An Exploration of Regional Capability

Towards A Comprehensive Understanding of Regional Development, Governance and Planning in China with Case Studies from the Northeast and Yangtze River Delta, 1978-2015

Dissertation

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Yan Li

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First Supervisor	Prof. Dr. Dörte Segebart
Second Supervisor	Prof. Dr. Oliver Ibert
Date of Disputation	14.07.2016

First Supervisor
Prof. Dr. Dörte Segebart
Freie Universität Berlin
Department of Earth Sciences
Human Geography
Malteserstraße 74-100
12249 Berlin
Germany

Second Supervisor
Prof. Dr. Oliver Ibert
Freie Universität Berlin
Department of Earth Sciences
Human Geography
Malteserstraße 74-100
12249 Berlin
Germany

Date of Disputation
14.07.2016

Erklärung

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Abbreviations

ACEF	All-China Environment Federation
ADB	Asian Development Bank
ANT	actor-network theory
APA	American Planning Association
AQI	air quality index
ASEAN	Association of Southeast Asian Nations
BBC	British Broadcasting Corporation
CBD	central business district
CCICED	China Council for International Cooperation on Environment and Development
CCTV	China Central Television
COD	chemical oxygen demand
CPC	Communist Party of China
CPPCC	Chinese People's Political Consultative Conference
CRI	China Radio International
DRC	Development and Reform Commission
ECR	economic cooperation region
EIA	environmental impact assessment
ENRPC	Environment and Natural Resources Protection Committee
EPB	Environmental Protection Bureau
EPD	Environmental Protection Department
ERM	Environmental Resources Management
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FDI	foreign direct investment
FON	Friends of Nature
FYEP	five-year environment plan
FYP	five-year plan
GDP	gross domestic product
GIAHS	Globally Important Agricultural Heritage Systems
GIS	geographic information system
GMP	good manufacturing practices

GONGO	government-organized NGO
GREMI	Groupement Européen des Milieux Innovateurs
GRP	gross regional product
HACCP	Hazard Analysis and Critical Control Point
HEI	higher education institution
IMF	International Monetary Fund
ISO	International Organization for Standardization
JCCC	Jilin Connell Chemical Company
JPC	Jilin Petrochemicals
MCA	Ministry of Civil Affairs
MEP	Ministry of Environmental Protection
MLR	Ministry of Land and Resources
MOA	Ministry of Agriculture
MOC	Ministry of Commerce
MOE	Ministry of Education
NBSC	National Bureau of Statistics of China
NDRC	National Development and Reform Commission
NE	the Northeast (= Northeast China)
NEPA	National Environmental Protection Agency
NES	new economic sociology
NGO	nongovernmental organization
NIE	new institutional economics
NPC	National People's Congress
OECD	Organization for Economic Co-operation and Development
OIE	old institutional economics
PM	particulate matter
PPCC	People's Political Consultative Conference
PRC	People's Republic of China
R&D	research and development
RMB	ren min bi
SCE	Standard Coal Equivalent
SDPC	State Development Plan Commission
SEI	Stockholm Environment Institute
SEPA	State Environmental Protection Administration

SETC	State Economic and Trade Commission
SOE	state-owned enterprise
SPC	State Planning Commission
SWOT	strengths, weaknesses, opportunities, and threats
TFR	total fertility rate
TN	total nitrogen
TNC	transnational corporation
TP	total phosphorus
TVE	township and village enterprise
UEQES	Urban Environmental Quality Examination System
UK	United Kingdom of Great Britain and Northern Ireland
UNCED	United Nations Conference on Environment and Development
UNCHE	United Nations Conference on Human Environment
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
VOA	Voice of America
WCED	World Commission on Environment and Development
WWF	World Wildlife Fund
YRD	Yangtze River Delta
YRDECC	Yangtze River Delta Urban Economic Coordination Committee

Summary

The Northeast of China as an old national industrial base has not been able to escape the shadow of deindustrialization. The Yangtze River Delta, on the other hand, has moved from strength to strength, becoming a leading region of the Chinese economy. Why have these two regions developed so differently? What factors play a role? This study attempts to grasp the complexity of regional development analytically. It examines the latest findings and concepts from economic geography – from the relational, institutional and evolutionary turns of economic geography to the concept of contextuality, path dependence and contingency –, develops a concept of regional capability and proposes path-assets analysis as a model for regional analysis based on a relational-dynamic perspective.

The study applies and tests the model empirically with reference to Northeast China and the Yangtze River Delta in the period from 1978 to 2015. It conducts a multi-dimensional path-assets analysis of economic, socio-cultural, environmental and political-institutional factors using official statistical data, planning documents, expert interviews and participant observation of planning processes in the two regions. It concludes that regional development cannot be sustained by relying on national policy and investment alone, but requires endogenous impetus and innovation based on regional assets, and hence regional governance and planning can be effective tools for the management and the strengthening of regional capability.

The analytical framework proposed deploys a capability-based interdisciplinary approach for regional analysis. It offers a new perspective for regional planners, scientists and policy makers to facilitate regional governance from an interdisciplinary and relational-dynamic perspective by analyzing regional capability with respect to the implementation of sustainable development, and is particularly suitable for a capability-based spatial analysis in the sense of a path-assets analysis under a relational dynamic perspective. It can be applied to the broader research fields of spatial analysis, with a six-step methodology recommended. The study therefore makes a theoretical contribution to geographical development studies and cognate fields, in particular in connection with current debates in economic geography.

Key words

regional development, regional analysis, economic geography, regional capability, path-assets analysis, relational-dynamic perspective, governance, planning, China, Northeast China, Yangtze River Delta

Zusammenfassung

Der Nordosten Chinas als ein altes nationales Industriegebiet ist heute noch nicht aus dem Schatten der Deindustrialisierung. Das Yangtze Delta hat sich vom Land des Überflußes zu einer führenden Region der chinesischen Wirtschaft entwickelt. Warum entwickeln sich zwei Regionen so unterschiedlich? Welche Faktoren spielen dabei eine Rolle? Diese Studie versucht die Komplexität der Regionalentwicklung analytisch zu fassen. Sie bezieht sich zunächst auf aktuelle Erkenntnisse und Konzepte aus der Wirtschaftsgeographie, von den relationale, institutionelle und evolutionäre Wendungen der Wirtschaftsgeographie bis zum Konzept der Kontextualität, Pfadabhängigkeit und Kontingenz, und entwickelt die Konzeption der Regionalkapazität (regional capability). In einem Modell zu Path-Assets Analyse wird eine Regionalanalyse in relationaler-dynamischer Perspekte vorgeschlagen.

Anhand der zwei genannten Regionen Nordostchina und Yangtze Delta wird das Modell empirisch angewandt und getestet. Die Studie untersucht die beiden Regionen im Zeitraum 1978-2015. Sie basiert auf der Auswertung statistischer Sekundärdaten, offiziellen Planungsdokumenten, Experteninterviews und Beobachtungen während der eigenen Mitarbeit in Planungsprozessen in den beiden Regionen. Dabei werden eine mehrdimensionale Path-Assets Analyse auf die wirtschaftliche, soziokulturelle, ökologische und politisch-institutionelle Aspekte analysiert. Es zeigt sich, dass die Regionalentwicklung nicht nur auf die nationale Politik und Investitionen angewiesen ist, sondern ebenso auf endogene Impulse und Innovationen basiert, um die eigenen regionalen Assets aufrechtzuerhalten. Regionalen Governance und Planung können so effektive Instrumente sein für das Management und die Stärkung der Regionalkapazität.

Die vorgeschlagene Analyse ist ein capability-basierter interdisziplinärer Ansatz zur Regionalanalyse mit verbundene analytische Rahmen, bietet aber eine neue Perspektive für regionale Governance, die regionalen Planern, Wissenschaftlern und politischen Entscheidungsträgern erlaubt, die Capability einer Region in Bezug auf die Umsetzung einer nachhaltigen Entwicklung interdisziplinär und relational dynamisch zu analysieren, und eignet sich besonders für eine capability-basierte räumliche Analyse im Sinne einer Path-Assets Analyse unter einer relationalen dynamischen Perspektive. Sie kann auf breitere Forschungsfelder der Raumanalyse angewandt werden. Empfohlen wird eine Sechs-Schritt-Methodik. Die Studie leistet damit einen theoretischen Beitrag zur geographischen Entwicklungsforschung in Bezug auf Methodologien zu geographischen Raumanalysen in Verknüpfung mit aktuellen Debatten aus der Wirtschaftsgeographie.

Schlüsselwörter

Regionalentwicklung, Reginalanalyse, Wirtschaftsgeographie, Regionalkapazität (regional capability), Path-Assets Analyse, relationale dynamische Perspektive, Governance, Planung, China, Nordostchina, Yangtze Delta

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1 Introduction

1.1 Research background and research questions

Since the implementation of the opening and reform policy in 1978, China as a developing country [1] has experienced astonishing rapid economic growth with tremendous accomplishments in industrialization, urbanization, marketization and globalization (Chen and Lu 2016: 39). According to a study of the International Monetary Fund (IMF), the market-oriented reforms since 1978 are the leading cause of China's strong productivity growth and unprecedented economic performance before the end of 1990s, and China's open-door policy has spurred foreign direct investment (FDI) in the country linking the Chinese economy with international markets (Hu and Khan 1997). Nevertheless, after a period of high-speed growth, the growth rate of Chinese national economy has obviously declined since the 2000s, accompanied with regional imbalance as well as alarming environmental and social consequences (Bi 2005: 112). Due to rapid economic ascendance since 1978, China has to face the challenges of "high inequality; rapid urbanization; challenges to environmental sustainability; and external imbalances", and "significant policy adjustments are required in order for China's growth to be sustainable" (World Bank 2015).

