features of the industrial gradient transfer. Industries moved from city centres with stronger economies to the suburbs with weaker economies. On the other hand, the third industrial transfer is not characterised by all features identified for previous industrial gradient transfer. First, relocated industries were not in the last phase of their life cycle and were not facing elimination. Following guidance from central government, sub-national governments compiled a list of sunset industries in their region which were all closed down and not relocated (according to Interviewee 7 and 14). Relocated industries were still economically viable with potential for growth. For example, many companies expanded their production lines after relocation. Although some state-owned industrial companies showed a decline before relocation, they were not sunset industries. Some state-owned companies do not have economic profits at their core, but focus on providing jobs and production (Interviewee 17 and 18).

Second, low economic activity was not the main criteria for location choice. Upon asking how companies chose their new, relocated areas, space capacity, availability of infrastructure, distance, access to raw materials, and political support and upstream–downstream industrial systems for future development were found to be the main factors (Interviewees 2, 4 and 7).

> "Lots of companies moved to the National Green Chemical Industrial Park in Yueyang city mainly because of the mature upstream-downstream industrial system and excellent services of this industrial park."
>
> —Interview 4

> "Our company moved to Hubei Province. The main reason is that one of the main raw materials comes from Hubei and the transport costs could be reduced. Simultaneously, the DZ of Hubei warmly welcomed us."
>
> —Interview 7, Head Engineer of Chemical Industry Company in Qingshuitang TIA, Feb 2017

> "I chose the Lukou DZ in Zhuzhou because the distance of it from the previous location is very short, approximately 45 minutes by car. The main managers and workers could still live in their homes and enjoy the reasonable commuting distance. Another main reason is the support of the government in Lukou district, it makes the development of my company smoother in the future."
>
> —Interview 2, Chairman of Chemical Company, Feb 2017

In addition, some industrial enterprises only moved their production facilities or parts thereof away, but kept the head offices in the original locations. For example, interviewee 7's company only moved the smelting factories to the new place but retained the head office location (i.e. Qingshuitang TIA) in the city centre. In this way, pollution was moved, but other non-polluting functions of the company remained in the city centre. There is the tendency to become an 'Enclave Economy Model'. Enclave Economy Model is a regional economic cooperation approach of nonadjacent industrial areas in different regions for the win-win purpose. Economic level of receiving areas was increased through the industrial transfer. At the same time, the departure areas also benefited from it through relocation.

Lastly, different from the previous two industrial transfers, economic gains were not the main objective in the third industrial transfer. Although this relocation project also applied market principles as both departure and receiving areas received economic benefits, however, sub-national governments played a vital role and were more concerned with the sustainable development of urban areas and improved quality of life and public welfare resulting from the relocation projects including health benefits through environmental protection, pollution treatment, infrastructure construction.

As a result, although this relocation-based transformation seems like an industrial gradient transfer at first glance, it is different in nature.

8.1.4.2 Deindustrialisation for Neo-Fordist City?

The international industrial transfer could be regarded as an approach or a phenomenon of the neo-Fordist city development in Western countries (see section 3.2.1.2). During the relocation-based transformation of TIAs in China, cities as departure areas (i.e. CZT) seemed to follow a Neo-Fordist City trend.

First, the policy focus shifted from welfare to supply-side. Following the guidance of the central government, the Hunan provincial government issued the *Supply-side Structural Reform and Four-Year Plan of the Upgrading of Industrial Structure* in 2016 (the year before the relocation of Qingshuitang TIA). The main objective of those policies was to raise the level of productive forces by (1) deindustrialising recessionary industries and industries with heavy contamination, energy-extensive consumption and high emission, such as steel, nonferrous metals, cement, papermaking and coal mining industries; (2) promoting high-tech industries (e.g. electric locomotive, rail transportation, engineering machinery, new energy vehicles, integrated circuits and new material industries); (3) promoting tertiary industries, i.e. emerging service industries, tourism industries and modern logistic industries (Fig 8.12 shows the added value of tertiary industries exceeding that of secondary industries for the first time in 2015 in Hunan Province); (4) promoting creative industries through the introduction of preferential policies (e.g. reducing taxes); (5) assigning management organisations of industrial parks more powers (e.g. they could now assess industries and determine whether they could leave or stay) to stimulate innovation and market vitalities; and (6) growing the proportion of the urban population through a reform of household registration and land (Fig 8.13).

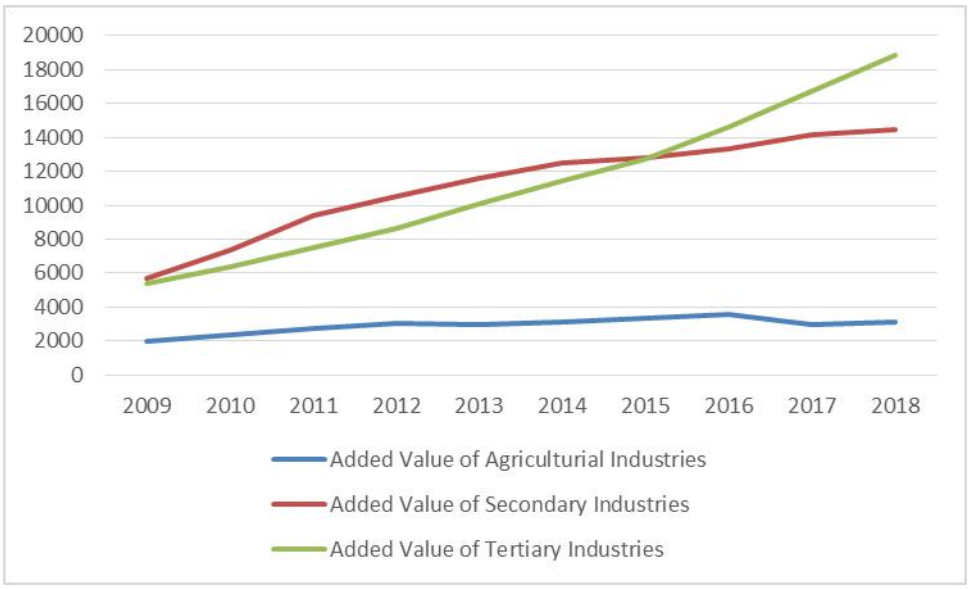


Figure 8.12 The Added value (100 million yuan) of three categories of industries in Hunan Province, 2009-2018

(Data Source: National Data, http://data.stats.gov.cn/)

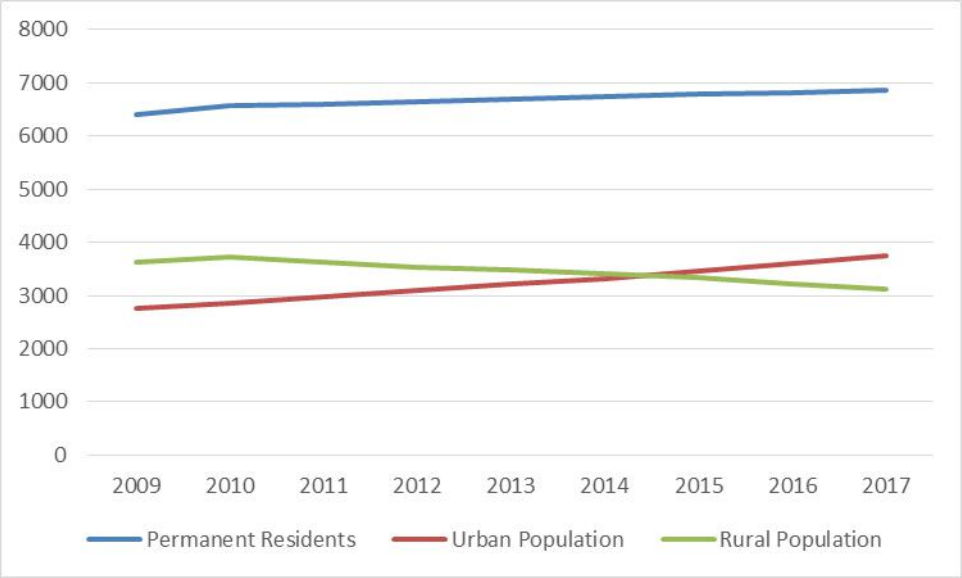
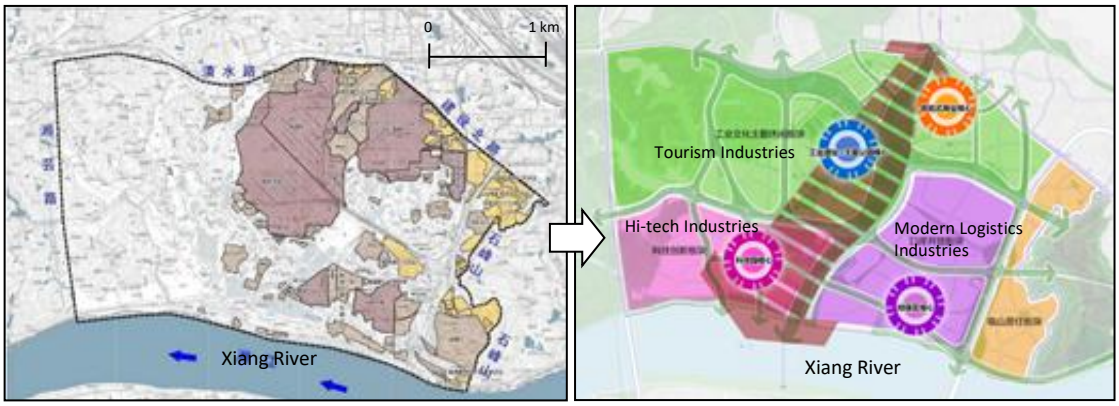


Figure 8.13 The population of urban exceeded the population of rural areas in Hunan Province after 2014, this is a sign of urbanisation

(Data Source: National Data, http://data.stats.gov.cn/)

Second, during the relocation-based transformation, secondary industries in the city centres were gradually replaced by tertiary industries, such as service industries, commercial industries, tourism industries (e.g. industrial heritage ecological park in Xiangtan) and hi-tech industries (e.g. rail equipment industrial park in Zhuzhou city). The industrial plan of Qingshuitang TIA in Zhuzhou city during the relocation-based transformation is a good example of this process (see Fig 8.14). An industrial heritage park would also be built in this region to improve access to culture, landscape, leisure and entertainment (Interviewee 5).



Areas with purple colour: spatial distribution of resource-intensive industries in Qingshuitang TIA in 2014

Resource-intensive industries planned to be replaced by tertiary industries

Figure 8.14 The industrial plan (left) shows the spatial distribution of resource-intensive industries. The plan on the right shows envisioned new industries as result of the relocation-based transformation of the Qingshuitang TIA which will replace secondary industries, which were originally in the city centres

(Source: *The Implementation Plan of the Relocation and Transformation of Qingshuitang TIA* issued by the government of Shifeng district in Zhuzhou city in 2014, translated by the author)

Third, this relocation project enabled equal development of suburban areas. On the one hand, large-scale professional industrial parks in suburban areas were built or developed for industries relocated from TIAs in city centres (details in section 8.1.2.2 and section 8.1.2.3), thereby boosting the regional and local suburban economy. On the other hand, large-scale theme parks and fantasy lands were built in suburbs as the redevelopment of TIAs (e.g. Dawangshan Resort Area transformed from Pingtang TIA). The sub-national government paid more attention to the traffic system between cities with suburban areas and also among cities in the urban agglomeration (details in section 8.2.3.1).

However, some key criteria of the neo-Fordist city were not met during the relocation-based transformation of TIAs. For the redevelopment of TIAs, large-scale industrial companies were seen as the main driving forces, and the prefecture level of government made substantial efforts to attract such companies (Interviewee 5, 9 and 15). However, the development of small- and medium-sized creative industries were not adequately promoted. Furthermore, different from the deindustrialisation process in advanced Western countries (e.g. UK and USA), China did not adopt absolute deindustrialisation, and heavy industries are still the focal point of industrial development (Zhang, 2009; Chen and Lin, 2010). Urbanisation lags behind industrialisation in China (Ye, 2009; Lin and Wang, 2012). The deindustrialisation phenomenon in city centres is an adjustment of this imbalance between urbanisation and industrialisation (Interviewee 15, a Director of the Strategy Planning Department of a PC). This section does not assert that China should enter a neo-Fordist city mode as the suitability of this mode in the Chinese context remains unclear. However, this comparative study can reveal the differences in the Chinese context.

8.1.4.3 Synergies between the Environment and Economy

The main trigger points for the previous two industrial transfers were policies and strategies with an economic purpose. Environmental policies were indirect factors, and environmental benefits in departure areas could be regarded as unintended positive consequences of industrial transfer. However, environmental policies were the main drivers of the third industrial transfer environmental concerns a strong objective (interviewee 4 and 17).

In Section 8.1.1, Table 8.1 lists the guiding policies for the relocation and transformation projects of TIAs in the CZT city agglomeration. Although those policies were published not only by environmental departments but also other departments for different purposes (e.g. urban regeneration and upgrading of industrial structure), all of them include aspects of environmental protection.

Moreover, policies for the third industrial transfer are more binding. Industrial enterprises, workers and residents could negotiate with governments (e.g. by devising more preferential policies), but the decision about relocation and closing down of identified polluting industries in TIAs was unnegotiable (Interviewees 2, 7 and 19). Some industrial enterprises did not have enough incentives to make changes for environmental protection (Interviewee 14). Without regulations and robust implementation by sub-national governments (especially, prefectural level of governments), this relocation-based transformation of TIAs could not be realised.

> "The main reason for our relocation was the policy issued by the government. We cannot violate those policies, but we still could communicate and negotiate with governmental organisations and make an appropriate alteration to fit each company within reasonable limits. […] Without a doubt, we understand this policy, pollution of Qingshuitang TIA to Xiang River and the whole region is serious."
>
> —Interview 2, Chairman of Chemical Company, Feb 2017

Environmental benefits for 'departure areas' after the third industrial transfer were immediate. From the data provided by the government in Xiangtan city during an interview in 2017, after the relocation and closing down of projects in Zhubugang TIA in 2014, electricity consumption was reduced by 96 million kilowatt-hours, wastewater discharge decreased by 2.6 million tonnes, and emission of sulphur dioxide and nitrogen oxide compounds were reduced by 20 million tonnes. During the pollution treatment of the lands formerly occupied by a large-scale polluting industrial company, 55,000 tonnes of building rubbish, 9,000 tonnes of residues and 3,520 tonnes of wastewater were disposed of. Workers and residents in Qingshuitang TIA also felt that the environment had improved (Interviewee 1, 2, 3, 7 and 20).