In fact, along with the implementation of the opening and reform policy since 1978, China has experienced an era of transformation with both transition from a central-planned economy to a market-oriented economy in the economic system and change of the growth pattern from extensive growth to sustainable development (Tisdell 2009; Kong *et al* 2012). Many efforts demonstrate the determination at the national level to promote sustainable development in China. Aimed to build a harmonious society[2] by 2020, the Chinese government has been promoting harmonious regional development (Wu *et al* 2006a; Liu *et al* 2015) under the Scientific Development Concept of putting people first and aiming at comprehensive, coordinated and sustainable development since 2003[3] (Xinhua 2007; Hu 2007a). In addition, recent five-year plans (FYPs) of China as the outline for national economic and social development also addresses issues on sustainability. For instance, China's 12th FYP (2011-2015) "highlights the development of services and measures to address environmental and social imbalances, setting targets to reduce pollution, to increase energy efficiency, to improve access to education and healthcare, and to expand social protection" and sets an

[1] "Yet China remains a developing country (its per capita income is still a fraction of that in advanced countries) and its market reforms are incomplete." (World Bank 2015)

[2] The idea of building a harmonious socialist society comes from the 'harmonious society' resolution, including the principles, main objectives and tasks for building a harmonious socialist society by 2020, published in the 6th Plenary Session of the 16th Central Committee of the Communist Party of China (CPC) on 11 October 2006 (Xinhua 2006a). Since then, many studies emphasized the concept of a harmonious society, see, for example, Shah and Shen (2006), Zhan *et al* (2007) and Zhou and Fu (2007). Earlier, Bi (2005) argues that China must "establish a long-term effective mechanism to encourage social harmony, coordinate various interests, protect legal rights and maintain social stability" in order to sustain its development (Bi 2005: 112).

[3] The Scientific Development Concept was put forward by Chinese President Hu Jintao in 2003 at the 16th Central Committee of the CPC. For further reading on the Scientific Development Concept and harmonious society, see: Scientific Concept of Development & Harmonious Society. 17th congress.org.cn, 8 October 2007. http://www.china.org.cn/english/congress/227029.htm, accessed on 25 June 2015.

annual growth target of 7%, which signals the intention of Chinese central government "to focus on quality of life, rather than pace of growth" (World Bank 2015).

However, with only five years left to achieve the goal of a harmonious society by 2020, the Chinese economy has generally confronted with the recent "new normal" (VOA 2015; Hu 2015) of slower growth by several bottlenecks (He 2015a,b) since the end of 2014. Currently China has to face many problems accumulated from the previous period with rapid economic growth such as expanded regional disparities, irrational expenditure of natural resources, ever-increasing environmental pollution and degradation, excessive inter-city and inter-province competition on the construction of development zones and industrial parks as well as laying-off of personnel during the reform of the state-owned enterprises (SOEs).

In fact, national development could be taken as the result of regional development in the country. Regional development as an important area of academic inquiry is of particular importance to developing countries like China, whose economy becomes more related to and important for the global economy (Wei 2000: 1). In this sense, the achievement of a harmonious society by 2020 is not only in accord with but also constrained by the achievement of harmonious regional development in China, which depends on the extent of regional sustainability. Presently, under the macro-economic background of the new normal with a slow growth, the various problems in China mentioned previously impel the national governmental departments as decision makers responsible for regional development policies, scholars in the field of scientific research in geographical sciences, economics, political sciences, social sciences and planners to reconsideration on China's regional development and sustainability, namely how should China maintain economic growth while balancing regional development (Chen and Lu 2016).

During the past decades, along with China's transition process, regional development in China has exhibited different models with respective characteristics. On the one hand, some regions in Eastern China have significantly benefited from the implementation of the opening and reform policy and have achieved rapid economic growth. For instance, in 1990, the Chinese government decided to open the Pudong New Area of Shanghai to overseas investment, and other cities in the Yangtze River Delta (YRD) also benefited from this decision. Consequently, YRD become one of the leading regional economies in Eastern China served as a growth engine of the Chinese economy. On the other hand, some regions have also aroused concerns during transition due to the problematic situations in the old national manufacturing centers served as an important part of Chinese economy since the 1950s. For instance, the Northeast (NE) has aroused the most attention on its "northeast phenomenon" as a long-term problem related to deindustrialization (Li and Nipper 2009). As a consequence, regional development in China exhibits heterogeneous characteristics with imbalance.

In order to achieve harmonious regional development as well as harmonious society in China by the end of 2020, either the Chinese central government or the academic community has paid great attention to both regions of the NE and YRD, since both regions not only make their achievements on industrialization and urbanization with contribution to national economic development, but also serve as representative

development patterns for other Chinese regions with respective unique development path. That's also the reason why this study selects the NE and YRD as two regions for case studies.

Accordingly, it becomes important to reflect on regional development in China to fulfill a harmonious goal on regional development, to analyze the factors that influence regional sustainable development and to lead a development path of a region towards sustainability. Distinguished from many other regional analyses focused on reducing regional disparities in China for balanced regional development (Goh *et al* 2015) or coordinated regional development (Yang 2004; Zhang and Hu 2004; Wu *et al* 2006a; Song 2015), this study aims for a comprehensive understanding of regional development towards sustainability and tries to analyze regional development in a new way: with a relational-dynamic perspective, a concept of regional capability as well as a new approach of path-assets analysis.

Aimed for a comprehensive understanding of regional development in a transformation era in China towards the national goal of harmonious regional development as well as a harmonious society in 2020, this study investigates regional development of the two regions of the NE and YRD (see 3.2 Research areas) in China with an emphasis on the reform period since 1978. Furthermore, this study tries to use an interdisciplinary approach by viewing the region as a complex and to answer the following research questions by analysing the two regions mentioned above for case studies: Why have these two regions developed so differently? What factors play a role? This study attempts to grasp the complexity of regional development analytically.

1.2 Research objective and arguments

Although there are many studies on the topic of regional development in China, few of them could provide a comprehensive understanding of it. The current studies on regional development in China could be approximately divided into the following two styles: one is the dynamic style, featuring by taking a dynamic perspective on one or two elements of regional development in China, e.g. Li *et al* (2015); the other is the relational style, featuring by analyzing the relationship or network of several elements on regional development in China, e.g. Liu *et al* (2015). It is obvious that regional development is a complicated process and both perspectives mentioned above are helpful for understanding of this process, but it would be even more helpful to combine both of them for regional analysis. Based on this consideration, this study tries to provide a comprehensive understanding of regional development, governance and planning in China with a relational-dynamic perspective.

The superordinate objective of this study is to present a conceptual framework of regional capability as a new capability-based interdisciplinary approach to regional analysis and to make theoretical contribution to regional development studies in developing countries with methodological application to spatial analysis of geographical sciences.

Besides providing a preliminary conceptual framework of regional capability as a new analytic framework for a capability-based analysis of regional development (Chapter 2),

this study applies the methodology (Chapter 3) in empirical case studies in the field of regional development, governance and planning (Chapter 4 to 8) in China towards sustainable regional development, and tries to assess the following three main arguments:

(1) Regional capability could influence the development path of a region besides contingency based on its administration of the range and function of regional assets.

(2) Regional governance matters for regional capability on the condition of effective management of regional assets and regional development path.

(3) A sustainable regional development path could be steered or improved by regional governance, with regional planning as an effective tool in practice.

1.3 Significance of the research

This study is worthwhile for its unique perspective on regional development during China's transformation with both theoretical and practical significance.

Theoretically, it is a supplement to the theory of regional development. Regional development theories are developed largely based on the assumptions of closed free market economies and the experiences of developed countries, and they are less relevant for explaining regional inequality in transition economies like China, where forces of regional development differ from that in capitalist economies (Wei 2000: 4). This study focuses on regional capability with a relational-dynamic perspective for a comprehensive understanding of the mechanism and process of regional development, and advocates a path-assets analysis for analyzing regional capability, which is not only helpful to understand the superiorities and deficiencies of a region including reaction to contingency, but also important to explain the unique development path of a region. The path-assets analysis put forward by this study for analyzing regional capability as a new interdisciplinary approach of regional analysis could be applied to spatial analysis in geographical sciences (see 9.3). This study probably provides a new approach to regional analysis and regional studies in geography with an interdisciplinary perspective. In addition, this study points out that regional governance including regional planning could improve regional capability and contribute to regional sustainability. It is also a supplement to the scientific research on regional development, governance and planning in China.

Practically, it is contributive to governments, decision-makers and planners to propose appropriate development strategies and polices for future development. This study is in accordance with the promotion of the Scientific Development Concept by the Chinese central government and the aim to achieve harmonious regional development as well as a harmonious society by 2020, and the findings of this study might provide policy implications for sustainable regional development, promote regional governance and regional planning in China and provide useful references for other transition economies and developing countries undergoing similar processes of economic restructuring and globalization with similar problems and conflicts. Moreover, in the field of scientific research, it is also helpful for scholars home and abroad to achieve a better understanding of regional development in China in the era of transformation and might

promote interdisciplinary learning as well as academic exchanges on similar topics. Scholars and planners might get new findings from the empirical case studies, which may constitute the basis for their further research on regional development in China.

1.4 Organization of the thesis

There are nine chapters in this thesis.

Chapter 1 is an introduction of the research background, research questions, research objective and arguments as well as the significance of the research.

Chapter 2 is the theoretical framework. It tries to understand regional development with focus on regional capability under a relational-dynamic perspective, and argues that the link between regional capability and regional sustainable development is regional governance. This chapter provides the theoretical basis for empirical case studies.

Chapter 3 introduces the analytical framework, methodology and the two regions of the NE and YRD in China as the research areas.

Chapter 4 to 7 are empirical work with case studies featured by a multi-dimensional path-assets analysis of the two regions on the economic (Chapter 4), the social-cultural (Chapter 5), the environmental (Chapter 6) and the political-institutional (Chapter 7) dimension.

Chapter 8 focuses on regional planning as a proposal of regional governance towards sustainability, with case studies of the NE and YRD in addition to literature review of the planning practices in China.

Chapter 9 as the concluding chapter summarizes the empirical results, reflects on the concept of regional capability and its methodological application in spatial analysis, recognizes the limitations of this study, gives future recommendations on regional governance and planning in China and puts forwards open questions and future research directions.

2 Theoretical Framework

This chapter intends to present a conceptual framework of regional capability as a capability-based interdisciplinary approach to regional analysis highlighting the interrelation between regional capability and regional development, regional governance as well as regional sustainability.

The theoretical framework starts from an outline of the multi-perspectival turns in economic geography (2.1) and the concept of contextuality, path dependence and contingency (2.2) before it focuses on regional development and regional capability (2.3), which analyzes the interrelation of regional development and regional capability (2.3.1) and the concept of capabilities and the capability approach (2.3.2) before it focuses on regional capability – its origin, definition and characteristics (2.3.3), and the analysis of regional capability lays emphasis on analysing regional assets and regional development path. Furthermore, regional capability could be improved by regional governance towards regional sustainability (2.4), and regional planning with its governance nature could serve as an effective tool towards regional sustainability: on the one hand, regional governance matters for the promotion or improvement of regional capability on the condition of effective management of regional assets, and the latter serves as the basis of a regional development path; on the other hand, a sustainable regional development path could be steered or improved by regional governance, with regional planning as an effective tool in practice. Finally, the concluding remarks on the theoretical framework (2.5) focuses on two key issues: for one thing, a relational-dynamic perspective applies to the analysis of regional capability for a comprehensive understanding of regional development; for another, regional capability as the center of regional analysis interrelates with regional development, regional governance and regional sustainability.

2.1 Multi-perspectival turns in economic geography

Since the 1980s “economic geography has moved away from traditional economic analysis and transformed into a more interdisciplinary approach” (Boschma and Frenken 2006a: 273) characterized by several multi-perspectival turns with shifts in research focus including the relational turn, the institutional turn and the evolutionary turn, which leads to diversification as well as reorientation in this discipline. Concerning the rise of these turns, there are both endogenous and exogenous factors. Due to an ever-changing economic as well as social-political background, limits of the traditional approaches in economic geography have become increasingly distinct. The internal turbulence of the main theoretical orientations as well as shifting methodological conventions in the discipline of economic geography[4] could be viewed as the endogenous causes, while the exogenous driving factor for these turns is the increasing connection between economic geography and other disciplines outside geography especially sociology and economics, with widely accepted concepts originated from these disciplines such as institution, embeddedness, network and path dependence.

[4] See Clark *et al* (2000). For a further reading on the development history of economic geography since the 1950s, see Scott (2000) and Barnes (2001).

This section mainly reviews the relational turn, the institutional turn and the evolutionary turn in economic geography with their respective perspectives and tries to find some common points behind them for further study.

2.1.1 The relational perspective and the relational turn

Economic geography has looked to other disciplines such as economic sociology (e.g. Granovetter 1985) and institutional economics (e.g. Hodgson 1988) to integrate the 'social' into economic analysis since the 1980s (Boggs and Rantisi 2003: 109).

Amin and Thrift (2000) argue that economic geography is at a turning point of both "high theoretical principle and pragmatic decisions about allies" (Amin and Thrift 2000: 4), which provokes wide debate in economic geography[5]. As part of this debate, Ettlinger (2001) proposes a relational perspective in economic geography with focus on the relation between the competitiveness of firms and the well-being of people, arguing that cultural analysis is notably helpful to the economically focused research. The relational perspective[6] emphasizes the social-spatial relations of economic actors in spatial-economic analysis (Yeung 2005). However, it is not a new perspective. A relational thinking[7] already exists in human geography (Massey with the collective 1999).

The relational turn in economic geography has spread since '*The "Relational Turn" in Economic Geography*' as a special session at the *98th Annual Meeting of the Association of American Geographers* in March 2002 in Los Angeles. Inspired by discussions on this conference, in April 2003, *Journal of Economic Geography* (Volume 3, Issue 2) published several papers in the stream of relational economic geography. And in the same issue, Boggs and Rantisi (2003) refer to a relational turn in economic geography as "a theoretical orientation where actors and the dynamic processes of change and development engendered by their relations are central units of analysis" (Boggs and Rantisi 2003: 109). In a word, the relational turn in economic geography integrates economic, social, cultural, institutional and political aspects of human agency (Bathelt and Glückler 2003; Bathelt 2006).

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[5] This debate is associated with a *cultural turn* (Crang 1997; Thrift 1999, 2000; Rodríguez-Pose 2001; Barnett 1998, 2004; Amin and Thrift 2000; Jessop and Oosterlynck 2008) or a *political turn* (Kourliouros 2003). However, this debate is unclear and somewhat misdirected because "the decisive question cannot be whether economic geography should be *economized* or *culturalized*. Rather, the economic and the social are fundamentally interwined." (Bathelt and Glückler 2003: 118). Therefore, Bathelt and Glückler (2003) emphasize a relational economic geography.

[6] There are strands of literature representing the relational perspective within the field of economic geography such as social relations of production (Massey 1979, 1984), social context and social interdependence (Clark 1982), global interdependence (Clark 1993), social context (Martin 1994; Sunley 1996), firm-territory nexus (Dicken and Malmberg 2001), a relational view of networks (Dicken *et al* 2001), relational geometries (Yeung 2002), multiple rationalities of workplace (Ettlinger 2003), firm internationalization (Glückler 2006), social-political relations (Walker 2006), social-spatial relations (Asheim 2006; Jessop *et al* 2008), inter-organizational relations (Yeung 2008) and relational distance (Ibert 2010).

[7] Besides economic geography, a relational thinking also happens in other fields of human geography, for example, relational ethics (Whatmore 1997), relational conception of social life/hybridity (Whatmore 1999) and relational performances of space (Rose 1999). In March 2004, *Geografiska Annaler: Series B Human Geography* (Volume 86, Issue 1) published a series of papers on 'thinking space relationally', which leads a relational view in human geography (Bathelt 2006) and study on relational space (Jones 2009). According to Yeung (2005: 49 note 1), such a relational thinking could also be found in sociology (Emirbayer 1997) and strategic management (Dyer and Singh 1998; Gulati *et al* 2000).

As a new area in economic geography, relational economic geography (Bathelt and Glückler 2002a,b, 2003; Yeung 2002, 2005; Sunley 2008) objects to contextual economic relations including social practice and process and calls for a relational approach based on network theory and embeddedness perspective which is "sensitive to particular contextual constraints and yet remains open and contingent of respond to the problematic at hand" (Boggs and Rantisi 2003: 115). However, it also receives critique. Relational approaches are "potentially infinite because these approaches can be applied to almost any issue" (Sunley 2008: 19). And what's more, suffered from a surprising lack of systematic and critical evaluation (Yeung 2005), "relational economic geography increasingly resembles a vocabulary or a suggestive and loose way of speaking about a wide range of issues and phenomena" (Sunley 2008: 7) such as relational assets, relational connectivity and relational proximity. Nevertheless, relational economic geography seems to obtain "further impetus and enthusiasm from the influence of actor-network theory[8]" (Sunley 2008: 6).

In short, the emphasis of the relational turn in economic geography lies in that *relation matters*. In other words, the relational turn makes a point of analyzing regional economic development in consideration of the specific relational context such as the social-economic relation, the institutional-economic relation and the economic-environmental relation, not solely with focus on the economic itself. Owing to the fact that relations are embedded in specific context with economic, social, environmental as well as political-institutional conditions, based on this kind of embeddedness, a relational approach offers new insight into regional analysis and asks for a contextual understanding of regional development, which will be discussed later in this chapter (see 2.2.1 Contextuality).

2.1.2 The institutional perspective and the institutional turn

Since the 1990s there has been "an increased concern with institutions and the relationship between institutional dynamics and economic development" (Wood and Valler 2001: 1139): for one thing, regionalized and territorially specific institutions play an important role in regional economic development (Storper 1995); for another, actions of particular social groups and institutions shape regional development within wider structures of accumulation and regulation (Allen *et al* 1998).

Considering that the key terminology of institution has been used in different ways by different economic geographers, which causes conceptual confusion (Cumbers *et al* 2003: 328), it is necessary to clarify the definition of institution before fully understanding the institutional turn in economic geography. Economic geographers following the tradition of old institutional economics (OIE)[9] seem to accept the definition proposed by

[8] Thrift (1996: 221) posits "four overlapping but relatively stable types of actor-network" in international financial system, since then actor-network theory (ANT) has been applied to economic geographical research on the globalization issues (Leyshon and Thrift 1997; Olds and Yeung 1999; Whatmore and Thorne 1997; Yeung 2000; Dicken *et al* 2001). According to Amin (1999: 367), the rising influence of ANT "has furthered analysis of the powers of networks by stressing the inseparability of people and things within them, producing distinctive properties that weave together actors, organizational cultures, knowledge environments, machines, texts and scripts". For further explanations on ANT, see 2.2.1 Contextuality.