> "When I worked here [in Qingshuitang TIA], there were strong chemical odours. But after the relocation and closing down of most industrial companies, the smell has almost gone."
>
> —Interviewee 7, Head Engineer of Chemical Industrial Company in Qingshuitang TIA

The environmental performance in receiving areas which was overlooked during previous two industrial transfers was also considered by the sub-national government during the third industrial transfer. All industrial enterprises were ordered to enter into professional industrial parks with professional environmental facilities and systematic environmental supervision and monitoring (details in section 8.1.2.3). Polluting industrial enterprises need to achieve the environmental standards before restarting in new areas. Governments in 'departure areas' would also track the industrial enterprises in their new places. Under such government pressures and because of economic benefits from environmental protection, the polluting

enterprises invested more in environmental devices after relocation. For example, the Xiangtan Electrochemical Scientific LTD. moved from Zhubugang TIA to the Heling Industrial Park in the suburb area of Xiangtan city in 2015, and it invested 50 million yuan for environmental projects in the new location.

> "Manganese in wastewater reduced 23.2 tons in 2015, which accounts for 90% of the amount in 2014. Moreover, the recycling and reusing of wastewater saved half of the water consumption in previous years."
>
> —Interviewee 9, Director of Municipal Land Resources Bureau (Geological Environment and Survey Office)

Nevertheless, the third industrial transfer is not merely for environmental protection, but it also allows for synergistic economic development and environmental protection in the long term. Through large-scale relocation of polluting industries in TIAs, a large amount of land, workforce and resources previously used by backward production facilities were used by emerging and environment-friendly industries (Interviewee 15, the director of the Strategy Planning Department of a PC). In order to counterbalance the economic loss of employment and economic profits through industrial relocation and close-down, governments in CZT rapidly introduced new industries. A Director of a prefecture level of government (Interview 6) claimed that the development of tertiary industries (e.g. hi-tech industries) is the foremost solution to relieve the economic pressures in 'departure areas' generated by the relocation and closing down of traditional industries in TIAs.

For example, during 2017-2018, there were approximately 153 industrial enterprises in Qingshuitang TIA (in Shifeng District, Zhuzhou City) which were relocated or closed down (details in 8.1.2). Investment in secondary industries, particularly heavy metal industries and chemical industries, declined in 2018 (Table 8.4 and 8.5). However, the regional GDP of Shifeng District still increased by 7.2% in 2018. This is mainly due to the development of greener tertiary industries in the region, e.g. tourism and rail transport industries. Investment in tertiary industries exceeded the number of secondary industries, and more attention has been paid to hi-tech industries (e.g. aerospace manufacturing industries) in 2018 (Table 8.4 and 8.5). According to the director of a prefecture level of government (Interviewee 6), although these hi-tech and tertiary industries need higher initial investment and are established after an inertia period, their sustained momentum and benefits for both the environment and the economy cannot be underestimated.

Table 8.4 Investment Amounts for Different Industrial Types in Shifeng District, Zhuzhou City, 2018

(Data Source: The Governmental Statistical Bulletin of Shifeng District, 2018)

Industrial Type	Investment Amount (100 million yuan)	Proportion (%)
Secondary Industry	60.3	37.2
Tertiary Industry	102	62.8

Table 8.5 Added Values and Growth Rates of Main Industries in Shifeng District, Zhuzhou City, 2018

(Data Source: The Governmental Statistical Bulletin of Shifeng District, 2018)

Industrial Category	Added Value (100 million yuan)	Growth Rate (%)	Proportion (%)
Total	165.9	7.2	100
Transportation Equipment Manufacturing Industries (e.g. railway, ship and aerospace)	74.9	14.2	45.1
Electronic Equipment Manufacturing Industries (e.g. computer and communication devices, etc.)	41.2	10.3	24.8
Nonferrous Metal Smelting and Rolling Industries	33.7	-6.4	20.3
Electric Power, Thermal Power Production and Supply Industries	4.8	11.9	2.9
General Equipment Manufacturing Industries	3.0	9.6	1.8
Manufacture of Non-metallic Mineral Products	2.4	-4.6	1.4
Manufacture of Metal Products	1.7	-10.5	1.0
Specialized Equipment Manufacturing Industries	1.5	37.4	0.9
Chemical Raw Materials and Chemical Products Manufacturing Industries	1.3	-40.3	0.8
Electrical Machinery and Equipment Manufacturing	1.1	13.7	0.7
Comprehensive Utilization Industries of Waste Resources	0.3	31.4	0.2

At the same time, receiving areas also achieved economic growth with low pollution risks, which is also why sub-national governments preferred to retain industrial companies within their cities or province. Larger spaces, professional services and preferential policies in new places positively influenced the economic development of industrial companies and also of the region. For example, a biological medicine company and a chemical industrial company previously located in Zhubugang TIA expanded their production lines in new places (Jiangxi province) and increased revenue four- to fivefold (Interviewee 8, a local governmental official).

Therefore, synergetic development of the environment and the economy in both the departure areas and receiving areas is achieved through such relocation-based transformation of TIAs.

To sum up, the third regional industrial transfer in China, investigated in this thesis, is a state-led relocation-based transformation of polluting industries in TIAs. Given its long-term and comprehensive achievements for the environment, economy and urban realm in the region, it could be regarded as the greening of industrialisation and urbanisation and a practice of EM in China.

8.1.5 Remaining Problems and Criticisms

There are, however still some problems to be solved. Firstly, during the relocation-based transformation of TIAs, certain steps implemented at the same time to reduce the time frame of the process, but there were still some problems regarding the connection of each procedure. During the relocation-based transformation process, three main steps—relocation and closing down, pollution treatment and redevelopment—were led in cooperation by governmental sectors (incl. multiple governmental departments, leading groups, PCs, spatial planning and design agencies) and non-state stakeholders (incl. industrial companies, companies for pollution treatment, and citizens). The three main steps should be taken in sequential order, but since different areas required a different amount of time to complete each task, the three activities often happened at the same time in different parts of one TIA. The overlaying of steps shortened the total duration of the transfer process and reduced the economic loose that came from the large-scale retreat of secondary industries in the region. However, there were still some problems regarding the connection of each step. “If the former step delayed in finish, then the later step cannot implement in time, which will generate the waste of manpower and material resources” (Interviewee 9, a local government official).

Secondly, the environmental supervision of each procedure was insufficient, resulting in multiple environmental problems arising. Interviewee 21 indicated that there were some pollutant leakage problems during the demolition of industrial devices for relocation and close down. Interviewee 7 stated that continuous pollution problems in receiving areas still existed (details in section 8.1.2.3). It was also noted that the standards for the acceptance inspection during pollution treatment was unclear, which may have had an influence on the ultimate results of treatment (Interviewee 21). Moreover, the monitoring mechanisms for new industries in the region were inadequate and lacked specific environmental supervision suggesting potential for new pollution problems in the future. Regarding the relocated industrial companies, governments in departure areas expressed their intention to visit and

review the current situations of industries in receiving areas and ensure that these industries are not the cause of environmental burdens in new places (Interviewee 21). While good in theory, there are challenges and questionmarks as to how this will be put into practice as there is no precise mechanism in place for environmental supervision across administrative boundaries.

If the superior levels of governmental organisations (e.g. organisations at the provincial or urban agglomeration level) coordinate their efforts, supervision across administrative boundaries can be more easily realised. But that question how many environmental responsibilities the governments in departure areas should assume. This is difficult to define, and further discussion and clarification is needed. Although the rescaling-up and soft recentralisation of environmental governance in China which started in 2015 (details in section 7.2) has the potential to increase the environmental performance of practices in region (e.g. the relocation-based transformation of TIAs in CZT)[38], a comprehensive environmental supervision and monitoring mechanism for each procedure that crosses administrative boundaries needs to be ensured. Without this, strengthened power of environmental departments after vertical reform will exist in name only.

The third problem involves public participation. While environmental NGOs had more influence over the transformation of TIAs than ever before (details in section 8.1.3), it is difficult for them to participate in policy-making and the decision-making process directly and effectively, particularly in regard to the territorial space planning. This thesis suggests that, on the one hand, capabilities and awareness of the public should be enhanced, on the other hand, more ways for the public to influence policy-making indirectly should be encouraged. Driving forces presented in section 8.1.3 could be used as references. For example, civil society organisations could exert more pressure on sub-national governments by providing transparent data and using media opinions to intensify contradictions of environmental events.

The fourth problem relates to sub-national governments paying more attention to large-scale industrial companies during the redevelopment stage, giving less attention to middle- and small-sized companies, which included innovation and creation industries in niche perspectives.

38 The central supervision strategy (details in section 7.2.1.1) of the sub-national environmental performance which began in 2016 had a positive effect on the relocation-based transformation projects. For example, lots of pollution problems during the relocation-based transformation in CZT were found and rectified by the central supervision (Interviewee 14). The vertical reform of the sub-national environmental department had not yet been pursued in CZT during the time of the interview and investigation period of this study (2017–2019), so the effects of vertical reform on the relocation-based transformation of TIAs could not be determined. But according to interviewee 14, theoretically, vertical reform was expected to solve some of the problems.

To summarise, the changes to the role of institutions in governance arranagements can influence the effectiveness on the greening of industries and urban areas. The problems that arose, and remain unresolved, during the relocation-based transformation process of TIAs in CZT indicate the inadequacy of the present governance situation.

8.2 The spatial restructuring of IAs through ET

The previous section (8.1) analysed the spatial movement of polluting industries in TIAs as the new phase of regional industrial transfer was influenced by ET policies and strategies. However, one of the new key characteristics of the ET of IAs was that spatial changes also involved structural changes not only in TIAs but also in DZs. Thus, this section will explore the spatial restructuring of IAs through ET focusing on three aspects: the spatial distribution and area size of IAs, the spatial density of industrial companies in an IA, and the spatial relationship between industrial areas with others (i.e. other industrial areas, other urban functional areas and landscapes). Since the geographical movement of polluting industries has a close connection with the spatial restructuring process of IAs, the relocation-based transformation of TIAs will also be discussed.

8.2.1 Spatial Distribution and Area Size

This section explores the changing share of area size of secondary and tertiary industries in CZT. Here, tertiary IAs refer to areas containing hi-tech industries, knowledge industries, information industries, areas identified as HIDZs, creative industrial parks or central business districts (CBD). Secondary IAs refer to areas containing manufacturing industries, areas identified as TIAs and ETDZs. The data came from two versions of the urban comprehensive/detailed spatial plans taken from between 2006 and 2017 of three cities—Changsha, Zhuzhou and Xiangtan—in CZT that were released by the local urban planning agencies. These plans were issued by local governments and illustrate the spatial strategies of industrialisation in the cities. The causes of the spatial changes will also be discussed, drawing on information gathered in interviews.

Information extracted from the Urban Comprehensive Spatial Plan for Changsha city (versions 2010 and 2014) was used to map the distribution of two kinds of industries in Changsha for the two years (Fig 8.15). Fig 8.15 clearly shows the changes in the distribution and size of secondary and tertiary IAs. The tertiary IAs (mainly knowledge industrial parks and business parks) increased in the city centre and were uniformly distributed (the distances between them were nearly the same) taking up approximately the same size. The locations of the secondary IAs (composed of mainly ETDZs) remained almost unchanged relative to the tertiary IAs, but showed a slight trend towards integration of other industrial sectors resulting in the

merger of previously separate locations in the eastern part of the city, the deconstruction of IA in the northwest and a slight growth of remaining secondary IAs.

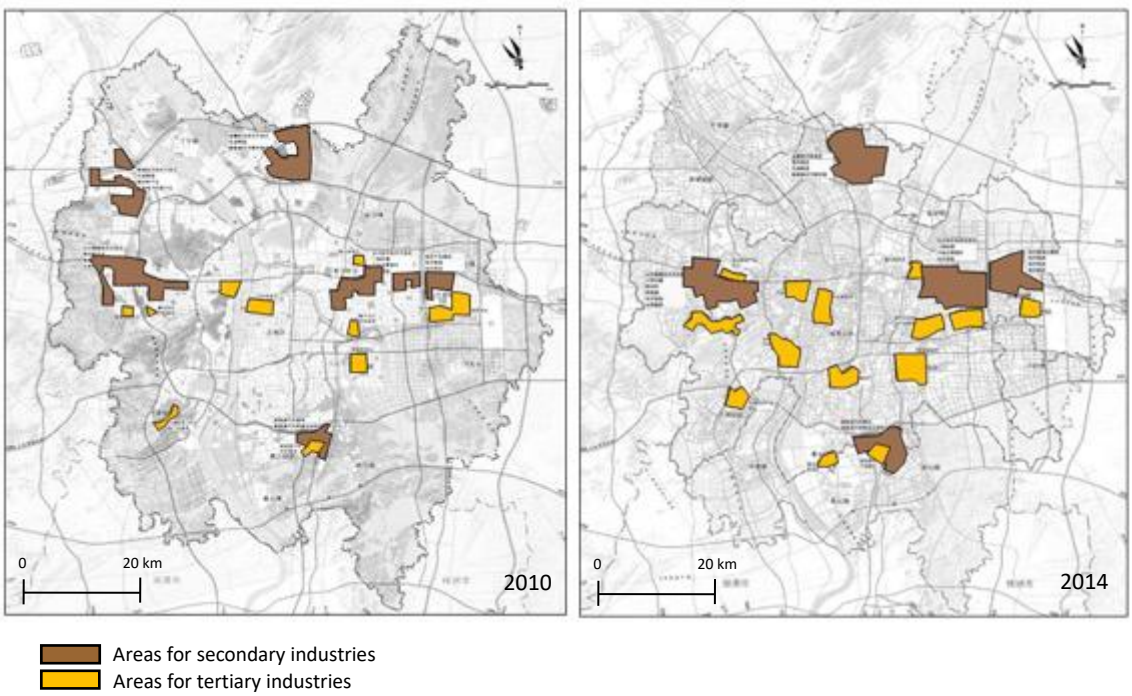


Figure 8.15 The spatial distribution of secondary and tertiary IAs in the Changsha city centre in 2010 and 2014

(Sources: The Urban Comprehensive Planning of Changsha City 2003-2020, revised versions in 2010 and 2014, compiled by the Author.)

Zhuzhou city presents a somewhat similar picture. The changes in industrial distribution between 2006 and 2017 were revealed by two versions (2006 and 2017) of the Urban Comprehensive Spatial Plans of Zhuzhou city (Fig 8.16) where the size of the tertiary IAs increased, while the size of the secondary IAs (especially those in the city centre and along the Xiang River) decreased much more dramatically than in Changsha. Tertiary industries replaced secondary industries in the city centre area in particular along the river. One primary driver of this phenomenon was the relocation of polluting industries from the Qingshuitang TIA (marked by red circle in Fig 8.16), which was discussed in detail in section 8.1. The development of tertiary industries was regarded as a crucial approach to environmental protection and sustainable economic growth in urban areas.

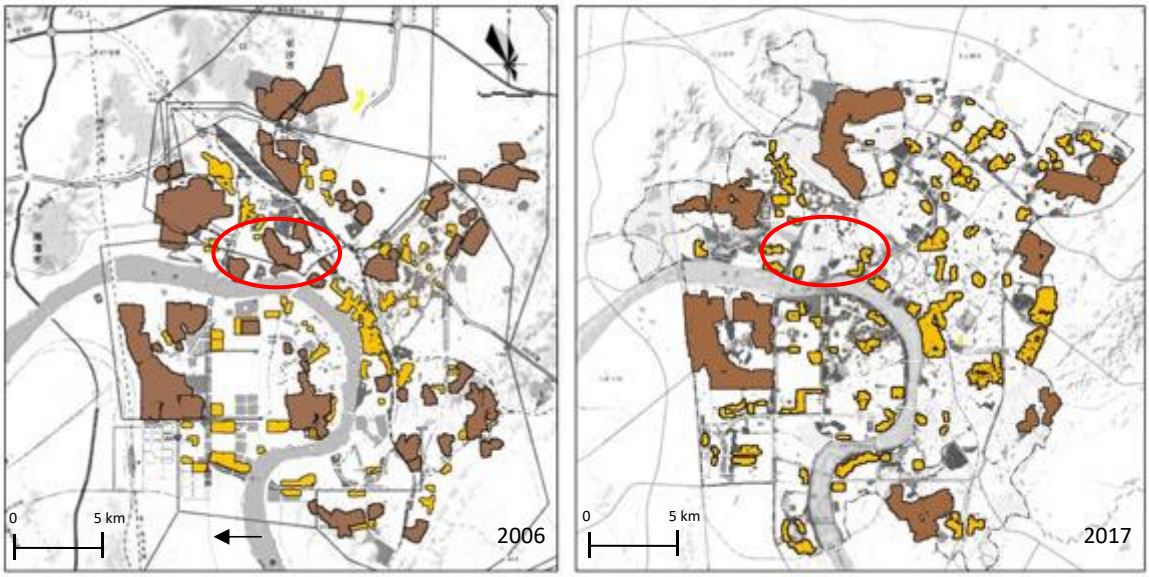


Figure 8.16 The distribution plans of secondary and tertiary IAs in the Zhuzhou City centre in 2006 and 2017.

(Sources: The Urban Comprehensive Planning of Changsha City 2006-2020, revised versions in 2006 and 2017, compiled by the Author).

In terms of pollution levels, the Chinese land policy classifies IAs into three classes based on pollution levels. The first class of IA refers to industries causing insignificant pollution and which have no effect on the surrounding residential areas and infrastructure. These include the electronic industry, apparel industry and handicraft industry (pollutions of these industrial still exist, but comparing to other polluting industries, they are insignificant). The second class of IA includes industries which generate a small amount of pollution and have limited effect on the surrounding residential areas and infrastructure, such as the food industry, pharmaceutical manufacturing industry and textile industry. The third class of IA refers to industries that cause severe pollution and have a great impact on the surrounding residential areas and infrastructures, such as mining, metallurgy, large and medium-sized machinery manufacturing and the chemical, paper and building materials industries (Source: Code for Classification of Urban Land Use and Planning Standards of Development Land, Ministry of Housing and Urban-Rural Development, 2011). Fig 8.17 shows the changes in land-use distribution of IAs distinguishing between the three industrial classes in 2010 based on the Detailed Spatial Plan of the Xiangjiang Ecological Economic Zone (2010). The actual industrial land use in 2010 was mainly restricted to the second and third class (Fig. 8.17, left), but the 2010 plan (Fig. 8.17, right) envisioned to enlarge the share of first-class and second-class IAs. The data from the Urban Comprehensive Planning of Xiangtan City (2008-2020) indicates that the industries in the second class of IAs are mainly secondary industries (e.g. the Shesi Heavy IA), and the industries in the first class of IAs are mainly tertiary industries (e.g. Xiangtan HIDZ and

University Town Science Park). Some changes have already generated according those envisioned plans. The small-scale IAs (mainly in the second and third class), scattered across the city centre and located along the Xiang river, have been relocated or closed down, such as the Zhubugang TIA (marked by red circle in Fig 8.17), as a result of the industrial transfer discussed in section 8.1. Guided by the provincial government, the municipal authorities in Xiangtan city regarded the 'Retreat (of secondary industries) into Three (tertiary industries)' project in Zhubugang TIA as an essential political mission to improve livelihoods construct a 'Resource-saving and Environment-friendly Society (Two-oriented Society)'. For example, according to the Comprehensive Spatial Plan of the Yuetang District in Xiangtan City (2016-2020), Zhubugang TIA was renamed as the Yuetang DZ after the relocation-based transformation, and now mainly hosts tertiary industries, such as modern logistics, commerce and trade, exhibition and cultural leisure industries. "It's an upgrading of the industrial structure and also a way for better environment qualities" (Interviewee 8).

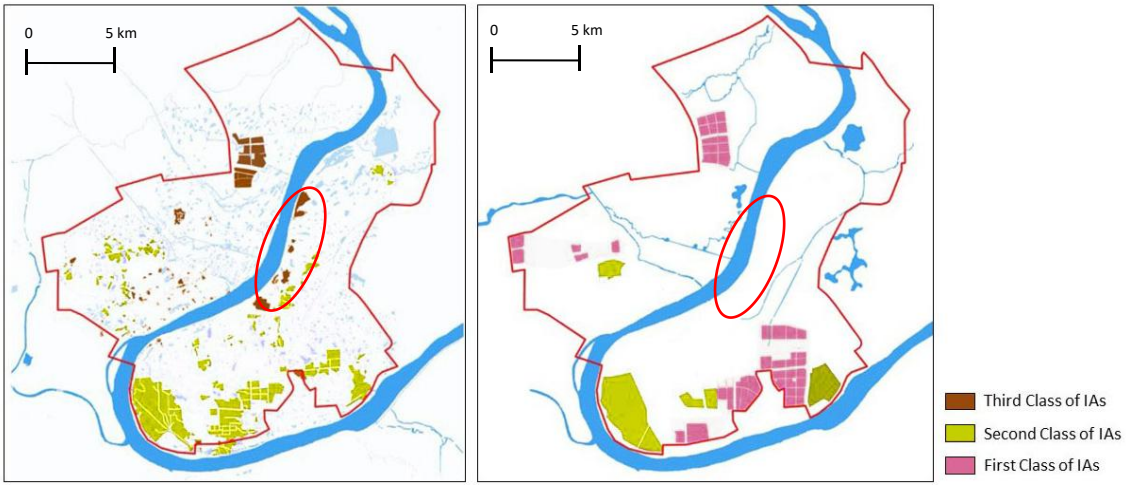


Figure 8.17 The actual land use situation (left) and envisioned plan (right) of industrial land use in the Xiangtan City centre in 2010

(Source: The Detailed Planning of the Xiang River Ecological Economic Zone in Xiangtan City, 2010, compiled by the Author).

To summarise, in the 2010s, the area size and location of secondary and tertiary IAs of the three cities in CZT changed. The size of IAs with mainly secondary industries (particularly those in the city centre and along the Xiang River) decreased, and the size of IAs with mainly tertiary industries (especially those in the city centre) increased. These changes were all triggered by local policies for industrialisation, urbanisation and environmental protection, such as the relocation-based transformation strategy for polluting industries in TIAs and the upgrading strategy of industrial structure, such as the 'Retreat (of secondary industries) into Three (tertiary industries)' project, released by the local government in CZT during the ET of IAs.

There are three fundamental reasons for those changes. Firstly, areas with tertiary industries are regarded as the first class of IAs that produce little to no pollution and do not affect surrounding residents. At the same time, the development of tertiary industries is seen as a solution to the economic loss caused by the relocation and closing down of polluting industries and as mechanism to ensure long-term economic growth of the city (Interviewee 6). Second, tertiary industries were intended to locate in a dispersed pattern equidistantly over the whole city through a polycentric development strategy of urban areas to achieve balanced development. Secondary IAs in the suburbs were intended to become more integrated. Professional industrial parks and EIPs applying circular economy principles and including comprehensive services (including environmental and financial services) were newly built or improved in the suburbs, and all secondary industries were ordered to relocate into industrial parks. Some of the polluting industries from the city centre became part of industrial parks in suburban areas after relocation and transformation (details in section 8.1.2.3). Thirdly, the change in distribution could be a result of urbanisation catching up with industrialisation. Industrialisation was the focus for many years in China, as opposed to urbanisation. In the past, the secondary industries enabled these three cities in CZT to develop, but now those same industries hinder their further development. The shift from secondary to tertiary industries improves the function of the city centres.

8.2.2 Spatial Density

'DZ Fever', a term used to describe the time period (the mid-1990s) where a large number of DZs mushroomed without restrictions, caused problems because of the absence of land-use regulations (Interviewees 4 and 17). At the end of 2004, there were 6866 DZs in China that occupied 38,600 km^2 (Ministry of Land and Resources). "One county had tens of DZs than before at that time" (Interviewee 15). The number and area size of the DZs increased uncontrolled, which in turn resulted in the reduction of high-quality farmland and degradation of vulnerable ecological systems (Interviewees 4 and 17). Moreover, a large number of DZs engaged in a seemingly 'race to the bottom' as they had to lower their standards (including environmental standards) to attract investments (Interviewee 14). Thus, after 2005, a series of policies and regulations were published to reduce and control the uncontrolled development of DZs. Following the introduction of the policy, the number of DZs in China declined sharply. In 2005, the number of DZs decreased from 6866 to 2053, and the area they occupied decreased from 38,600 km^2 to 13,700 km^2 (Ministry of Land and Resources). An intensive land-use pattern was adopted during the development of DZs.

> "Environmental problems fundamentally due to the uncontrolled land development, and extensive land use mode."

---- President Xi Jinping, 2013 (Governmental Meeting Records)

Data from the *Hunan Statistical Yearbook* (2011-2017) were used to calculate the total land area of the provincial and national DZs and the total number of industrial companies in Hunan Province from 2010 to 2016. The average size of industrial companies in IAs in Hunan province was obtained by the division of the total number by the total area size each year.

The formula is as follows:

$$y_i = x_i \div n_i$$

where y is the size of land occupied by each industrial company, n is the total number of industrial enterprises in DZs of Hunan Province, x is the total area size of the IA in Hunan Province and i refers to the year from 2010 to 2016.

The average size of industrial companies also shows the density of the IAs each year (Fig 8.18). The density of industrial land use was at a low level until 2012, where it increased dramatically; then from 2013 to 2016, it arise gradually.

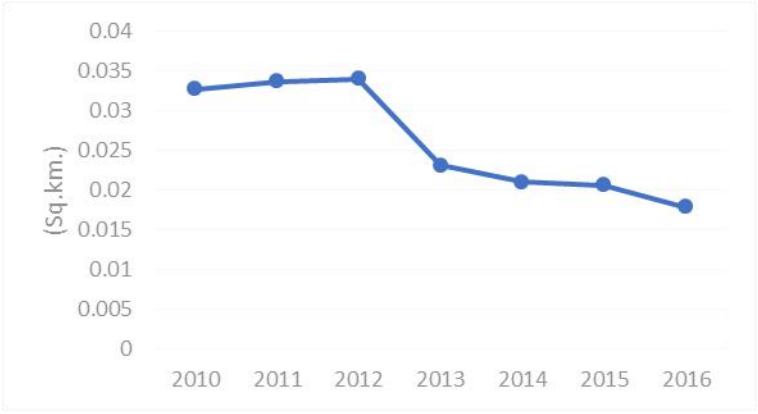


Figure 8.18 The average size of industrial company in DZs in Hunan Province

(Data Source: Hunan Statistical Yearbook)

In order to promote the intensive land-use of IAs, the Hunan Provincial Government issued the *Suggestion about Abolishment and Control of the Expansion of Development Zones* in Hunan Province in 2011. As a result, some authorised DZs were abolished, and some DZs were suggested to be merged together (Interviewee 15). In 2014, Hunan Province released the *Advice about the Industrial Real Estate*[39] *Construction in Industrial Areas,* which recommended enhancing the density of industrial real estate in IAs at between 35–45%, and the share of green space of an IA at a minimum of 10 –20%. In 2016, the Hunan Provincial Government

39 Industrial real estate refers to real estate for industrial production, industrial research & technology, and administrative / office functions of industrial enterprises.

published the *Advice for Further Strengthening of Intensive Land Use* and the intensive land-use mode of DZs was emphasised further.

The government in Hunan province also initiated a number of marketing approaches and management strategies to stimulate the intensive development of IAs, as follows (sources: Interviewees 14 and 15; *Plan of CZT Urban agglomeration 2008-2020, 2008; The Standard of the Lowest Price of Industrial Lands in China*, *2009; Advices for Further Strengthening of Intensive Land Use in Hunan Province*, 2016; *Promoting Resilient Ways to Transfer the Possession of Industrial Lands in Hunan Province*, 2018):

- Strengthening the controlling force of governments to IAs (Interviewee 15).
- Reducing the rentable duration of industrial lands. Generally, the time duration of industrial land use decreased from 50 years to 10–30 years. The transfer of the possession of industrial lands became more flexible.
- The adjustment of the pricing system of industrial land and an increase in the price of industrial lands.
- The introduction of tax incentives to promote intensive land use. For example, owners of idle land and inefficiently used land would pay the highest tax and cannot benefit from any preferential policies.
- Encouragement to redevelop brownfield sites and the re-use of idle industrial lands, such as the re-development of TIAs after the relocation of polluting industries (section 8.1.2.5). The re-development of TIAs can be seen as a kind of urban regeneration which "accounts for more than 50% of all urban regeneration projects in Zhuzhou City in 2017" (Interviewee 14). Governments also facilitated the re-use of idle industrial lands through preferential policies (e.g. lower prices): "It's more and more difficult to get the green light to expand industrial areas" (Interviewee 15).
- The intensive land-use of IAs being included as a criterion for the assessment of sub-national official's political performance.

8.2.3 Spatial Relationship

The data analysed also suggests that the spatial relationships between IAs within the urban agglomeration, the spatial relationship of IAs with other urban functional areas and the spatial relationship of IAs with landscapes changed during the ET process.

8.2.4 Spatial relationships between industries in CZT

There is a trend in the spatial planning of IAs to focus not only on the prefecture level but also the urban agglomeration, or even the extensive urban agglomeration areas. Industries in the same (extensive) urban agglomeration have more and more close connections with each other and are considered as a whole by regional and local governments.

The spatial planning of IAs in Xiangtan city can serve as an example. In the primary stage of industrialisation in Xiangtan (during the 1950s and 1960s), traditional industries, such as mining, chemical and heavy metal, gradually established and promoted economic growth regionally and even nationally. However, since the initial site selections of those industries

were not strategic and without apparent forethought and planning, many problems occurred. For example, industries in different areas and cities were very similar and were in intense competition with each other and massive land resources were occupied and wasted by the extensive land-use mode of industrialisation (Interviewee 8). Thus, a comprehensive spatial plan for industrial development and land use in the region was urgently needed. At first, randomly distributed factories located with resources (e.g. mining and water resources) were reorganised into planned industrial areas or parks in Xiangtan around the year 2000 (Interviewee 8). The patterns and forms of industrial distribution in Xiangtan changed from a dispersed industrial land use pattern to a more grouped layout (Zhou, 2012). IAs at the municipal level started to cooperate and share resources with each other (Interviewee 8). During this stage, industries in each city of CZT developed separately so that every city had its own industrial clusters and system. In 2001, the first Regional Economic Integration Meeting was held by the Hunan provincial government and declared that the industries/IAs in a CZT urban agglomeration should be considered at the same time.