[9] The OIE refers to 'the Veblerian tradition' evolved in the USA at the end of the 1890s, see Hodgson (1988, 1998),

Hodgson (2006): “Institutions are systems of established and embedded social rules that structure social interactions. Organizations are special institutions…” (Hodgson 2006: 18). While other economic geographers based on a new institutional economics (NIE)[10] approach follow the definition advanced by North (1991): “Institutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights)” (North 1991: 97).

The main difference between the OIE and the NIE[11] lies in whether they distinguish between institution and organization. The OIE views organizations as special institutions, while the NIE distinguishes between institutions and organizations. A NIE paradigm regards institutions as rules of the game and organizations as players (North 1995: 15). In the NIE, “institutions mainly refer to the political and economic regulations functioning as constraints on individual choice and activity or ‘the (formal / informal) rules of the play’, while organizations, which refer to concrete social infrastructure consisting of buildings and equipment like schools, universities, hospitals, or companies, are ‘the players’” (Dale 2002: 7). “Both what organizations come into existence and how they evolve are fundamentally influenced by the institutional framework; in turn they influence how the institutional framework evolves” (North 1990: 5).

No matter what they are based on, the OIE or the NIE, “economic geographers have drawn two main insights from institutional economics: that economic action is both shaped by social context and path-dependent” (Cumbers *et al* 2003: 328). Institutions are often seen as sources of stability and order (Scott 2001: 181), since individuals and organisations tend to comply with the institutional pressures to which they are subject (Battilana 2006: 13) and the ambitions of actors to shape institutions for regional development are a form of embedded agency (Sotarauta 2009: 869).

The notion of an institutional turn gets more popular since the *Conference on Reflections on the ‘Institutional Turn’ in Local Economic Development* held in Sheffield in September 1998. Based on insights into institutional economic theory, Amin (1999) asks for an institutional perspective on regional economic development and argues for an “institutional turn in regional development studies”[12]. Martin (2000) introduces the institutional turn in economic geography by recognizing “various social institutions on which economic activity depends and through which it is shaped” (Martin 2000: 77). According to Martin (2000: 77-78), the institutional turn “derives from various sources” including the French regulation theory, the social-cultural recognition within economic

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Hodgson *et al* (1993). Concepts of the geographers follow OIE such as institutional thickness (Amin and Thrift 1994, 1995; Raco 1998), locality as agent (Cox and Mair 1991) and institutions as geographical accomplishments (Philo and Parr 2000). For a comparison of the concept of institution in OIE and NIE as well as the value of an institutional approach in local/regional economic development studies, see Dale (2001, 2002).

[10] The NIE, which evolved in the last decades of the 20th century, including important contributions of Williamson (1985) and North (1990), represents a revival of the institutionalist elements that for a long period had been neglected in classical and neo-classical economics (Rutherford 1994). For an overview on the development and progress in NIE, see Williamson (2000).

[11] For comparison and critique on the OIE and the NIE, see Langlois (1989).

[12] An institutional turn in development studies (Evans 2004, 2005, 2006) is based on an institutional approach for development analyses (e.g. Acemoulu *et al* 2001, 2002, 2005).

geography and institutionalism in social sciences (especially in economics, sociology and political science). Jessop (2001) identifies three types of institutional turn: thematic, methodological and ontological[13], and these three types of institutional turn "seem to be evident with key strands of the literature appearing to link an empirical focus on particular institutions with a more general claim that institutions play a key role in shaping processes of economic development" (Cumbers *et al* 2003: 328). Nevertheless, there are also sympathetic critiques on this institutional turn, e.g., Rutherford (2004). Notwithstanding the strand of literature[14], the influence of institutional approach "remains quite limited within this field" (Gertler 2010: 4) and the institutional turn "may be rather less well founded than commonly perceived" (Wood and Valler 2001: 1139).

Institutional economic geography is also developing along with the institutional turn. Martin (2000) identifies four key themes for institutional economic geography: the role of the different sorts of institution, evolution of the economic landscape, cultural foundations of the space economy and social regulation and governance of regional and local economies. Gertler (2010: 11) outlines four desirable features of institutional economic geography: agency of individuals and organizations, processes of institutional evolution, the interaction between institutional architectures at different scales and adopting comparative methodologies.

The institutional turn in economic geography could be summarized as *institution matters*. It originates from institutional economics, which could be divided into the OIE and the NIE with different understandings on institutions: the OIE views organizations as special institutions, while the NIE distinguishes between institutions and organizations. Owing to the fact that the definition of institution by the OIE is too broad, which might cause confusion in practical studies, this study accepts the NIE paradigm: institutions as rules of the game and organizations as players. Under an institutional perspective, regional economic development is shaped by institutions. Due to the fact that institutions are path-dependent, regional development is probably likewise (see 2.2.2 Path dependence). Given these points, specific institutional arrangements might play an important role in understanding regional economic development.

2.1.3 The evolutionary perspective and the evolutionary turn

Since the 1990s economic geographers have made efforts to explore evolutionary economics[15] as a basis for regional development study on explaining uneven spatial

[13] A thematic turn focuses on institutions as a theme; a methodological turn takes institutions as a departure for investigating territorial economy; and an ontological turn emphasizes that institutions provide the crucial underpinning to the operation of economic processes across space (Jessop 2001).

[14] There is a diverse set of literature holding institutional perspectives on regional/local development in economic geography such as industrial districts, regional innovation systems and learning regions (Amin 1989, 1999, 2000; Asheim 1994, 1996, 2001; Cooke and Morgan 1994, 1998; Florida 1995; Belussi 1996; Heidenreich 1996; Markusen 1996, 1999; Staber 1996; Asheim and Isaksen 1997; Morgan 1997; Braczyk *et al* 1998; Maskell *et al* 1998), clustering process (Zeng and Bathelt 2011), institutional capacity building (Phelps and Tewdwr-Jones 2000), institutional landscape of economic development (Fuller *et al* 2004), neighbouring institutions (Bosker and Garretsen 2009), local reregulation (Clark *et al* 1997) and local restructuring (Dale 2002).

[15] Evolutionary economics aims to understand the dynamic process which influences both behavior and market environment of firms (Nelson and Winter 1982). The development of evolutionary economics can be traced back to the end of the 19th century since Veblen (1898) argued for an inability of static neoclassical theory to explain

development[16]. Accordingly, principles and metaphors originated in evolutionary economics such as path dependence (see 2.2.2 Path dependence), lock-in, routines or evolution have brought about increasing impact upon studies of economic geography (Grabher 1993; Hudson 1994; Storper 1997; Hodgson 2009).

In an evolutionary perspective, regional economy should be viewed as "a dynamical, irreversible and self-transformational system" rather than as predefined, static or fixed entity (Boschma and Martin 2007: 538). With insight into evolutionary economics, the evolutionary approaches in economic geography (Boschma and Van der Knaap 1997; Cooke *et al* 1998; Boschma and Lambooy 1999; Martin and Sunley 2007; Boschma and Frenken 2009; Essletzbichler 2009; Hodgson 2009; MacKinnon *et al* 2009; Pike *et al* 2009) as well as a systematic theoretical framework for evolutionary economic geography (Boschma and Martin 2007; Essletzbichler and Rigby 2007; Frenken and Boschma 2007; Jovanović 2009) are being formed.

In 2006, the *Journal of Economic Geography* published the article *"Why is economic geography not an evolutionary science? Towards an evolutionary economic geography"* by Boschma and Frenken (2006a). Since then, the evolutionary turn has gained sufficient momentum as a distinctive perspective in economic geography proposed besides the relational turn and the institutional turn (Boschma and Martin 2007)[17].

According to Boschma and Frenken (2006a), evolutionary economic geography analyzes the spatial distribution of routines of firms over time and assumes that the behavior and success of firms are primarily dependent on the routines a firm has built up in the past (path dependence); routines are context-specific, specific to organizations, and can be understood as organizational skills, which cannot be reduced to the sum of individual skills (Nelson and Winter 1982). In an evolutionary economic geography, regional economic development will be explained from the dynamics of structural change at the level of sectors and networks. In other words, spatial structures are viewed as the outcome of historical processes, while chance events, or contingency, might play an important role in this evolutionary process (see 2.2.3 Contingency). One of the main scientific challenges for evolutionary economic geography is to cope with complexity issues caused by unpredictability, non-determinacy and contingency (Jovanović 2009). For the reason that evolutionary economic geography is still at an early stage of development, some fundamental concepts such as routines and path dependence need both theoretical and empirical elaboration (Boschma and Frenken 2006a: 295).

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economic change. Although evolutionary economics has a long history, "it is by no means continuous, unidirectional or uncontested" (Essletzbichler and Rigby 2007: 550), see, for example, Veblen (1898), Schumpeter (1939, 1942), Nelson and Winter (1974, 1982), Hodgson (1993, 2002), Dosi and Nelson (1994), Nelson (1995) and Witt (1992, 2002, 2004).

[16] See, for instance, Steiner and Belschan (1991), Rigby and Essletzbichler (1997), Storper (1997), Essletzbichler and Winther (1999), Lambooy (2002), Essletzbichler and Rigby (2004), Hassink (2005), Boschma and Frenken (2006b, 2008), Iammarino and McCann (2006), Martin and Sunley (2006), Frenken (2007) and Suire and Vicente (2009).