> "The economic integration of CZT promotes the industrial systems of each city to be connected with each other as a unified whole."
>
> — Interviewee 8, Section Chief in Municipal Land Resources Bureau in Xiangtan City, 2017

Thus, after the first publication of *The Regional Plan of the CZT Urban agglomeration* in 2005, the economic integration of CZT connected the industrial systems of each city with the others to consider industrial land use at a joint regional scale (Interviewee 8). In the *Regional Plan of the CZT Urban agglomeration* (2005), the integrated land-use planning of industries is described as 'two nucleuses and four belts' (Fig 8.19): Changsha city is seen as a nucleus, with Xiangtan and Zhuzhou city as another nucleus. These two nucleuses are connected by four north-south running industrial belts which include, from west to east, the ecological industrial belt, the hi-tech industrial belt, the Xiang river scenery belt and the manufacturing industrial belt. These industrial belts represent the distribution and classification of promoted industrial land use.

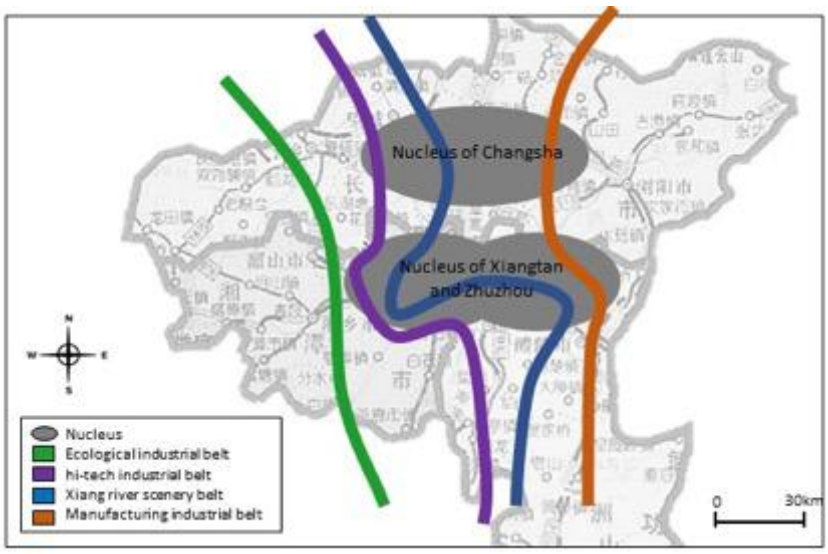


Figure 8.19 The 'two nucleuses and four belts' spatial structure of CZT

(Source: Image drawn by the author according to *The Regional Plan of the CZT Urban agglomeration*, 2005)

The comprehensive planning of industries in the CZT urban agglomeration generated 'Economies of Scale' (Stigler, 1958) and led to the rapid development of economic growth in the region. Between 2006 and 2010, the GDP of CZT increased 3.49 times with 13.3% annual average growth, and the share of GDP in Hunan province rose from 37% (2005) to 43.2% (2010) (*The Annual Report on the Development of CZT*, 2016).

During the late 2000s and the early 2010s, more and more attention was paid to the environmental performance of economic growth. The office for integrated economic development in CZT was changed to the 'Two-oriented Society' office in CZT. The comprehensive planning of industries in the CZT urban agglomeration was rolled out and even strengthened by a series of environmental policies/strategies. For example:

- The relocation-based transformation of polluting industries in TIAs in CZT can be seen as a strategy for the comprehensive spatial planning of industries in the urban agglomeration. The choice of location for the transformed polluting industries was considered on the scale of the (extensive) urban agglomeration for better environmental performance and economic efficiency (details in section 8.1.2.2).
- The land resources of the CZT urban agglomeration were considered as a whole. Lands in CZT were classified into four types according to different ecological capacities (*The Plan of the CZT Urban agglomeration*, 2015): areas excluded from development, areas with restricted development, areas for optimized development and key areas for development. The 'Green Heart Area' located in the central area of the CZT urban agglomeration (which occupies parts of the three cities), was designated main area excluded from development.
- *The Plan of the CZT Urban agglomeration* (2015) classified IAs in CZT into seven types based on the different environmental effects of different industries: (1) comprehensive IAs located in city centres mainly composed of modern service industry and green industry; (2) IAs located in suburban areas, consisting mainly of advanced

manufacturing industry, hi-tech industry and logistics industry; (3) CBD areas located near transportation junctions were designated for circulation trades, financial services and leisure industry; (4) areas for education and innovation located in proximity to university towns; (5) the 'Green Heart Area' located in the centre of three cities for ecological protection and the tourist industry; and (6) areas of bio-diversity (e.g. forest or wetland parks) in which any activities that could harm the ecological environment are forbidden.

8.2.4.1 Spatial relationship of industrial areas with other urban functional areas

In the past, IAs (both TIAs and DZs) were designed with a single function in mind and other functional areas, for example, for residents, retail activities, sports, education, leisure and green space were seldomly considered. Therefore, although IAs significantly contributed to regional economic growth in the primary stage of industrial development, social problems and environmental problems occurred in and around IAs and hindered the further development of the urban economy.

Regarding TIAs, industrial activities negatively affect the quality of life in urban environments. Taking the Qingshuitang TIA as an example, Fig 8.20 presents the spatial distribution of industrial companies. The average distance between a factory and a residential area was about 1-2km. Residential areas distributed around production areas. The average living space per resident accounted for no more than 6 m^2 (Interviewee 17) (Fig 8.21). With urban growth and expansion, a large area of TIAs and their 'shanty areas'[40] were incorporated into the city centre area, which led to serious urban problems (e.g. urban village problem). Furthermore, in the 2000s, the recession industries in TIAs made the poverty problem in 'shanty areas' more serious (Zheng, 2007). Therefore, during the ET of TIAs, the relocation of residents from 'shanty areas' commenced. In Qingshuitang TIA (Fig 8.22) for example, the government completed the resettlement of 7000 families from 'shanty areas' in 2017.

40 'Shanty areas' refer to the old town and old industrial areas with a long history and degraded environmental quality. The shanty areas in city centres are referred to as 'urban villages'.

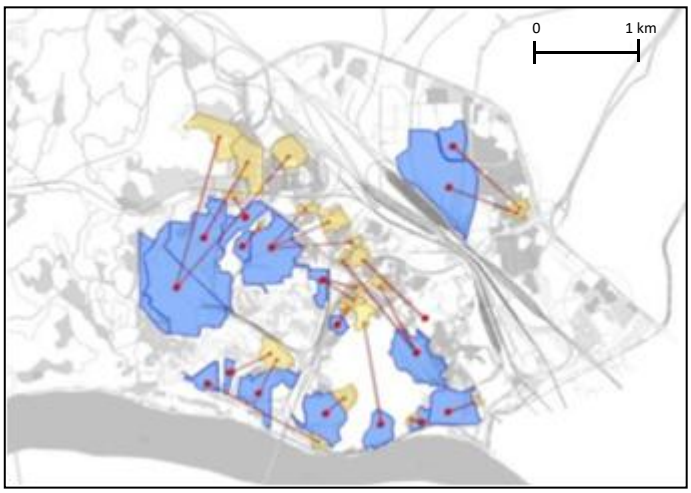


Figure 8.20 The relationship of residential areas and industrial areas in Qingshuitang TIA

(Source: *The Implementation Plan of the Relocation and Transformation of Qingshuitang TIA* issued by the local government of the Shifeng district in Zhuzhou city in 2014)

Figure 8.21 Traditional residential Spaces for Workers in Qingshuitang TIAs, Zhuzhou City

(Source: image taken before relocation in 2016, governmental records)

Figure 8.22 'Shanty' houses in Qingshuitang TIA were demolished as part of relocation projects

(Source: Author, images taken in 2017)

In terms of DZs (especially ETDZs), 'ghost city' problems occurred where newly constructed residential buildings in and surrounding ETDZs only attracted a low occupancy rate.

Interviewee 5 provided the reason that most DZs are located too far away from the city centre, which was originally for environmental protection and urban expansion. The DZs however, did not focus investment on infrastructure provision such as green spaces, commercial areas and education which resulted in low interest of citiziens moving into the new residential areas.

> "I have been to a DZ in Jinan city, that place is a typical 'ghost city'. It is crowded with factories and people just come there for work. There were no people there at night or on holidays […] we [a DZ in Zhuzhou city] also suffered from 'ghost city' problems for a short time."
>
> ---- Interview 15, Strategy Planning Department Director of Governmental Company (PC), Apr 2017

In order to solve those problems, despite the resettlement of residents in 'shanty areas', the government introduced the concept of 'industry-city integration' (产城融合) and 'integrative distribution of production spaces, living spaces and ecological spaces' (三生融合) (e.g. the Third Plenary Session of the 18th CPC Central Committee, 2013). In response to these political concepts, spatial planners and developers of IAs paid increased attention to the coordinated development of industrial spaces with other urban functional areas, e.g. residential areas, green spaces, commercial areas, transportation and other urban infrastructure. Interviewee 15, the Director of the Strategy Planning Department of a PC, is one of the key participants of the spatial development of four DZs in Zhuzhou city. He gave the author a detailed description of the spatial planning ideas of three DZs in different time periods (i.e. the 1990s, 2000s and 2010s).

The first DZ, developed in 1992, occupied 1.4 sq.km. of farmland in the suburb of Zhuzhou city. "At that time, we did not think about the concept of 'integration of industry and city', but we still left some spaces for retail use for surrounding residents" (Interviewee 15). In 2002, the Liyu DZ was established and occupied 14 sq.km. It considered the relationship of industry and environment, and tentatively implemented the 'industry-city integration' concept for the first time. "We located commercial areas, residential areas and large-scale of landscape areas in the centre of this DZ" (Interviewee 15). This industrial area was designated as the first demonstration DZ for 'environment-friendly and resource-efficient society' construction in Zhuzhou city. Based on those experiences, the third DZ with 27 sq.km. was developed in 2012, the total area was bigger than former DZs, and the area size of the landscape areas also increased. Moreover, the natural landscape features was "not only an area for greening and leisure, but also a channel for flood discharges which with some ecological functions" (Interviewee 15). Last but not least, a new DZ (i.e. Xinma DZ) was under construction in 2017. From the spatial planning strategy presented in Fig 8.23, it provided spaces for production

industries, service industries and urban infrastructure (including commerce, administration, education, entertainment, catering, transportation, communication networks and logistics). Residential living and ecological environments (including landscapes and water spaces) were also considered and merged with each other.

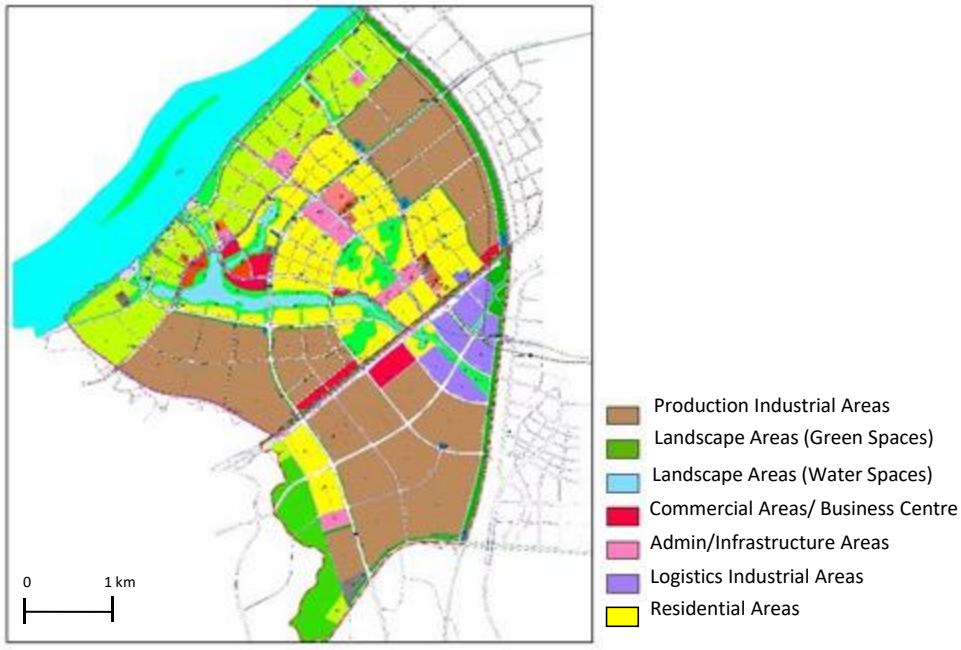


Figure 8.23 The land planning model of Xinma DZ in Zhuzhou city

(Source: the official website of the Urban and Rural Planning Bureau of Changsha city, http://ghj.changsha.gov.cn/index.html)

From the evolution process of spatial planning strategies of four DZs, this thesis finds that IAs transformed from an unordered single function area to an ordered mixed-function area, and then to a synergistic state. Residential areas and other functional areas were no longer the accessories of IAs, but also supported the development of industries, e.g. industries were also promoted due to their increased population and integrative development concepts.

After the relocation and pollution treatment of TIAs in the city centre, the local government of Zhuzhou and Xiangtan city planned to redevelop the Qingshuitang TIA and Zhubugang TIA to create new ecological industries in urban areas. This shift is consistent with the integrative development of industries with other urban functions. Urbanisation led to the industrial upgrading of those areas, whereby the “changes of industrial structure of old industrial areas led to the shifts of the employment structure and further the consumption structure […] those changes put forward new demands about spatial structures” (Interviewee 15, the Director of the Strategy Planning Department of a PC).

However, interviewee 15 reflected on their [PC] integrative development practices, and thought that the cultural element was seldom mentioned and considered, and therefore needs to be taken more seriously in the future.

> "We found that only the blend of industry and city is kind of stiff and lacks cohesion […] the establishment or construction of DZs brought a new and more combatable urban area for people, but didn't provide a sense of belonging […]. DZs in different cities all look the same […]. We should pay more attention to the extension of cultures in the region and local, such as protecting the existing landscape, mountains, country living styles and industrial cultures, and so on."
>
> ---- Interview 15, Strategy Planning Department Director of Governmental Company (PC), Apr 2017

8.2.4.2 Spatial relationship of industrial areas with landscapes

From the illustration of the redevelopment direction of TIAs in section 8.1.2.5 and the analysis of the integrative development of industries with other functional urban areas in section 8.2.3.2, it became apparent that the landscape and other natural spaces played an increasingly important role during the ET of IAs. Therefore, this thesis selected five typical landscape spaces (the landscape in DZ has already been discussed in section 8.2.3.2) (Table 8.6).

Table 8.6 Five typical landscape spaces in CZT

Name of Landscape Spaces	City	Landscape types	Current Status (in 2017)
Green Spaces in Xinma DZ (details in 8.2.3.2)	Zhuzhou	Landscapes in DZs	Under construction
Qingshuihu Ecological Park	Zhuzhou	Urban ecological park after the relocation and transformation of TIA	Expected to start by the end of 2017
Yanghu Wetland Park	Changsha	Urban ecological wetland park near IA	Put into use in 2012
Manganese Ore Industrial Heritage Ecological Park	Xiangtan	Industrial heritage ecological park after the relocation and transformation of TIA	Expected to finish in 2019
Pingtang Ice World	Changsha	Flagship landscape after the relocation and transformation of TIA	Expected to finish in 2019

8.2.4.2.1 Qingshuihu Ecological Park (Zhuzhou)

After the relocation and pollution treatment of Qingshuitang TIA in Zhuzhou city, the Municipal Urban and Rural Planning Committee issued the spatial plan for the redevelopment of this area in 2015, and planned to construct the Qingshuihu Ecological Park. This landscape strategy aimed to promote 'pollution abatement, ecological restoration, protection and re-purposing of industrial heritage and the development of green and low-carbon industries (such as, sports leisure and industrial tourism)' (*The Plan of National New-type of Urbanisation in Zhuzhou City 2015-2020, 2015*). According to the planning strategy, Qingshuihu Ecological Park will occupy an area of approximately 0.96 km² (including municipal roads and green spaces) divided into three main green zones: the Qingshuihu core zone (i.e. the central lake), the wetland zone (including wetlands and shoals) and the riverside zone (including riverside and the intertidal zone). By the end of 2017, the construction of the Qingshuihu Ecological Park had started (Interviewee 4). In February 2019, the central lake started to store water (CCTV News), which meant that this landscape project was nearly finished.

From the maps of the distribution and concentration of existing pollution areas and the spatial planning of the Qingshuihu Ecological Park in this area (Fig 8.24), we can clearly see that the Qingshuihu Ecological Park is located in the area with the highest degree of contamination. The Qingshuihu Ecological Park can be regarded as one solution to industrial clean up and environmental problems during the ET of IAs.

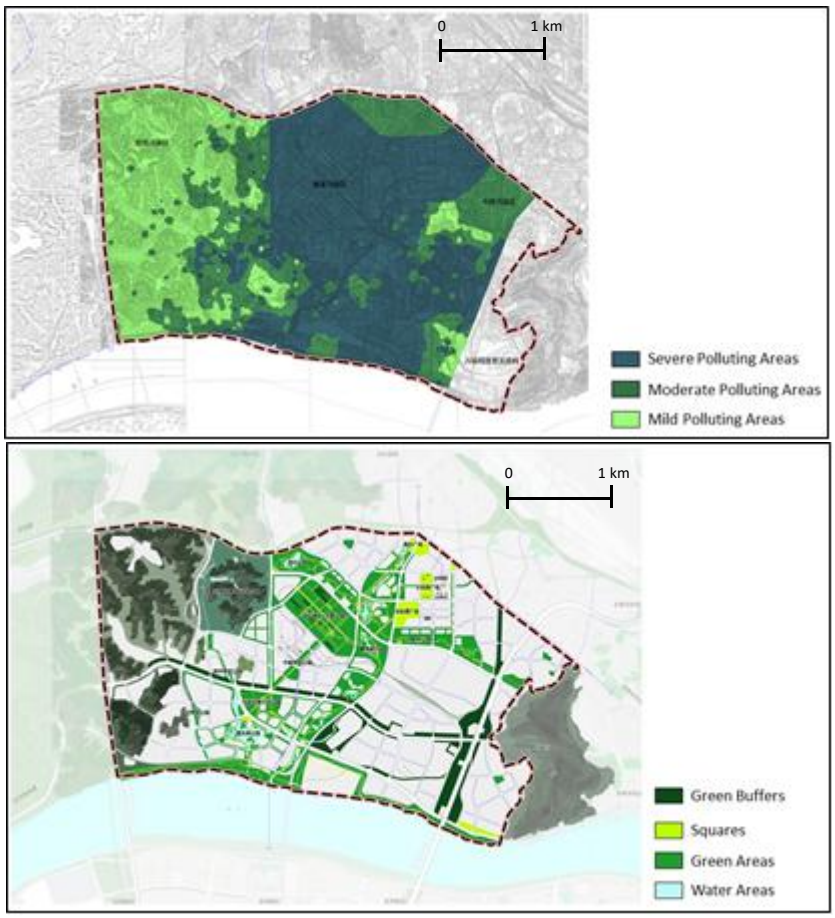


Figure 8.24 Top: pollution degrees of Qingshuitang TIA; Bottom: the spatial plan of Qingshuihu Ecological Park

(Source: The Strategic Planning of Relocation and Transformation of Qingshuitang Old Industrial Area in Zhuzhou, 2016)

Drawing on interviews and government documents on the spatial plans for the Qingshuihu Ecological Park, three main approaches to the response to pollution through green spaces can be identified. First, a series of green/environmental technologies and concepts were adopted for ecological protection and recovery during this landscape construction, such as a rainwater collection system, ecological embankment strategy and ecological corridor design. According to interviewee 11, a landscape designer, the construction of a rainwater collection system in this area is mainly for water use in and around this area (mainly landscape area), since a part of the area did not have enough natural water sources. Moreover, regarding the ecological corridor design in this area (Fig 8.25), green spaces had been planned to form the shape of corridors and classified into three categories by their width. The main purpose was to assure diversity and connectivity of water, plants and animals. Therefore, rain collection and irrigation, biodiversity and connections between the park with surrounding areas (e.g. the 'Green Heart Area', Xiang River and some mountain areas) were achieved.

Figure 8.25 The Planned Ecological Corridor in Qingshuihu Ecological Park

(The green lines with arrowheads refer to the green corridors) (Source: The Strategic Planning of Relocation and Transformation of Qingshuitang Old Industrial Area in Zhuzhou, 2016)

Second, the construction of this park enhanced the image and was used to brand Zhuzhou city. A greener image was revealed to attract more people (e.g. residents, workers, investors and talents) and green investments.

> "After the construction of this project (i.e. Qingshuihu Ecological Park), the image of Qingshuitang TIA will realise a big transformation […] More green spaces make at least the surface look greener […], quality of life and the environment will be improved […], ecological functions are recovering gradually [… and] the urban image of Zhuzhou city will be enhanced."
>
> ---- Interview 6, Director of District Government, Feb 2017

> "As the transformation of Qingshuitang TIA is a national demonstration and pilot project of the green transformation of TIAs in China, the old image of Zhuzhou city transformed from a traditional and polluting industrial city to a green industrial city."
>
> ---- Interview 5, Head of Technology Department of Governmental Company (PC), Feb 2017

Last but not least, the industrial heritage of this area was protected, displayed and re-used in this landscape area, which was not only important from the heritage protection and education

point of view, but also for the extension of regional and local history and culture. According to the discussion about the 'industry-city integration' concept in section 8.2.3.2, the protection and extension of regional and local culture was an essential element for attracting both residents and tourists. Qingshuitang TIA was established in the 1950s and represented a long history of industrialisation and development in Zhuzhou city. Regarding the industrial heritage, a leading group focusing on industrial heritage protection in this area was established.

> "Over 400 industrial heritage objects and sites have been analysed [in Qingshuitang TIA], not all but some valuable industrial heritage could be saved […]. One factory wasn't dismantled, and we are going to transform it into a provincial industrial heritage museum using a landscape approach […]. Industrial heritage is involved into the landscape as the landscape facilitates […] the real experience, such as touch and smell, are better than just reading for education and cultural protection."
>
> ---- Interview 4, Vice General Manager of Governmental Company (PC), Feb 2017

8.2.4.2.2 Yanghu Wetland Park (Changsha)

After the relocation-based transformation of Pingtang TIA in Changsha city, the Yanghu Wetland Park (Fig 8.26, Left) and Hunan Pilot Yanghu Reclaimed Water Co., Ltd. (Fig 8.26, Right) were built in this area in 2012.

Figure 8.26 Left: Yanghu Wetland Park, Right: The main building and the artificial wetland of the Hunan Pilot Yanghu Water Recycling Co., Ltd.

(Source: Changsha Evening Paper, www.icswb.com; Report of Municipal Engineering Research and Design Institute)

One main purpose of the Yanghu water recycling enterprise is to recycle the urban sewage of this area. The Yanghu wetland is also involved in the treatment process of wastewater, and after treatment, the water would be re-used again within the landscape area and the municipality.

> "The Yanghu Water Recycling Company can deal with 40,000 tons of wastewater per day. Wastewater flows through 'pre-treatment, MSBR[41], artificial wetland and natural wetland' for pollution treatment and re-use […]. During the artificial wetland process, wastewater flows through the artificial riverway and then to a pond full of plants, such as iris and canna, for wastewater treatment. Water becomes clearer after this ecological purification by artificial and natural wetlands, and the environment of this area also improved obviously [...]. After the treatment, part of the water is re-used for the water supply of the lake, and another part of the water is re-used for the irrigation, cleaning and flushing toilets, and so on."
>
> ---- Technical Director (https://hn.qq.com/a/20180927/001736.htm)

This ecological purification process not only improved the environment and water quality in this area, but also reduced the costs (energy, chemical reagent and workforce) for wastewater treatment. "The operating costs are 40% of other water treatment factories with traditional approaches" (Interviewee 14). Moreover, it also solved the 'nimby problem' of water treatment factories, whereby the quality of life for surrounding residents increased (Interviewee 14). In 2014, the company was designated as the demonstration pilot of the 'two-oriented society' construction in Changsha city. In 2017, this water recycling company invested 0.2 billion yuan for further development.

8.2.4.2.3 Manganese Ore Industrial Heritage Ecological Park (Xiangtan)

The Manganese Ore Industrial Heritage Ecological Park was built after the relocation and transformation of Manganese Ore TIA in Xiangtan city. The Manganese Ore TIA was initially a place with abundant manganese ore resources, but after uncontrolled and illegal mining activities over the past 100 years, this place became highly polluted and affected by geological substances. Waste residue and electrolytic manganese residue could be seen everywhere, and because wastewaters were being dumped directly into Xiang River, this led to severe damage to the whole ecological environment.

Therefore, a series of policies and strategies was released for the ET of this IA, including *The Implementation Plan of Heavy Metal Pollution Treatment of Xiang River in Xiangtan City (2011-2015)*, the 'Primary Project (一号重点工程)' published by the provincial government in 2013, the *Plans of Sustainable Development of Resource-based Cities* (2013-2020) published by the State Council and finally, the *Implementation Plan of National Mining Industry Heritage Park* issued by the Ministry of Land Resources in 2006. Therefore, in 2010, the municipal government of Xiangtan city proposed the idea to establish the Manganese Ore Industrial Heritage Ecological Park after the relocation of Manganese Ore TIA. In 2012, the municipal

[41] MSBR: Modified Sequencing Batch Reactor, a technique for wastewater treatment.

government established a leading group for the pollution treatment and heritage protection of this area, and started construction.

> "Actually, one important reason to construct this park is that this place was seriously damaged including the subsidence and pollution of soil and underground water, so that the real estate could not be built on this kind of problem land. However, there are also some places without the hidden danger of landslides, and some green industries could be introduced, such as the logistics industry. The mining activities of the Xiangtan Electrochemical Scientific LTD. have been strictly controlled, the total value of output was reduced by 90% at present."
>
> ---- Interview 9, Director of Municipal Land Resources Bureau (Geological Environment and Survey Office), Feb 2017

This Manganese Ore Industrial Heritage Ecological Park in Xiangtan achieved environmental protection and regional economic growth as follows: (1) by using the landscape as a resource for mining pollution treatment to improve the quality of the regional environment and ecological diversity; (2) by upgrading the industrial structure that polluting industries transformed into tourism industries; and (3) by strengthening the regional and local brand of '100 years manganese ore city' and preserving the mining histories and culture.

> "The mining industrial heritage is a non-renewable resource and the witness of mining histories in the region. The protection of the heritage is valued for travelling, scientific investigation, science popularisation and teaching. So, in 2012, the municipal government established a working group [i.e. leading group] for pollution treatment and heritage protection […] According to the plan, this park mainly focused on environmental recovery, heritage protection and cultural retention."
>
> ---- Interview 8, Section Chief Municipal Land Resources Bureau (Geological Environment and Survey Office), Feb 2017

When the author visited this place in February 2017, the main square and north part had already been completed. The Interviewee 9, the Director of the Municipal Land Resources Bureau, guided the author to both areas before and after pollution treatment and landscape construction. The soils that haven't been disposed off were covered by black manganese ore slags, suffered serious settlement problems in the terrain, and almost no plants would grow there (Fig 8.27, left). However, after pollution treatment and landscape reconstruction, there were many green surroundings and many facilities and amenities, such as basketball courts and kiosks, where people gathered and participated in sporting events together (Fig 8.27, right). Comparing those two areas, we can see that the pollution treatment and landscape project made a positive impact. However, the author thinks that untreated soil exposed to the public is unsafe and ill-considered.

Figure 8.27 Areas haven't been (left) and areas have been (right) disposed and constructed in the Manganese Ore Industrial Heritage Ecological Park

(Source: Author, images taken in Feb 2017)

> "After transformation, this area is becoming green in colour, is no longer black and grey, and the air is becoming much cleaner. Before, residents did not choose to come here, but now, more and more people are delighted with this positive change and would like to come here for leisure and recreation. Especially in the evening time after work, so many people come here for dancing, singing and exercising."
>
> ---- Interview 9, the Director of the Municipal Land Resources Bureau (Geological Environment and Survey Office), Feb 2017

Non-state actors positively participated in the construction of this industrial heritage park. Interviewee 9 introduced a pollution treatment project via a landscape approach growing mulberries on the polluted lands to decontaminate the excessive heavy metal elements. "Every mulberry tree can absorb about 0.8 mg. of heavy metal from the soil" (Interviewee 8). This is a cooperative project of the Provincial Department of Land Resource, a provincial mulberry science research institute, a municipal geological environment monitoring centre, Hunan Funong LTD., and local farmers. Together, they generate multiple benefits for the surrounding area. For example, the mulberry park is not only used for environmental treatment and recovery, it also improves the average salary of local farmers through tree planting (Interviewee 8).

Moreover, during the construction phase of the heritage park, the protection of some industrial heritage landmarks underwent heated debates by the public about how these sites or elements should be protected, and what parts should be protected. Taking the disposal of a blast furnace (Fig 8.28, Left) as an example, citizens thought it should be saved and protected for cultural memories, however, the government was focused on practicality, and therefore they applied a compromise solution.

> "First of all, this blast furnace is too old and fragile, it's very dangerous to expose it in a public space. Further, it is 3km away from the planned park, although the

old blast furnace looks very spectacular, moving it to the park area is so difficult as the old obsolete equipment is hard to recover after dismantling and relocation […]. Although we still tore down the old blast furnace, we responded to the public interest through the establishment of a new sculpture in the shape of a blast furnace [Fig 8.28, Right] on the top of a small hill in the main square of the park for industrial culture memories."