[17] In September 2007 the *Journal of Economic Geography* (Volume 7, Issue 5) published a series of articles on *Constructing an evolutionary economic geography*; afterwards in 2009 *Economic Geography* published a special issue (Volume 85, Issue 2) on a debate in evolutionary economic geography.

The evolutionary turn in economic geography could be summarized as *history matters*. On the one hand, the historical process influences present and future dynamic development; on the other hand, unpredictable contingent events might play a key role in shaping the process of regional development (see 2.2.3 Contingency). As has been noted, under evolutionary perspective, regional development is not a static situation but a dynamic process, which is both path-dependent and irreversible.

2.1.4 Summary of the turns and a relational-dynamic perspective

The common features of the relational, the institutional and the evolutionary turns in economic geography lie in that they do not view economy apart from its social, cultural and political context, rather they understand economy from its context and call for new insights into economic geographical analysis with efforts to overcome the deficiency or inadequacy of the neoclassical approach. The following three aspects are the common arguments shared among these turns.

First, the concept of embeddedness can be found in both of the relational turn and the institutional turn, while the difference between them is the specific context of embeddedness. Context of institutions or institutional context matters for the institutional turn, while context of relations or relational context (especially social-spatial context) matters for the relational turn. An institutional context could be viewed as part of a social-spatial context, meanwhile a social-spatial context is simultaneously influenced by an institutional context. Therefore, in this sense, the relational turn and the institutional turn in economic geography should not be viewed as two separated spheres, but they are actually interrelated with each other.

Second, the concept of path dependence, which could be understood as an aspect of evolution, is shared between the evolutionary turn and the institutional turn. However, for the institutional turn, it particularly refers to the path dependence of institutional evolution; while for the evolutionary turn, which takes a broader view on path dependence, it may refer to the path dependence of the evolution of firms, networks, territories, etc. To put it briefly, the evolutionary turn and the institutional turn in economic geography interrelate with each other in sense of sharing a common concept of path dependence though with different contents.

Third, these three turns are intertwined with each other through the connection between embeddedness and path dependence. Taking a historical view, at any point in time, institutions, networks or territories are always embedded in a specific context, and just this kind of embeddedness generates specific path dependence of institutions, networks or territories during the whole time series of a dynamic process; meanwhile, the specific embeddedness could also be viewed as a consequence of the path dependence. This special connection between embeddedness and path dependence might be understood as the duality of embeddedness and path dependence.

Given these three points mentioned above, based on previous analyses of these three turns in this section, a comparison of the relational, institutional and evolutionary turn in economic geography is conducted in Table 2.1.

Table 2.1 Comparison of the relational, institutional and evolutionary turns in economic geography

	Relational turn	Institutional turn	Evolutionary turn
Perspective	Static[18]: relational	Static/dynamic: institutional	Dynamic: evolutionary
Type of analysis	Context	Context and evolution	Evolution
Theoretical origin	Economic sociology	Institutional economics Economic sociology	Evolutionary economics
Application fields	Firm/network/territory	Network/territory	Firm/network/territory
Main aspects of analysis	Context of relations Embeddedness of relations Social-spatial relations Social-economic relations Actor-network	Context of institutions Embeddedness of institutions Institutions Path dependence Evolution of institutions	Organizational routines Multi-level/group selection[19] Contingency Path dependence / lock-in Firm/network/territory evolution
Reference to regional development	Context of regional development: actors, assets and network	Institutions relative to regional development	Regional development path

Source: Yan Li

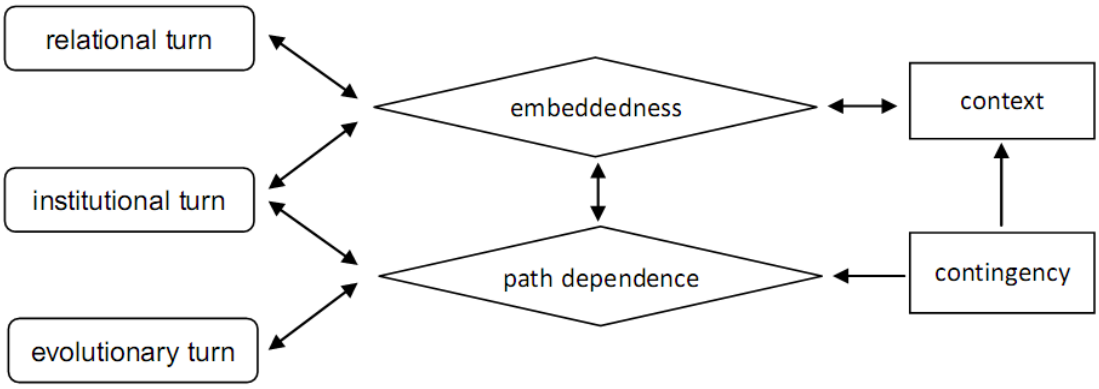
To learn from these three turns in economic geography, at least the following conclusion should be highlighted in this study: a comprehensive understanding of regional economic development could only be achieved with both a relational perspective and a dynamic perspective, or, in short, a relational-dynamic perspective. For one thing, a relational perspective could be applied to analyze the context at a specific point in time, and the context may include social-spatial relation, social-economic relation, economic-environmental relation, political-economic relation, institutional-economic relation, political-institutional relation, and so forth. For another, a dynamic perspective could be taken to scan the whole evolutionary historical process of regional economic development with data analysis of the whole time series. It is noticeable that the institutions are also included into consideration in both of a relational perspective and a dynamic perspective. In a word, this study will take a relational-dynamic perspective in the analysis of regional development.

As an aspect of evolutionary analysis, contingency, which could be understood as unpredictable chance events or incidents during a historical dynamic process, influences the context as well as path dependence. At a specific point in time, the context may change due to the influence of contingent events. In an evolutionary process, contingency also influences path dependence and contingent events may even considerably alter the evolutionary path. The issues of interrelated context, embeddedness, path dependence as well as contingency in these turns are showed in Figure 2.1, which will be further discussed in the next section with the concept of

[18] Here a static perspective refers to looking at the context at one point in time, while a dynamic perspective refers to a historical perspective, which looks on the whole process of evolution.

[19] See Essletzbichler and Rigby (2007: 554): though it remains unclear "whether firms are the most appropriate unit of selection within the economy", "multi-level selection theory and group selection are possible ways out of this dilemma and potentially important for the development of an evolutionary economic geography (Sober and Wilson 1998; Vromen 2001)".

contextuality, path dependence and contingency.



Source: Yan Li

Figure 2.1 Summary of the relational, institutional and evolutionary turns in economic geography

2.2 Contextuality, path dependence and contingency

Aimed to integrate the inseparably intertwined economic and social aspects of human action in space, based on the preliminary study by Glückler (1999) on contextuality and contingency as principles for spatial research, Bathelt and Glückler (2000, 2002a,b, 2003) developed an interdisciplinary and multidimensional concept of contextuality, path dependence and contingency of economic action. This section reviews the concept of contextuality, path dependence and contingency with other related concepts or perspectives in regional development.

2.2.1 Contextuality

The term of contextuality has been used in diversified studies in social sciences[20] and has also been applied to economic geography, for instance, by Bathelt and Glückler (2003) and Bathelt (2006)[21]. Generally, the term of contextuality might be understood as the state of embedded context of economic agents. In fact, some widely used sociological theories or concepts in economic geography such as the theory of structuration (Giddens 1979, 1984), the concept of embeddedness (Granovetter 1985) and the actor-network theory (ANT) (Callon *et al* 1986) offer similar understandings of contextuality as the state of embedded context, which will be explained further below.

First, the theory of structuration[22] argues that structures are rules and resources (or relations) organized as properties of social systems, and agency[23] is performed within

[20] For instance, contextuality in policy science (Robinson 1964; Lasswell 1970; Wittrock 1983; Farr 1985), contextuality and dynamics of individuals (Harder 1974), contextuality of organizational action (Knorr 1979), contextuality of mode of life (Simonsen 1991), contextuality within activity systems (Porter and Siggelkow 2001, 2008) and contextuality for learning (Hager 2005; Hager and Halliday 2006).

[21] "From a structural perspective, economic agents are situated in contexts of social and institutional relations (Granovetter 1985, 1992a,b) ... this conceptualization views action as being embedded in specific contexts ..." (Bathelt and Glückler 2003: 128). "… economic agents are situated in particular contexts of social relations and operate under specific institutional and cultural conditions from which they cannot easily be separated (Polanyi 1957; Granovetter 1985). The resulting economic relations can be formal (eg, contract-based) or informal (eg, trust-based) in character." (Bathelt 2006: 226)

[22] For structuration theory in geographical analysis, see Dyck and Kearns (2006).

[23] Agency, as Giddens (1979, 1984) calls it, is human action. The essential characteristic of agency is the *reflexive monitoring of action*, which is enacted in social situations (Peillon 1985: 261).

the context of an existent social structure governed by a set of norms or laws distinct from those of other social structures. The duality of structure, central to the structuration theory, expresses the mutual dependence of structure and agency: "structure is both medium and outcome of the reproduction of practices" (Giddens 1979: 69).

Second, the concept of embeddedness[24] in new economic sociology (NES)[25], which has gained much prominence in economic geography since the 1990s, suggests that actors are embedded in structures and embeddedness has both relational and structural aspects (Granovetter 1990: 98)[26].

Third, the ANT[27] "aims to uncover how associations and networks are built and maintained" (Murdoch 1997a: 335). Though the ANT seems to focus solely on the links between actors in networks without a sense of the social processes constituting these relationships (Dicken *et al* 2001: 105), recently the ANT has been taken as a possible new base for planning theory (Olsson 2009; Boelens 2010a,b; Rydin 2010) and world city study in urban geography (Smith 2003).

In a word, the three theories mentioned above share a common argument that actors or agents are embedded in structures and networks, which reflects the concept of contextuality. In other words, contextuality as the state of embedded context of economic agents is in accordance with the paradigm of actors embedded in networks.

All economic actions take place within a context, and a "context delimits action though it doesn't determine action" (Warde 1989: 279). Accordingly, economic action is "embedded in concrete, ongoing systems of social relations" (Granovetter 1985: 487) or "socially constructed, embedded and instituted" (Hodgson 1988). In this sense, space matters "probably because of the contextual nature of social action" (Warde 1989: 280). Therefore, analysis of regional economic development should be carried out in a specific regional context. Actually, context analysis has already been applied to the study of places and regions as a way to investigate spatial relations[28] with various formulations[29]. The main concepts reflecting context in regional development are summarized in Table 2.2.

In this work, contextuality is understood as actors embedded in regional context. For a specific region, regional context refers to relations of different actors forming and changing regional assets, which leads to the change of regional assets in this region. In

[24] For a critical review of the embeddedness concept and its application in economic geography, see Hess (2004).

[25] For assessment of NES, see Swedberg (1997) and Peck (2005). For contributions in economic geography share concepts with NES, see Peck (2005: 131).

[26] "The behavior and institutions to be analyzed are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding" (Granovetter 1985: 482) ... "most behaviour is closely embedded in networks of interpersonal relations." (Granovetter 1985: 504)

[27] The ANT is "a relational and process-oriented sociology that treats agents, organizations, and devices as interactive effects" (Law 1992: 7), which is developed by Michel Callon, Bruno Latour, John Law and others colleagues of the Paris group of science and technology studies in the 1980s. See: Callon *et al* (1986), Law (1992, 1999), Latour (1996, 1999), Murdoch (1997a,b), Law and Hassard (1999), Hassard *et al* (1999) and Bosco (2006).

[28] For example, see Sayer (1985, 1989, 1991), Massey (1985, 1994), Agnew (1987), Thrift (1990, 1991), Entrikin (1991), Sunley (1996), Ettlinger (2003) and Gertler (2003).

[29] There are surely other formulations that have not been included in this analysis, for example, territorial competitiveness (Camagni 2002) and territorial capital (Camagni 2008).

this sense, to analyze regional context is to investigate regional assets and the relations among different actors changing the assets.

Table 2.2 Main concepts reflecting context in regional development

Concepts	Representative authors	Object	Basic Elements
regional capabilities	Heidenreich 2004, 2005	firm	✧ institutions and networks ✧ experience and implicit knowledge ✧ geographical proximity
fundamentals and external economies	Krugman 2003	region	✧ fundamentals: well-educated local population, local culture of entrepreneurship, natural advantages of climate or resources, sustained public policy difference ✧ external economies: the ability of a large local concentration to support specialized suppliers of intermediate inputs of goods and services, 'thick' labor market in specialized skills, pure knowledge spillovers
collective competition goods	Le Galès and Voelzkow 2001	firm	✧ to equip a section of the workforce with new skills ✧ to access R&D, new technology and patents ✧ to acquire information ✧ to raise capital and establish new markets ✧ to articulate a policy concern to local/central government ✧ to ensure quality and standards of the firm's product
entitlements	Sen 1981	individual	✧ trade-based entitlement ✧ production-based entitlement ✧ own-labour entitlement ✧ inheritance and transfer entitlement
moments	Harvey 1996	social process	✧ material practices ✧ social relations ✧ institutions/rituals ✧ beliefs/values/desires ✧ power ✧ language/discourse
institutional regime	North 1990; Martin 2000	institution	✧ institutional arrangements: broad context of formal and informal conventions (corporate behavior, culture, trade, labor, competition regulation…) ✧ institutional environments: particular organizational forms situated and governed by the institutional environment (markets, firms, economic agencies) ✧ interaction and path dependence
(evolutionary) regional competitiveness	Boschma 2004	firm	✧ untraded interdependencies (region-specific assets) ✧ ability to offset variety-destroying processes ✧ long-term unpredictable
(relative) regional competitiveness	Martin 2006	region	✧ attractiveness for mobile labor, capital and knowledge ✧ locally-specific environment of resources, capabilities or assets: externalities and fundamentals
milieu[30]	Camagni 1988, 1991, 1999, 2004; Camagni and Salone 1993	city	✧ geographic and social-cultural proximity ✧ interaction and synergy ✧ cooperative attitudes and trust ✧ cohesion and sense of belonging

Source: Yan Li

[30] The term of *milieu* comes from the notion of 'innovative milieux' (Aydalot 1986), which is the central theoretical notion of the GREMI (Groupement Européen des Milieux Innovateurs) group. Milieu is "essentially a context for development, something like a territorial version of what Granovetter (1985) labeled the 'embeddedness' of social and economic process" (Storper 1995: 203). The 'innovative milieux' considers firms no longer as isolated innovative agents but as agents operating in milieux acting as incubators of innovation (Aydalot 1986; Aydalot and Keeble 1988; Camagni 1991).

2.2.2 Path dependence

The concept of path dependence has been used by economic geographers to understand regional economic landscape (Clark *et al* 2001; Bathelt and Boggs 2003; Sydow *et al* 2010). There are three main interrelated perspectives of path dependence by economists (Table 2.3) giving insights into the sources of path dependence.

Table 2.3 Three perspectives of path dependence

Perspective	Origin	Main arguments
Technological lock-in	David (1985)	Historically contingent 'chance events' can have long-run effects on the future path of economic technologies, organizations and systems. Early decisions closing alternative paths and validating a particular path with three features─technical interrelatedness, scale economy and quasi-irreversibility of investments─lead outcomes not to be rational or optimal.
Increasing returns	Arthur (1989)	Increasing returns can cause the economy gradually to lock itself into an outcome not necessarily superior to alternatives, not easily altered, and not entirely predictable in advance. Random 'historical events' may decide the outcome.
Institutional hysteresis	North (1990)	The tendency for formal and informal institutions, social arrangements and cultural forms to be self-reproducing over time, in part through the very systems of socio-economic action they engender and serve to support and stabilize.

Source: revised from Martin and Sunley (2006: 400)

In fact, path dependence is "about much more than the processes of technological change, or institutional evolution, or hysteresis effects and unit roots in macroeconomic growth" (David 1997: 43)[31]. "From a dynamic perspective, contextuality leads to path-dependent development" (Bathelt and Glückler 2003: 128), which in a certain degree influences future actions as well (Nelson and Winter 1982; Nelson 1995). Page (2006) provides an explanation on path dependence:

> "In common interpretations, path dependence means that current and future states, actions, or decisions depend on the path of previous states, actions, or decisions. Of late, path dependence has become a popular conveyor of the looser idea that history matters (Crouch and Farrell 2004, Pierson 2004)."(Page 2006: 88)

Given these points, economic processes are path-dependent and constrained by history. What happens in history might influence the economic process today and today's activities might affect future processes. Bathelt and Glückler (2003) believe that contextuality is the reason of path dependece. In fact, the relationship between contextuality and path dependence could be viewed as some kind of duality: they are both causes and outcomes of each other. For one thing, contextuality as embedded context is partly determined by path dependence, and it will also influence the development path; for another, path dependence is also constrained by contextuality, and it will affect concrete context as well as contextuality as time goes by.

Hudson holds similar argument by viewing institutional path dependence as "a conditional dependence" (Hudson 2004: 451). Considering that "there are forces that

[31] The concept of path dependence has been widely used in, for example, evolutionary economics (Magnusson and Ottosson 1997), NIE (North 1991), political science (Pierson 2000; Hollingsworth 2000), organization studies (Antonelli 1997; Bruggeman 2002; Sydow *et al* 2005) and economic geography (Clark and Wójcik 2004; Martin and Sunley 2006; Boschma and Frenken 2006b).

seek to break path dependency as well as those that reproduce it" (Hudson 2004: 451), some minor historical events may affect development into a particular path not necessarily with the most optimal solution (Arthur 1989; David 1985, 1988, 1994; North 1990). Therefore, Hudson prefers to use the term of "path contingent" (Hudson 2004: 451) to describe economic and institutional development trajectories, which is related to the concept of contingency and will be explained in the next part.

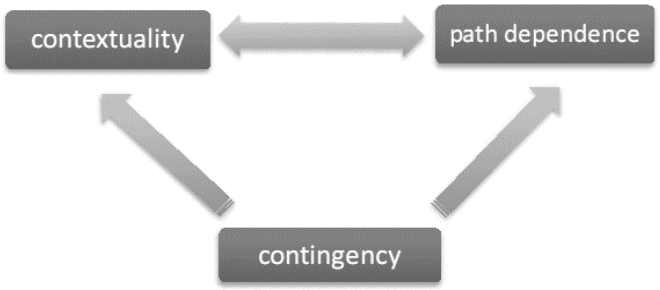
2.2.3 Contingency

Contingency is being used to eliminate context as a constraining or empowering condition of action (Warde 1989: 279). Sayer (1982) divided relations into two types: "external, contingent relations" and "internal, necessary relations", which could be viewed as a starting point of economic geographical analysis considering of contingency. Affected by contingently-related conditions (Sayer 1982), what was significant or strategic before could not be predicted. In consequence, economic action is subject to unforeseeable changes and is fundamentally open-ended (Sayer 1992, 2000; Bathelt and Glückler 2003).