---- Interview 9, Director of Municipal Land Resources Bureau (Geological Environment and Survey Office), Feb 2017

Figure 8.28 Left: The old blast furnace before dismantling Right: The new sculpture of a blast furnace in the park

(Source: Left: Xiangtan News http://app.xtol.cn/m.php?id=619067; Right: Author, Feb 2017)

8.2.4.2.4 Pingtang Ice World (Changsha)

Pingtang Ice World (also known as Dawangshan Ice World) is a large section of an area previously known as Pingtang TIA in Changsha City. The primary industries in Pingtang TIA were cement, chemical and mining industries, which are high in pollutants and energy consumption sectors, and negatively impacted the environment. Therefore, from 2008 to 2010, 47 industrial companies known for heavy pollution (including ten mining industrial enterprises and 21 cement industrial and chemical enterprises) were relocated or closed down as a result of the new policies (see section 8.1). Compared to Qingshuitang TIA and Zhubugang TIA, Pingtang TIA was located farther from downtown. Furthermore, for redevelopment, the local government planned to develop tourism industries to take advantage of the natural resources and transport connectivity of the area, and started to build the Dawangshan Resort Area. At present, this is the most prominent tourism industrial project in the Hunan province, the total investment for the green transformation of this area was 80 billion yuan (i.e. about 8.8 billion pounds). Pingtang Ice World, an ice arena, is one of the Dawangshan resort projects, and was created mainly for amusement activities related to ice and snow, e.g. skiing and skating.

The main feature of Pingtang Ice World is a huge deserted mining pit (more than 100m deep) (Fig 8.29, left). In order to keep the original terrain, the buildings and landscapes were

designed to merge with the environment naturally. The main building will hang above the mining pit which will generate a unique view (Fig 8.29, right). At the same time, the unique topography will bring about many difficulties for construction. By the end of 2018, more than 80% of the main building was completed and Pingtang Ice World is expected to open at the end of 2019 (Sohu News, http://www.sohu.com/a/275545342_802299).

Figure 8.29 Left: The Base Feature ---- Dumped Pit; Right: The Design Sketch of Pingtang Ice World

(Source: The Planning Report of Pingtang Ice World)

> "This area was a mining area for Xinsheng Cement Company, during about 50 years of mining, a huge pit generated. This plan takes full advantages of this unique terrain and re-uses it as the protection of industrial heritages."
>
> ---- Interviewee 11, a landscape Designer of an Architecture Design Institute, Mar 2017

> "The deep hole brings many technical difficulties for construction. We established a technique group. This group invented a construction technology for this complex building above the hole. The Discovery Channel came here and filmed for about one week in 2015 for the documentary of the 'Top 9 Difficulty Structures Projects in the World'. I think this project deserves it."
>
> ---- Project Leader
> (https://new.qq.com/omn/20191121/20191121A0PEYU00.html)

This project can contribute to the regional economic growth to some degree. Previously, nobody liked to visit this area. However, after the construction of these landscape projects, a large number of tourists will come and raise income levels and generate employment.

> "This pit had already existed when I was a child, the mining of limestone generated it. This was the place where nobody wanted to get close."
>
> ---- Local Residence, 2017

> "This place [i.e. Pingtang Ice World] is expected to receive 100,000 visitors a day at most, and the predicted total income is 3 billion yuan per year. Moreover, this

> place is estimated to create job positions for 8000 people directly and 50,000 people indirectly […] The land value of this area and its surroundings will increase. I am optimistic about the recouping of investment."
>
> ---- Engineer (http://travel.sina.com.cn/china/2014-05-29/0845264063.shtml)

Some people (including some officials, spatial designers and scholars) believe this project is meaningful for the green transformation of TIA. It is a project for the ecological recovery and re-use of environmental and water resources. Moreover, it is also the regeneration and revival of the old urban area, the regional and local economy, the value of the land and an improved level of income in this area. Last but not least, this flagship project could provide a positive identity and image to the city on a national and international scale.

> "It [the Pingtang Ice World project] protected the original terrain, the water resource at the bottom of this pit will be filtered and purified for the water supply of this landscape area."
>
> ---- Interview 11, landscape Designer of Architecture Design Institute, Mar 2017

> "This project is a good example of the 'ecological treatment and urban renovation (城市双修)'."
>
> ---- Prof Shu, Tongji University (http://news.sina.com.cn/c/2017-11-27/doc-ifypapmz5359300.shtml)

However, the author thinks the environmental performance of this project is worth further research and discussion. The redevelopment of TIA cannot be seen as green, considering that an Ice Arena of this size (about 920,000 m^2) will require significant amounts of energy for cooling, the construction of the resort and the infrastructure plus resulting carbondioxide emissions from visitors. By its nature, it is highly questionable whether this can be considered a sustainable land use considering the energy use of an artificial ice world.

8.3 Summary: Spatial Model of City Urban agglomeration during EM Development in China

In order to explore the relationship between the EM developments in China with the urban space, this chapter focused on some of the spatial changes of the impact of IAs by ET policies/strategies. From the investigation of eight IAs (including three TIAs and five DZs) in the CZT urban agglomeration case study, this thesis finds that the spatial changes of these industries can be differentiated into geographical movement (i.e. physical relocation) and spatial restructuring (including spatial distribution and area size, spatial density and spatial relationships). By organising those findings, this thesis draws a spatial model of city urban

agglomeration during EM development in China (Fig 8.30). This section provides a summary to those changes while explaining the following figure.

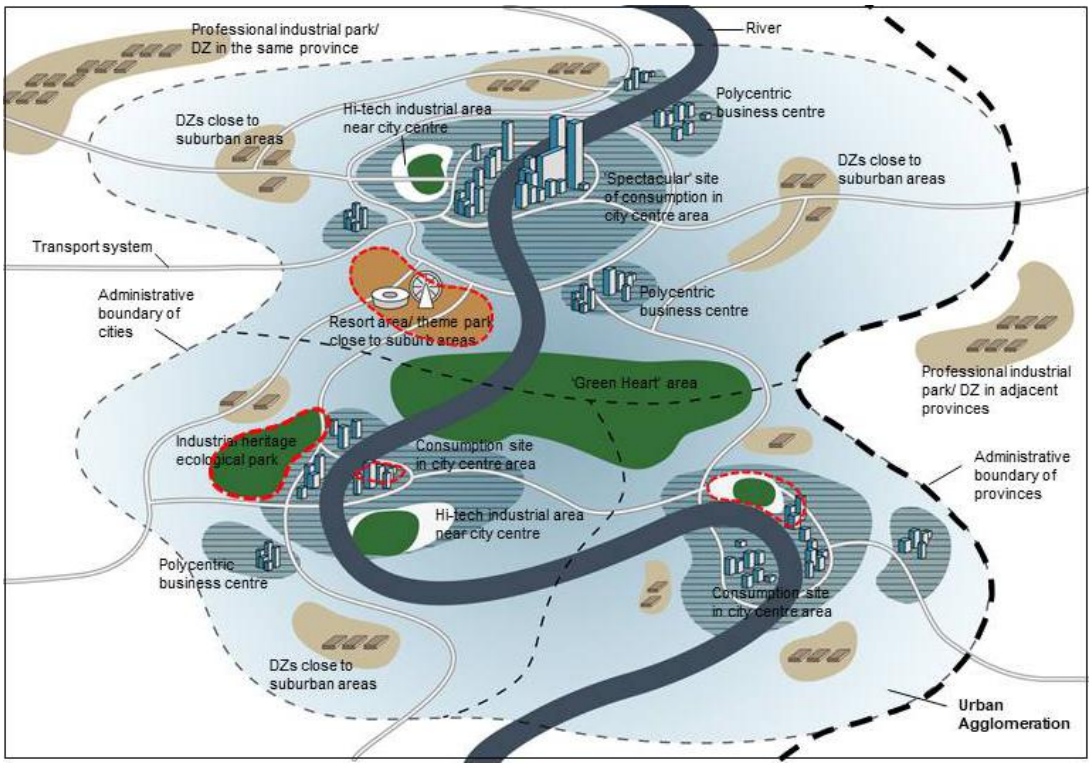


Figure 8.30 Spatial model of the CZT city urban agglomeration during EM development in China

(This is a conceptual spatial model that functional areas were simplified for clearer expression. In practice, it cannot be denied that spatial structure may be more complicated and compound.)

Section 8.1 outlined the main trends in the spatial movement of polluting industries in TIAs in CZT urban agglomeration which mainly started in the late 2000s to 2019. Accepting that some sunset industries were closed down, polluting industries and resource-based industries (i.e. chemical industries, nonferrous metallurgy industries, building materials industries, machine manufacturing industries, cement iindustries and mining industries) in TIAs relocated from city centres to suburban areas approximately 80km away (i.e. within the urban agglomeration range), and then, 170km away (i.e. in the extensive urban agglomeration range) from 'departure areas'. The spatial movements of polluting industries were put forward and executed by local governments following the guidance of the central government. Not only did the environmental department, but also departments in other fields (department of land resources, department of science and technology, and department of industry and information technology) set the requirements of this industrial transfer. It is not only for environmental protection, but also for local economic growth and urban development in the long-term. Therefore, industries didn't merely move from one area to another, but some environmental transformation also happened in these industries and 'departure areas'. 'Departure areas' were highlighted by red imaginary lines in Figure 8.30. 'Departure areas' were transformed

from TIAs to new ecological urban areas, resort areas or industrial heritage ecological parks based on their situations (e.g. distance with the city centre and local resources). According to different development directions of relocated industries, they moved to different 'receiving areas', such as EIPs, DZs, HIDZs or professional industrial parks.

Section 8.2 discussed the changes of spatial structures of IAs during the ET process, including the changes in spatial distribution and area size, spatial density and spatial relationship. First, in terms of the changing size in area occupied by secondary and tertiary industries, the size of the tertiary industry (mainly knowledge industrial parks and business parks) increased and was more uniformly distributed across the city centre (see areas with cross stripes in Fig 8.30), while, the size of IAs mainly with secondary industries (especially IAs in city centres and along with Xiang river) decreased and integrally distributed in marginal or suburban areas (see brown areas in Fig 8.30).

Second, the local government promoted the intensive distribution and land use of industries through regulation policies, marketing approaches and management strategies. The development of IAs focuses on the intensive land-use mode and renewal of brownfields.

Third, regarding the spatial relationships of industries/industrial areas, this thesis finds that the relationship among industries/IAs in an urban agglomeration, the relationship of industries/IAs with other urban functional areas, and the relationship of industries/IAs with landscapes were changed during the ET process. The synergetic development of industries in the urban agglomeration unit promoted the integrated planning of industries not only at the municipal level but also expended to the urban agglomeration level, which expanded across administrative boundaries. The urban development mode transformed from an intensive to a polycentric and networked mode that multiple centres (incl. residential centres and commercial centres) were built in a city. The local government paid more attention to the traffic system between cities with suburban areas, and also among cities in the urban agglomeration. Moreover, to address the 'urban village' and 'ghost city' problems of IAs, and under the guidance of the 'industry-city integration (产城融合)' and 'integrative distribution of production spaces, living spaces and ecological spaces (三生融合)' concepts, the spatial synthesis of IAs increased residential areas, green spaces, and commercial land use. IAs transformed from single functional areas to mixed functional areas with integration of industries, living, consumption and recreation. The landscape played a vital role during the spatial restructuring of IAs. This thesis takes five landscapes as cases, and illustrates the landscape's efforts in environmental protection, economic growth and the maintenance of local culture.

For further discussion, this thesis compared those changes with some spatial theories of industries and urbanisation (e.g. industrial transfer, industrial gradient shift and neo-Fordist city), and also critically analysed their differences. The spatial changes of industries/IAs in China from the late 2000s to 2010 shows the trend of the industrial gradient shift and the neo-Fordist city superficially, whereby a large amount of industries were moved out from advanced city centres to suburbs with lower economic levels. However, those changes were mainly for the purpose of environmental protection and the sustainable development of industries and urban areas, not merely local economic growth. They show essential differences to the industrial gradient shift and neo-Fordist city generated in advanced western countries (e.g. UK and USA). This difference avoided the Pollution Paradise Hypothesis (PPH) in 'receiving areas' to an extent, however, the considerations about the development of medium and small-sized creative industrial companies during the ET of IAs is inadequate.

Through the exploration of spatial practices during the greening of industries and urban areas, the influences of the rescaling process of environmental governance during Chinese EM could also be investigated and reflected upon. During the decentralised environmental governance mode, sub-national governments have more capacities (e.g. funds and powers) and responsibilities in dealing with environmental problems in the region. For example, despite pressures from the economy, governments in the Hunan province and CZT urban agglomeration still made a tremendous amount of effort in the relocation and redevelopment of TIAs. However, the supervision mechanism during the whole transformation process was insufficient which generated significant pollution problems due to local political failures. Therefore, there happened the misconduct activates done by the former director of Provincial Environmental Protection Department in Hunan Province, the wastes leakage problems in an 'receiving area' (i.e. Hunan Petrochemical Industry Park), the continuing pollution of few industrial companies after relocation in 'receiving areas' (Interviewee 7), and the environmental performance of some landscape projects for redevelopment of TIAs. During the recentralised environmental governance mode, central supervision in 2015 found and enhanced the environmental performance of the sub-national government in CZT. Vertical Reform of Sub-national Environmental Departments was estimated to have a positive effect and was implemented at the end of 2019. However, from the investigation of spatial practices of the ET of IA in this chapter, this thesis finds that a comprehensive and specific environmental supervision and monitoring mechanism for every procedure during the relocation-based transformation of TIAs should be built, or powerful environmental departments after rescaling-up of environmental governance still could not achieve what they should.

Chapter 9 Discussion and Conclusion

9.1 Findings for the Research Questions

The following sections review the research objectives and discuss the extent to which the research questions have been answered. The implications of the present study are also considered.

9.1.1 Findings for Research Question 1

Q1: What are the trends in policies affecting Chinese EM?

Chapter 6 (concretely, section 6.1) focused on the first research question; this question was also addressed in chapters 2, 7 and 8. EM is a theory but also a practical strategy for policy discourse. Investigating how EM policies and strategies have developed in China is an effective way to understand the development of EM in China.

9.1.1.1 Impetuses and challenges for Chinese EM

National and international pressures influence Chinese EM. These pressures include international green economic barriers, strong competition with foreign-owned enterprises and the significant increase in environmental standards for exports. Internal pressures include serious environmental problems in China, which hinder economic development and decrease citizens' quality of life (see Fig 2.2). These pressures are the driving force behind Chinese EM. China needs EM and is on the path to implementing it. Moreover, China is in line with the prerequisites of EM theory listed in section 2.1.3 as China adopted a market economy with capitalist logic and paid increasing concern to environmental governance. Therefore, China meets the basic conditions and also aspirations for EM development.

However, applying a Western-based concept of EM to China presents challenges. These challenges mainly relate to 1) the backward nature of China's economy, independent technological innovation, and civil society and 2) the differences between China's political regime, institutional mechanisms, industrial structure, and market system compared to those of the West (see section 2.2.1). So far, EM has been theorised and well-documented in modernised capitalist countries such as the the UK, Germany and the Netherlands. However, the literature analysis in section 2.2.2 suggests that the Chinese context requires a unique EM path that will differ from the Western interpretations.