As to regional economic development, contingency might be understood as the unpredictability or unknowability of some events and their constituent aspects which might change the development path of a region. In the process of regional development, contingency is presented by some chance events from external sources, and those unpredictable actions might lead regional development to an inevitable outcome under identical circumstances without following a preset pattern. Therefore, contingency matters for regional development in that it creates uncertainty of the past and unpredictability of the future, and both of them are important to understand the dynamics of regional development. The influence of contingency might be significant, because a small change at an early stage may produce large effects at a later stage.

2.2.4 Summary

The concept of contextuality, path dependence and contingency gives a comprehensive examination of economic action, which could be applied into regional analysis. Contextuality could be understood as actors/agents embedded in regional context, which reflects a relational perspective on regional development; path dependence and contingency reflect a dynamic perspective by considering regional development as an evolutionary process with unpredictable contingent events. The duality of contextuality and path dependence is represented by their interactive influence to each other, while contingency affects both of them (Figure 2.2).



Source: Yan Li

Figure 2.2 Interrelations of contextuality, path dependence and contingency

Shaped by contextuality, path dependence and contingency, regional development could be understood through a relational-dynamic perspective with a path-assets analysis, which will be explained further in the next section.

2.3 Regional development and regional capability

Based on the concepts of contextuality, path dependence and contingency analyzed above, this study tries to understand regional development with a relational-dynamic perspective and to use the concept of regional capability to explain why some regions develop themselves better than others facing uncertainties or contingency. This section first introduces the relational-dynamic perspective on regional development (2.3.1). Then, it reviews the concept of capabilities and the capability approach (2.3.2). And next, it focuses on regional capability and advocates a path-assets analysis for regional development (2.3.3). Finally, it summarizes regional development and regional capability (2.3.4).

2.3.1 Regional development: a relational-dynamic perspective

This study examines regional development through a relational-dynamic perspective as a synergy of both a relational view and a dynamic perspective, which is explained in detail in this part.

For one thing, regional development should be understood relationally through relations between agency and structure, which refers to a relational view of regional development (Allen *et al* 1998; Hudson 2005; Allen and Cochrane 2007; Yeung 2009). A relational perspective emphasizes the social basis of regional economy and is in opposition to isolated regional economic analysis. From the relational perspective, regions are "constituted from spatialized social relations" and "can be seen as products of complex condensations of social relationships" (Hudson 2005: 620); regional economy is "socially constructed" (Hudson 2004: 451) and "embedded within certain shared historical and socio-cultural formations" (Yeung 2009: 327). Following this relational view, regional economy could be redefined as "stocks of relational assets" (Storper 1997: 28). Actually, *Habitus* (Bourdieu 1977), *relational assets* (Storper 1997) or *untraded interdependencies* (Storper and Salais 1997) reflect a common concept that they are "engendered through the particular historical-geographical trajectory of the region" (Swyngedouw and Baeten 2001: 833), which is termed as regional assets in this work as part of the concept of regional capability (see 2.3.3).

For another, regional development should also be understood as a dynamic process with a unique development path. This dynamic process is not only a multi-level process but also a multi-actor process. In this dynamic process, multiple actors in the economic, social-cultural, environmental and political-institutional dimensions operate at the local, regional and national level with development as well as changes. These multiple actors include governmental as well as non-governmental actors. Governmental actors are the national government, local and provincial governments as well as government-organized media, enterprises and organizations; non-governmental actors are firms, planners, professors, researchers, associations, groups and individuals. Dendrinos and Sonis (1990) advocate examining the dynamic process of regional

development through four lenses: absolute/relative lens and continuous/discrete dynamics (Dendrinos and Sonis 1990: 11). This study holds that regional development path is constrained by both internal and external factors: regional capability including regional assets (see 2.3.3) are the internal factors, while contingent incidents are the external factors.

In a word, a comprehensive analysis on regional development needs a relational-dynamic perspective with a path-assets analysis. The next part will briefly review the concept of capabilities and the capability approach before it focuses on regional capability.

2.3.2 The concept of capabilities and the capability approach

(1) The concept of capabilities

The concept of capabilities could be found in two areas of economics: the theory of production and normative economics of well-being (Salais and Villeneuve 2004: 6). Accordingly, there are different understandings towards it.

For one thing, in the theory of production, the concept of capabilities "originated from the analysis of relations between division of labor, knowledge and specialization of the firm operating under market conditions (from Adam Smith to Alfred Marshall)" (Salais and Villeneuve 2004: 6). For a firm, capabilities are "repeatable patterns of action in the use of assets to create, produce, and deliver offerings" (Ramirez and Wallin 2000, cited by Blois and Ramirez 2006: 1027). "Capabilities only become distinctive competencies when they create value for the firm and other organizations with which the firm relates or wishes to relate to" (Blois and Ramirez 2006: 1027).

For another, in normative economics of well-being pioneered by Amartya Sen (Sen 1985, 1993), capabilities are understood as "given equal resources, when faced with the same contingencies, people do not have the same ability to overcome them" (Salais and Villeneuve 2004: 287). According to Sen (1999), the analysis of development should pay particular attention to "the expansion of the 'capabilities' of persons" (Sen 1999: 18).

In a word, the common aspect of the two concept of capabilities mentioned above lies in the ability of the main body of the concept to use and manage its assets, despite difference in the main body between them: as for the theory of production, it is a firm; as for normative economics of well-being, it is a person.

(2) The capability approach

> "The capability approach is a broad normative framework for the evaluation of individual well-being and social arrangements, the design of policies and proposals about social change in society ... The core characteristic of the capability approach is its focus on what people are effectively able to do and to be, that is, on their capabilities." (Robeyns 2003: 5)

Generally, the capability approach focuses on the evaluation of capabilities, which does not mean that capability analysis would not pay attention to resources or assets such as the evaluation of economic growth, social capital, institutions and environmental quality.

Rather, the analysis of the assets are also important for the study within the capability approach (Drèze and Sen 2002). Since "the capability approach is inescapably pluralist" (Sen 1999: 76), it allows for flexibility in use and has become an important new paradigm in thinking about development (Comim *et al* 2008). In fact, the capability approach has been used in a wide range of fields, prominently in development studies, but also in social cost-benefit analysis as well as in designing or evaluating development policies of developing countries (Robeyns 2003: 5).

Although Sen's capability approach (Sen 1985, 1993)[32] originally focuses on well-being, the concept of capabilities could be applied to broader fields as well, such as firms and territories. This study tries to apply Sen's capability approach in a broad sense, namely to a territory, and tries to use the concept of capabilities to explain why some regions develop better than others under similar (including a problematic) situation. Based on the expositions of capabilities mentioned above, in light of Sen's work on the capability approach, this study puts forward the terms of regional assets and regional capability with further explanation in the next part to analyse regional development.

2.3.3 Regional capability

Inspired by the concept of capabilities as well as the capability approach in 2.3.2, aimed to explain regional development with a relational-dynamic perspective, this study focuses on regional capability with a path-assets analysis. Nevertheless, before defining regional capability in this study, it is necessary to take a look at another two firm-based terms briefly: regional capabilities and dynamic capabilities.

(1) Regional capabilities and dynamic capabilities

Regional capabilities by Heidenreich (2005) is based on the concept of regional innovation systems:

> "Regional capabilities can be defined as the capacity to create and provide collective competition goods and to stimulate and stabilise communication and cooperation between regional companies, schools, universities, technology transfer, research and development facilities and political and administrative actors." (Heidenreich 2005: 742)

With regards to his definition mentioned above, Heidenreich (2004) also provides following explanations on regional capabilities:

> "The basis of regional capabilities is the experience and implicit knowledge that regional businesses and employees have accumulated through their close involvement in the production of a specific product or the use of a specific technology. Such implicit, context-specific, non-tradable competencies can best be passed on through direct interactions and regional cooperation networks facilitated by close geographical proximity. Regional capabilities are therefore anchored in the institutions and networks that facilitate such patterns of inter-organisational learning." (Heidenreich 2004: 57)

[32] Sen (1985) provides a formal treatment of the framework of capability approach; later, Sen (1993) makes a clarificatory analysis on the capability approach. Robeyns (2003) offers an introduction to Sen's capability approach. For a further reading on developments, critiques and recent advances of the capability approach, see Clark (2006).

Besides the term of regional capabilities defined by Heidenreich (2004, 2005), another firm-based concept is dynamic capabilities (Teece *et al* 1997; Augier and Teece 2007). Augier and Teece (2007) provide the following definition of dynamic capabilities:

> "Dynamic capabilities...relate to the firm's ability to adapt in order to generate and exploit internal and external firm-specific competences, and to address the firm's changing environment (Teece et al 1997)". (Augier and Teece 2007: 268)

"Intended in the beginning as a set of ideas around flexibility, adaptability, integration, disintegration, etc" (Augier and Teece 2007: 279), dynamic capabilities reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions (Leonard-Barton 1992).

Although both regional capabilities (Heidenreich 2004, 2005) and dynamic capabilities (Teece *et al* 1997; Augier and Teece 2007) are firm-based concepts, the main difference between them lies in their different perspectives. Regional capabilities attach much weight to the institutions and relations shaping the cooperation in firm-networks, which reflects a relational perspective, whereas dynamic capabilities lay emphasis on the flexibility as well as adaptability of a firm, which represents a dynamic perspective. For the purpose of having a comprehensive understanding of regional development, learning from both perspectives mentioned above, this study makes an attempt to take a relational-dynamic perspective for the development of the concept of regional capability in the next part.