9.1.1.2 EM policies and strategies: The ET of IAs

Since urbanisation and industrialisation are the leading forces behind both modernisation and pollution in China, the greening of urbanisation and industrialisation is a significant strategic measure for Chinese EM (China Modernisation Report, 2007; He, 2007). In order to present

this embodiment of EM practices in China, this thesis proposes the phrase ET of IAs. Section 6.1 provided the policy context of the ET of IAs in China. In the Chinese national policy context (see section 6.1.1 and Fig 6.1), EM policies and strategies have transformed from weak to strong policies.

From 1979 to the late 2000s, the Chinese central government noticed the 'win-win' potential of combining economic with environmental concerns. The government then initiated many strategies to improve environmental performance during production and consumption. These included the circular economy policy and the 'scientific development outlook' strategy. After the late 2000s, the central government began to focus on transforming development patterns and social institutions to improve sustainability. This included the 'EM' concept, the construction of 'resource-economy and environmental-friendly society', the transition/switching of economic growth patterns, and transforming industrial structures (see section 2.3.2, third bullet point). Mol (2006) argues that, in Christoff's (1996) classification, China's EM implementation is a weak version of EM. However, since the end of the 2000s, the government has increasingly focused on transforming institutional and economic social structures more fundamentally to consider ecological concerns, and this suggests strong EM.

9.1.1.3 Most local EM practices are two-dimensional

The activities of regional and local actors (including governmental agencies and non-state actors) are crucial to carrying out, coordinating and localising national initiatives. Under the guidance of the national government's EM plan, many local officials have also established EM policies and strategies. Local policies and strategies for the ET of IAs also align with the institutional perspective and the spatial perspective (Table 5.2).

In sum, the findings for the first research question provided the background, tendencies, and key points for an analysis of a Chinese EM. Therefore, to understand EM in China, this research explored changes in institutional and spatial perspectives that occurred during the ET of IAs.

9.1.2 Findings for Research Question 2

> Q2: How have governing modes changed in the eco-transformation of industrial areas in China?

Chapter 7 focused on the second research question, exploring how power over environmental governance in China has shifted since the 2000s to the present (2019). Here it should be noted that, in China, powers allocated to the local level do not indicate that the local level has absolute control over that issue. Power allocation in China refers to responsibilities, duties or obligations; the power to rule always remains with the central government.

9.1.2.1 Rescaling-up process during decentralised environmental governance mode

China has seen two phases of environmental decentralisation. One began in 1979 and continued to the end of the 2000s; the other began in the mid-2000s and continued to the early 2010s. These two decentralisation movements were driven by different elements. In the first, the fiscal decentralisation implemented after the establishment of a market economy system in 1979 was a crucial driver. Environmental decentralisation began during this time, but it was inadequate and unstable: although fiscal decentralisation provided local governments with the critical prerequisites for local environmental protection, such as funds, powers, capabilities and pressures, local governments often deprioritised environmental issues in favour of economic growth. Therefore, environmental decentralisation entered the second stage due to regulations and incentive policies and strategies implemented by the central government.

Since the mid-2000s, the Chinese state has used three main tools to encourage local governments to consider environmental issues: (1) local environmental responsibility and punishment systems; (2) environmental indexes, which are included in the performance assessments of local officials; and (3) local institutional mechanisms for environmental monitoring and supervision. The power to make decisions, monitor, supervise, and enforce environmental regulations was decentralised from central to local governments. This can be regarded as the second stage of environmental decentralisation, in which not only enforcement and decision-making power were shifted from the central government to local institutions, environmental responsibilities and punishment mechanism were issued to increase the attentions and efficiencies of local government for local environmental qualities during modernisation process.

Local authorities established various initiatives to protect the environment. These efforts were not limited to local environmental departments; the top officials of two kinds of governmental organisations (the People's Government and the Communist Party Committee) played leading roles in local environmental governance. Top leaders guided regional environmental councils, local environmental protection projects and cooperation across regions. Moreover, to adapt to this decentralisation, local governments adjusted their institutional mechanisms to improve performance. Leading groups were established to facilitate the cooperation of various governmental departments in local environmental governance; not only environmental departments but departments in other fields had to consider the environment in decisions, and various approaches were used to protect the environment in multiple fields. This cooperative mode broke the conventional 'pyramid' hierarchy by mixing linear and matrix structures. Local governments positively adjusted their mechanisms to support local environmental protection.

However, some problems still arose during the shift to a more decentralised mode of environmental governance. Regional protectionism, data falsification and hierarchy problems decreased the effectiveness of environmental protection policies and strategies. The funds and power for environmental policy-making, environmental law enforcement, and environmental supervision and monitoring were all rescaled to the local level, which led to regional protectionism and data falsification problems. Moreover, the environmental performance of central government-owned companies could not be managed by local authorities, even though they were one of the major polluters in many regions.

In 2015, rescaling-up of environmental governance was issued by a series of policies and strategies. These included the Central Supervision of Sub-national Environmental Performance (2016), the Vertical Reform of Sub-national Environment Departments (2016) and the institutional structure for 'Two-oriented Society' Programme (2015). This thesis defines this shift as a 'soft recentralisation' in which some powers (including personnel management and budgetary allocation for local environmental departments, local environmental supervision and monitoring, and policy-making power for local development plans) were rescaled up from the local to the regional levels, and recentralisation from sub-national to national level. However, this thesis argues that these policies do not represent efforts by the central government to strengthen itself; on the contrary, most powers were gathered at the regional level (i.e. the provincial and urban agglomeration level), and the responsibility of local jurisdictions to implement and realise environmental policies and strategies was intensified. Although some challenges and problems remain in practice, and these should be considered in more detail during rescaling-up process, some problems generated by decentralisation could be solved by this rescaling-up and soft recentralisation process.

These findings suggest that, for Chinese EM, the experiences of other countries can be used for reference, but Western methods of EM are not fully suitable for the Chinese context. This thesis finds that two main differences (the different political regime and the behindhand nature of China's economy, described in section 2.2.1) between China and Western countries have impacted on the ways EM has been implemented in China resulting in a Chinese version of EM. Rescaling environmental governance down enhanced sub-national authorities' environmental responsibilities and powers but failed to establish adequate supervisory mechanisms, reducing the efficiency of sub-national environmental policies and strategies. The Chinese political regime requires the intervention and supervision from the central government. Moreover, due to the behindhand nature of China's economy, and because eagerness for quick success and instant benefits was intensified by fiscal decentralisation, local governments could not prioritise the environment over local economies. Therefore, soft

recentralisation is the path to EM in China. This retains the resilience and flexibility of local governments in environmental governance while returning partial powers (mainly supervisory powers) to higher authorities (central government and regional authorities) and reinforcing the effectiveness of local authorities in local environmental protection.

9.1.2.2 The region as a unit for environmental governance

During the rescaling-up process of environmental governance in China since 2015, most powers were rescaled upward from the local level to the regional level. Environmental supervision, personnel management and environmental monitoring were rescaled up to the provincial level. Moreover, the central government designated CZT as the national pilot of the 'Two-oriented Society' in 2007, and the Office for the 'Two-oriented Society' in CZT was established to create a "win-win for the economy and the environment" (interviewee 18). A new spatial unit for local environmental governance was created – urban agglomeration. Sub-national environmental governance was dominated by authorities at regional levels. This raises questions about the appropriate scale for sub-national environmental governance.

The region was chosen as the unit for environmental governance in China for four reasons: 1) the trans-boundary nature of environmental issues, such as the pollution of the Xiang River across multiple cities; 2) the development strategy of a scale economy adopted in previous decade led to environmental pollution in the region, and also provided a good basis for environmental cooperation in the region; 3) compared to the central level, the regional level can deliver national policies and strategies based on more local specifics; and 4) organisations at the regional level could supervise local authorities' (i.e. authorities at the prefecture, county and township levels) efforts on local environmental protection; and 5) environmental governance at the regional level can ensures a same environmental standard in the region, which can ignore the pollution transfer on account of different environmental standards of different cities and counties.

9.1.2.3 Increasing engagement of private sectors in environmental governance

Around 2015, an increasing number of non-governmental stakeholders (including actors from the private sector and environmental NGOs) began to participate in local environmental governance. This thesis defines this shift as the rescaling out of environmental governance. It was promoted by both top-down and bottom-up approaches.

In terms of private sector participation, this thesis has explored the implementation and evolution of the PPP mode for local environmental projects and projects implementing the ET of IAs. Many private companies in the areas of pollution detection, pollution treatment, infrastructure construction, and the operation and management of industrial areas were involved in the PPP projects for the relocation-based transformation of TIAs. PCs and large-

scale private companies became the main contractors for projects involving the ET of IAs. They were in charge of environmental aspects during early stages and land development (e.g. infrastructure construction, the introduction of industry or business, property management) as well as in the later stages. Small and medium-sized private companies signed contracts with these private actors but not the government. This improved the efficiency of communication between projects at different stages as well as reducing costs and facilitating the circulation of resources and materials at different stages (interviewee 8). Furthermore, in order to participate in the PPP project, PCs were required to transform. PCs were once state-owned companies that handled financial issues for local governments, but during this transformation, they disconnected from the local government – the leaders of PCs were no longer governmental officials.

However, the central government used another approach to guide PCs and PPP projects. After the transformation of the PCs, local governments were still shareholders in these companies. Moreover, representatives for the property rights of state-owned entities were selected and trained by the local government. These representatives were assigned to the boards of PCs as individuals but also as representatives from the Administration Commission of the State Council. The participation of PCs in PPP projects is itself a government intervention. These measures allowed local governments to control the direction of development and ensure the performance of environmental PPP projects.

9.1.2.4 The role of civil society in local environmental governance

Regarding the involvement of civil society in local environmental governance, this thesis has identified the drivers, approaches, changing roles, controversies and consensus affecting the involvement of local environmental NGOs in the ET of IAs since 2015. Both the government and the public have highlighted the importance of local environmental NGOs for local environmental governance and have supported NGO involvement in environmental governance. From a top-down perspective, governments have empowered, regulated and encouraged public participation in environmental governance. The public have also provided increasing amounts of enthusiasm, effort and funds to local environmental protection initiatives. The organisational structure of local environmental NGOs has become more professional, and private foundations have provided significant financial support for the development of environmental NGOs. As a result, environmental NGOs' participation in local environmental governance has gradually increased.

NGOs play a more critical role in environmental policy-making than before, including the ability to propose policies and to engage in environmental litigation in the public interest. However, in China, governments and environmental NGOs still have a long way to go. Public

participation, especially in environmental governance, is still a new phenomenon in China. As described in section 7.3.2.1, it was initiated in 2006 but was not fully adopted until the early 2010s. Both governments (especially local governments) and environmental NGOs lack the experience and skills needed for public participation in policy-making, such as environmental litigation in the public interest. Therefore, they still need more time to learn, explore and try different approaches. As a result, civil societies' engagement in environmental policy-making is limited in China at present.

To address this, environmental NGOs are developing their roles to fit in the Chinese context; this includes functioning as a co-operator with governments. This may seem to represent a compromise solution for environmental NGOs under the Chinese regime, but in fact, as this thesis points out, environmental NGOs in China are ambitious and vital. Environmental NGOs can also utilise other means to influence local environmental policy agendas.

In sum, a consideration of how powers for environmental governance are allocated to different levels of government and what powers should be allocated to which level is essential to EM. EM causes the rescaling of environmental governance. Countries with different situations (e.g. economic factors or political regimes) may generate different environmental governance modes in their unique approaches to EM. For example, self-regulation mode has already generated in Netherland's governance of sustainable production and consumption in the 2000s (Driessen et al., 2012), but this mode didn't happen on a large scale in China currently.

The Chinese government is positively adapting its institutional mechanisms to facilitate cooperation with NGOs and other private sector, and NGOs and other private sector are also shifting their roles and methods of participation to adapt to the Chinese context. Due to China's behindhand economy and unique political regime (compared to Western countries, see section 2.2.1), local governments, private companies and civil societies have gained more power for local environmental governance, but the central government still takes the lead through other methods (e.g. soft recentralisation, the participation of PCs in PPP projects, the employment of representatives of state-owned property rights at PCs, regulations, and limitation of public participation) in EM.

9.1.3 Findings for Research Question 3

> Q3: How have industries and industrial areas changed during eco-transformation in China?

Chapter 8 addressed the third research question, exploring the spatial movement and spatial structural changes to industries and IAs in CZT.

9.1.3.1 The relocation-based transformation of TIAs

Under the guidance of central and local governments, many polluting industries (e.g. chemical, cement, glass, papermaking and mining industries) in TIAs have relocated from city centres to suburban areas. Most of these relocations involved moving fewer than 80km (urban agglomeration region) or 170km (extended urban agglomeration). This relocation project was regarded as the fundamental long-term solution for severe environmental problems, declining industry, problems of spatial development and social problems in TIAs. It involved three main phases: relocation/closing down, pollution treatment and redevelopment. Polluting industries did not merely relocate from one area to another; they also made changes to comply with environmental standards in the new locations. This included the upgrading of the production mode and waste treatment devices. TIAs also experienced tremendous changes during the redevelopment process; some TIAs were transformed into resorts, and some became new urban areas hosting environmentally friendly technological and tertiary industries. Moreover, the receiving areas also made some changes so that professional EIPs developed gradually. In this thesis, this shift is called the relocation-based transformation of TIAs.

On the surface, this large-scale shift of industry from the city centres to suburban areas is similar to the industrial gradient transfer (see Zhou and Cao, 2010; Liu et al., 2014) and decentralisation of a neo-Fordist city (Knox and Pinch, 2010). This thesis has compared this shift to previous industrial changes (i.e. the fifth international industrial transfer between the 1970s and 1980s and the regional industrial transfer during the early 2000s and early 2010s) and to the Western mode of a neo-Fordist city. These shifts differ to the present shift, although there are some similarities. The recent geographical movement of industries was not only implemented for economic reasons but also for environmental ones (i.e. EM). Moreover, China did not directly copy the EM approaches of Western countries but made some changes to fit its own context.

9.1.3.2 The spatial restructuring of IAs

During the EM of China, industries and industrial areas (i.e. TIAs and DZs) shifted geographically and were restructured spatially. This spatial restructuring included changes in spatial distribution and area size, spatial density, and the spatial relationship of industries and IAs. The spatial relationship includes the relationships among industries and IAs in a urban agglomeration, the relationship of industries and IAs with other functional urban areas, and the relationship of industries and IAs with the landscape.

In the 2010s, the area size of IAs containing mostly secondary industries (especially IAs in the city centre and along with Xiang River) decreased, and the area size of IAs containing mostly tertiary industries (especially in city centres) increased. The development and land-use of IA

transformed from an extensive mode to an intensive mode. The spatial relationship of industries and IAs in the CZT urban agglomeration and the spatial relationship of industries and IAs to other urban functions (e.g. residential areas, landscaping, commerce, administration, education, entertainment, catering, transportation, communication networks and logistics) became closer than before. This thesis has explored the changing relationship of IAs with five typical landscaping spaces. Multiple functional landscapes have been developed and adopted for the ET of IAs, including wastewater treatment areas, the integrated development of IAs with other urban areas, the protection of industrial heritage and culture, and the revitalisation of TIAs. Finally, this thesis summarises these findings in a spatial model of an urban agglomeration during EM development in China (Fig 8.30).

9.1.4 Reflections on Research Question 4

> Q4: How can these research findings contribute to EM in China and other centralised developing countries?

9.1.4.1 Relationship of EM with Space

A sociological perspective reveals that space is much more than an empty geographical element (Seghezzo, 2009). On the one hand, it contains and is shaped by social activities and relationships, economics, and political systems; on the other hand, it is a powerful tool that can be used for social, economic and political development. Fig 9.1 illustrates a new spatial dimension for EM analysis and research.

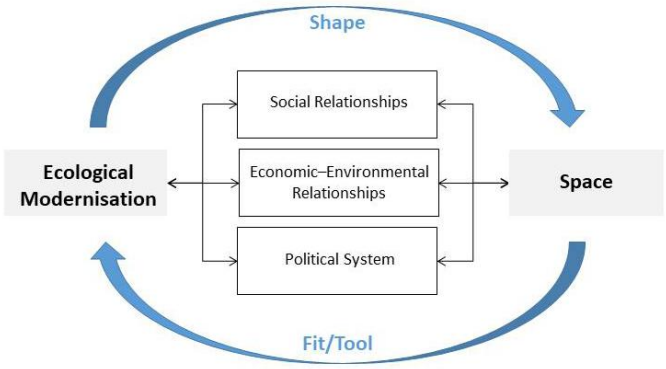


Figure 9.1 Relationship between EM and space

EM, as a social science theory, encourages new relationships between economic growth and environmental performance by adjusting institutional structures and stakeholder involvement (see section 2.1.1). Then, under the influence of EM, the reform or reflection of society, economy and political governance shape spatial constructions. Space can also be a tool that leads or accelerates those reforms and transformations.

Industrial areas (Incl. TIAs and DZs) have always been developed as spaces undertaking only local production. Under the influence of EM concept, local government on long focuses only on

the local economic growth, but the win-win of economy and environment. Increasingly attentions were paid to the environmental performance and urban functions of industrial areas. Large amount of polluting industries of TIAs were closed down or relocated, and original TIAs been redeveloped to new urban areas with greener industries (details in section 8.1). The spatial structure (Incl. spatial distribution and size, spatial density and spatial relationship) of industrial areas also changed in respond to EM concept (details in section 8.2). The institutional adjustment for EM development in China, i.e. rescaling of environmental governance, also acted on the institutional mechanism of eco-transformation projects of industrial areas in China. Local government attached greater importance to the cooperation with non-state actors, e.g., PPP mode for the relocation-based transformation of TIAs. Vice versa, central and local government adopted spaces as the tool to accelerate the EM development.

9.1.4.2 Effectiveness of Sub-national Governments for EM

The nonfeasance of local government about local environmental protection has long been recognised as the main reason of environmental problems in China. So, this thesis finds that, regardless rescaling-up or out process of environmental governance in China, they all focused on the improvement of the environmental effectiveness of sub-national government. However, since the different political regime and economic level of China comparing to western developed countries, China adopted different strategies. These strategies can be divided into five categories (Fig 9.2). Some remaining problems have been identified and some suggestions are offered below for the future of Chinese EM. Moreover, this could provide a reference for EM in other centralised developing countries.

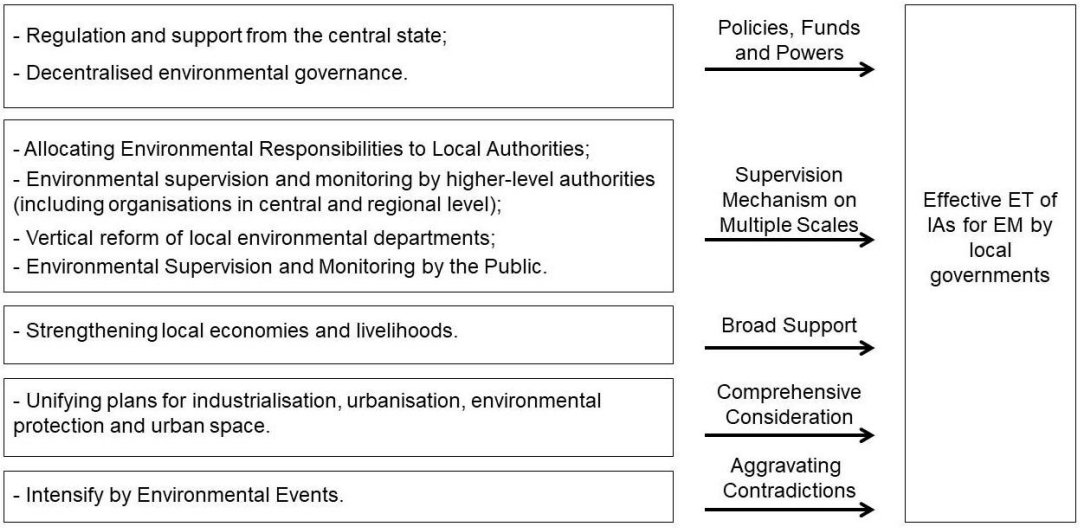


Figure 9.2 Strategies promoting the efficiency of local governments in Chinese EM

Firstly, the support of the central government for EM is more important in China than in Western countries. As illustrated in the rescaling of environmental governance of the ET of IAs that has been taking place in China since the late 2000s, support from the central government does not only include funds and preferential policies, but also the empowerment of local authorities and the implementation of restrictive policies (e.g. regulations and supervision). Financial capabilities, central subventions and power (especially executive power) should be given to local governments. In practice, these have been provided to local authorities through the decentralisation of fiscal and environmental governance in China. Environmental supervision by the central government is also important. According to the Central Supervision of Local Environmental Protection Project, which was implemented in China in 2016, central environmental supervision is not for private enterprises but local governments (see section 7.2). Without support from the central government, local governments and private enterprises would lack the motivation and power to promote EM. China's centralised, hierarchal political regime determines the authority and importance of the central government. Since high-level members of government rather than the public assess officials' political performance, local governments are more likely to respond to central government guidance than to public demands. Moreover, the problem of pollution by central government-owned industrial companies can only by addressed through central regulations. However, central guidance and supervision are not enough.

Secondly, in addition to supervision by the central government, supervision of local authorities on multiple levels (e.g. higher levels of government and environmental NGOs) is also crucial for EM in China. Through the Vertical Reform of Sub-national Environmental Departments, supervisory powers (including environmental supervision, environmental monitoring and personnel management of local environmental departments) initially allocated to every layer of local government was rescaled upward to the highest local authorities – that is, to the provincial level (see section 7.2). Furthermore, the government has offered more and more opportunities for the public to participate in environmental supervision, such as the Folk River Chief Project and the development of local environmental NGOs. This participation involves supervising local governments and also enterprises. The awareness, motivation and professionalism of the public and of local environmental NGOs have increased gradually. Environmental supervision mechanisms that cross administrative divisions have also been established, such as the Office for Two-Oriented Society of CZT Urban agglomeration.

However, current environmental supervision mechanisms in China still have some problems which have impeded the progress of EM. Firstly, local environmental NGOs provide strong environmental supervision of private firms, but their supervision of local governments is

relatively weak. Environmental NGOs have more influence than in the past (see section 7.3.2), but it is hard for them to participate directly and effectively in policy-making and decision-making processes, especially spatial plans. This is a problem that probably cannot be solved quickly in China. However, this thesis suggests that, other than participating in the policy-making process, more ways for the public to supervise local government and to influence local government's decisions should also be explored, e.g. enhancing information disclosure, strengthening public medias' impacts, improving skills and professional degrees, and improving connections with central organisations.

Secondly, environmental supervision mechanisms have been adjusted on the macro level, but these changes have not been implemented concretely in the ET projects of IAs. For example, the relocation-based transformation of TIAs in CZT left some environmental problems unresolved at every step. For example, according to interviewee 21, some pollutants were leaked when industrial devices were demolished for relocation or during closure of a site. Moreover, interviewee 7 stated that pollution continued in 'receiving areas' (see section 8.1.2.3). There were also problems during pollution treatment stage: the standard for acceptance inspection was unclear, which may affect the ultimate results of pollution treatment (interviewee 21). Regarding the relocated industrial companies, local governments in 'departure areas' intended to visit and review industries in 'receiving areas' and ensure they did not cause environmental burdens in new places (interviewee 21). In theory, this is a good idea, but it will be difficult in practice as there is no clear mechanism for environmental supervision across administrative boundaries. Coordination among higher levels of government (e.g. organisations at the provincial or urban agglomeration levels), would simplify supervision across administrative boundaries, but how many environmental responsibilities should fall to the local governments in 'departure areas'? This question needs further discussion and clarification. To address those problems, this thesis suggests that, on the one hand, the environmental responsibilities of relevant local authorities should be clearly defined by higher levels of government (i.e. authorities at the provincial or urban agglomeration levels). On the other hand, as most large-scale EM policies and strategies have been implemented by one or two leader groups, the corresponding supervisory organisations, groups or mechanisms could be established for specific leading groups.

Thirdly, EM policies and strategies can benefit local economies and livelihoods. The present study finds that, aside from corruption, there are two main reasons why EM projects implemented by local governments fail. Firstly, in contrast to other environmental policies, EM policies focus on the win-win potential of combining environmental and economic goals. However, the time to the return on investment differs in environmental and economic projects.

Especially in the early days of policy implementation, the benefits of pollution treatment appear slowly, and the economic benefits of environmental policies are also only observable after some time. Conflicts between EM and local economies may impact the careers of local leaders, as local economic growth is a crucial criteria in their political performance assessments. This reduces the willingness of local governments implement EM policies. Secondly, EM strategies that do not consider local livelihoods may encounter difficulties in practice, such as objections from local residents.

Therefore, the benefits of EM to local economies and livelihoods must be highlighted and be realised as soon as possible. Local government in CZT recognised this point. Some PPP projects and the Mulberry Project (see section 8.2.3.3) emphasised the economic benefits of the ET of IAs to private firms and farmers, which led to increasing support for these projects. The relocation-based transformation process includes three sequential steps (relocation/closing down, pollution treatment and redevelopment), but since these phases may take more or less time in different locations, all three phases can be implemented simultaneously at different locations for one TIA (see section 8.1). This strategy reduced the total duration of the project that new industries could be introduced in this area. It relieved the economic conflicts that arise from the large-scale retreat of secondary industries from a region. To secure local livelihoods, physical aspects such as working and living environments should receive attention, but less tangible aspects such as the spirit, culture, lifestyle and leisure activities of locals should be considered as well. For example, during the relocation-based transformation of TIAs in CZT, the shanty areas surrounding TIAs were rehabilitated; residents received subsidies and free job training; other functional areas (including commercial and educational areas and landscaping) also were considered during the redevelopment process.

Fourthly, the unification of plans for environmental protection, industrialisation, urbanisation and urban space affects the efficiency of the implementation of local governments' EM policies and strategies.

Fifthly, the intensification of environmental incidents could support the implementation of local EM policies and strategies. Environmental events usually attract widespread attention, which sharpens conflicts between the public and local governments over environmental issues. One example is the Water Conservancy Project described in section 8.1.3.1. Disruptive environmental problems raise public concern so that local governments can no longer ignore the issue.

9.2 Limitations and Further Research

The present study has some limitations. Firstly, this thesis has only explored three TIAs and eight DZs in the CZT urban agglomeration. Although it describes eleven IAs, it focuses on one urban agglomeration, so the findings cannot easily be generalised to the rest of China. So far, the rescaling of environmental governance is implemented in the national scale, and the spatial changes of IAs also existed in other areas. For example, the central government designated 21 TIAs from 20 provinces as pilot locations for relocation-based transformation. However, further research is needed to determine whether these locations have the same drivers, procedures and problems as CZT. Different economic conditions and environmental standards in different areas may create different situations. Regional differences affecting EM in China could be explored in future research.

Furthermore, during the interviews and fieldwork conducted for this thesis in CZT in 2017, the Vertical Reform of Sub-national Environmental Departments was still in the drafting and preparation stage. This policy was issued and implemented in Hunan Province at the end of 2019. Therefore, the current study has described the potential contributions and issues of this reform identified during the drafting stage, but the practical effects of the vertical reform to the ET of IAs in CZT were not investigated. Future research on the impacts of vertical reform in CZT would support a better understanding of the rescaling of environmental governance during EM in China.

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Appendix 1: A formal introduction letter

UNIVERSITY OF Hull

Introduction Letter

Dear _____,

I am writing to introduce Bingni Deng, a Human Geography PhD student in Hull University, to your place for field work/interview for her PhD research (Eco-transition of the industrial areas in China). Please kindly provide assistants she requires.

Sincerely,

P. Deutz

Dr. Pauline Deutz

Geography, School of Environmental Sciences

University of Hull, Hull HU6 7RX UK

Tel: 44 (0) 1482 465948

p.deutz@hull.ac.uk

16/01/2017

介绍信

_____：

兹有我单位，人文地理专业在读博士生，邓冰旎同志，因博士课题（中国工业区的生态转型——以长株潭城市群为例）的研究需要，前往你处调研访谈，请予以理解和协助。

此致

敬礼

P. Deutz

（签名）

Pauline Deutz 博士

英国赫尔大学环境科学学院地理系

2017 年 1 月 16 日

Appendix 2: A list of the coding categoties

- Environmental decentralisation – time
- Environmental decentralisation – changes of powers
- Environmental decentralisation – drivers/reasons
- Environmental decentralisation – achievements
- Environmental decentralisation – remaining problems
- Central supervision – changes of powers
- Central supervision – drivers/reasons
- Central supervision – achievements
- Central supervision - remaining problems
- Vertical supervision – changes of powers
- Vertical supervision – drivers/reasons
- Vertical supervision – achievements
- Vertical supervision – remaining problems
- 'Two-Oriented Society' management system – changes of powers
- 'Two-Oriented Society' management system – drivers/reasons
- 'Two-Oriented Society' management system – achievements
- 'Two-Oriented Society' management system – remaining problems
- Participation of private sectors – drivers/reasons
- Participation of private sectors – changes of cooperation modes
- Participation of private sectors – remaining problems
- Participation of civil societies - drivers/reasons
- Participation of civil societies – changes of cooperation modes
- Participation of civil societies – remaining problems
- Relocation of TIAs – time
- Relocation of TIAs – process
- Relocation of TIAs – drivers/reasons
- Relocation of TIAs – achievements
- Relocation of TIAs – remaining problems
- Spatial Distribution and area size – changes
- Spatial Distribution and area size – drivers/reasons
- Spatial Distribution and area size – achievements
- Spatial Distribution and area size – remaining problems
- Spatial Density – changes
- Spatial Density – drivers/reasons
- Spatial Density – achievements
- Spatial Density – remaining problems
- Spatial Relationship – changes
- Spatial Relationship – drivers/reasons
- Spatial Relationship – achievements
- Spatial Relationship – remaining problems