(2) Regional capability: definition and characteristics

In this study, regional capability is defined as the total ability of a region being capable to develop itself with its possession of regional assets under any circumstances including adaptability to contingency.

Distinguished from the firm-based concept of regional capabilities and dynamic capabilities mentioned above, inspired by Amartya Sen's capability approach (Sen 1985, 1993), the concept of regional capability in this study is based on a region as a whole, as an application of Sen's capability approach to the analysis on regional development. Furthermore, this study advocates analysing regional capability in a relational-dynamic perspective, which is in accord with the analysis on regional development (2.3.1).

From the relational perspective, regional capability reflects the context of regional development at one point in the time sequence by the possession of a variety of regional assets; from the dynamic perspective, regional capability presents the function of regional assets through a certain development path of a region with the process of time (Table 2.4). That is to say, regional capability is shaped by both the region's assets and its development path. Accordingly, regional development is constrained by the region's assets and its development path.

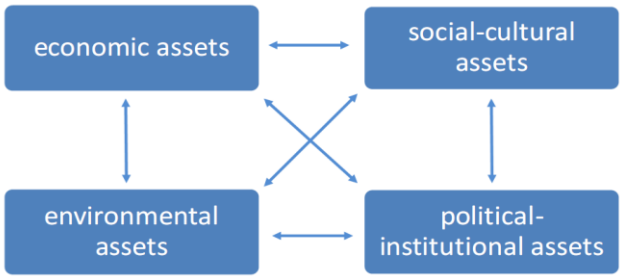
Table 2.4 Perspective and analysis of regional capability

perspective	categories of analysis
relational: context	regional assets: economic, social-cultural, environmental, political-institutional
dynamic: process	regional development path

Source: Yan Li

(3) Regional assets

This study defines regional assets as multiple resources and elements inherent or available to a region, including several interactive component parts such as economic assets, social-cultural assets, environmental assets and political-institutional assets (Figure 2.3).



Source: Yan Li

Figure 2.3 The composition of regional assets

Some of the regional assets are regional-specific while others are not (e.g., macro institutions or policies). Regional assets can be either tangible or intangible. Considering the value for regional development, regional assets can be positive/active ones or negative/passive ones. The main concerns in the analysis of regional assets are listed in Table 2.5.

Table 2.5 Analysis of regional assets

regional assets	explanation	outline of main concerns
economic assets	economic position and potential	✧ economic aggregate ✧ economic output ✧ economic structure ✧ domestic/foreign trade ✧ firms, organizations, networks ✧ geographic location ✧ infrastructure ✧ ecological conditions
social-cultural assets	human capital (labour), social condition and knowledge	✧ employment/unemployment ✧ income/wage ✧ social relations, e.g. firm culture and networks ✧ cultural heritage ✧ information/knowledge ✧ education/research ✧ human capital ✧ human rights ✧ health ✧ social equity
environmental assets	environmental quality and pollution	✧ natural resource ✧ air and water quality ✧ cultivated land ✧ natural scenery ✧ biodiversity ✧ climate stability ✧ forest/grassland ✧ environmental problems: degradation, pollution, hazards, deforestation
political-institutional assets	institutional arrangements; government actors in/out	✧ national/regional/local policies ✧ political/administrative structure ✧ legislative system ✧ executive system/structure ✧ special preferential policies ✧ participation of non-governmental actors in politics

Source: Yan Li

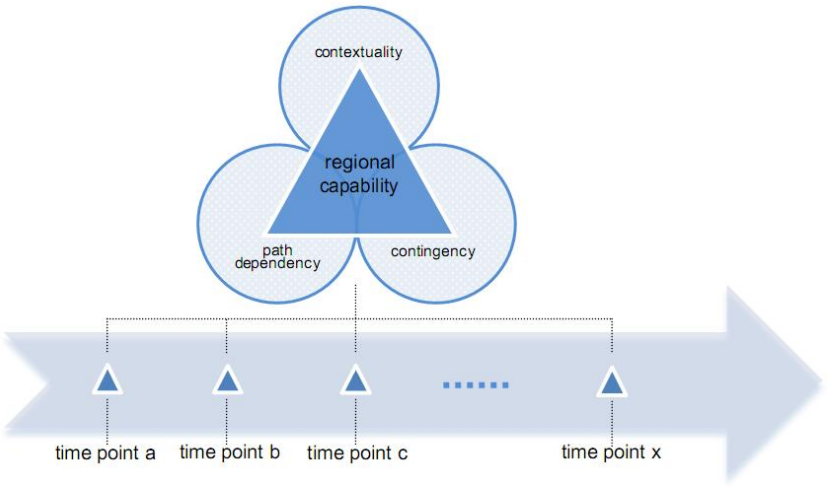
The formation and change of regional capability is a dynamic process, in which the access to regional assets is quite important; especially when a contingent incident happens, regional capability represents the adaptability to contingency. When it comes to analysis of this dynamic process, it might be necessary to select several key points in time in order to reflect the crucial transitions or great changes in history, and this historical process forms the unique development path of a region by the evolution of regional capability.

2.3.4 Summary

This part mainly makes a theoretical analysis on regional development and regional capability and advocates a relational-dynamic perspective towards a comprehensive understanding of regional development by exploring the concept of regional capability. From a relational perspective, at one point in time, regional development should be understood through a specific context of relations; from a dynamic perspective, regional development is viewed as a dynamic process with a particular development path as well as uncertainties.

Built on the concept of contextuality, path dependence and contingency (2.2), starting from discussions of capabilities and the capability approach (2.3.2), this study defines regional capability as the total ability of a region being capable to develop itself with its possession of regional assets under any circumstance including adaptivity to contingency.

Furthermore, this study argues that regional capability plays a key role in dealing with contingent situations or problems for a region, which relates to regional competitive advantage. Shaped by regional assets and the region's development path, regional capability plays a crucial part in the process of regional development (Figure 2.4).



Source: Yan Li

Figure 2.4 Regional development and regional capability

In Figure 2.4, the arrow reflects the dynamic process of regional development, which could be examined in detail from a relational perspective through several points in time (time point a, b, c,…, x). At each point in time, regional capability plays its role in shaping regional development, which is constrained by contextuality, path dependence and contingency. In this sense, facing the uncertainties of regional development,

regional capability should be reinvented as well, and regional governance is an important factor for steering or improving regional capability. In addition, regional governance could also contribute to promoting regional sustainability, which will be analysed in the next section.

2.4 Regional governance: towards regional sustainability

Beginning with regional governance as a synergy of multi-level governance and multi-actor governance, this study argues that regional governance could contribute to regional sustainability by improving regional capability (2.4.1), and regional planning with its governance nature (2.4.2) could serve as an effective tool towards regional sustainability (2.4.3). Finally, this section is briefly summarized in 2.4.4.

2.4.1 Regional governance: a synergy of multi-level governance and multi-actor governance

Although governance is traditionally understood as "the act or process of governing" as a synonym for government, recent academic research usually distinguishes governance from government (Painter 2000: 316).

> "Governance is defined as the involvement of a wide range of institutions and actors in the production of policy outcomes, including non-governmental organizations, quangos, private companies, pressure groups and social movement as well as those state institutions traditionally regarded as formally part of government. Here 'governance' is a broader category than 'government', with government being one component of governance among many." (Painter 2000: 317)

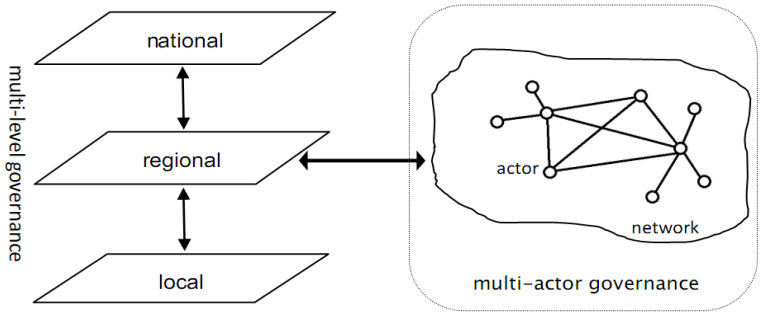
Governance regulates complex relations (vertical and horizontal relations) between actors (Bache 2010a: 2): vertical relations refer to actors organized at various territorial levels, and horizontal relations refer to relations between actors from public, private and voluntary spheres. By the process of regulating relations, governance also forms networks.

Regional governance deals with relations between actors with focus at regional level to implement regional solutions and forms networks by regulating these relations. Regional governance happens when a region meets the following three aspects: a distinct geography in common with strong geographic identity, positive experiences with regional agencies and special features of the central city in the metropolitan region (Baldassare 1994). Networked form of governance might become a potential model of regional governance, where a network employing deliberative practices coordinates formal political institutions and other actors from non-state sectors (Everingham 2009).

In this study, regional governance is positioned as part of a process of the formation and improvement of regional capability, which could be understood as a synergy of multi-level governance[33] and multi-actor governance, involving both vertical and horizontal dimensions, conflicts as well as cooperation and collaboration (Figure 2.5).

[33] Multi-level governance originally refers to regional governance in the European Union which combines national, supra-national and sub-national spatial formations and institutions, see, for instance, Marks (1993), Jachtenfuchs (1995), Marks *et al* (1996) and Salet and Thornley (2007).

Multi-level governance represents resolution in a vertical hierarchy of various territorial levels, while multi-actor governance shows horizontal relations between actors which form networks.



Source: Yan Li

Figure 2.5 Regional governance as a synergy of multi-level governance and multi-actor governance

For one thing, regional governance could be taken as a form of multi-level governance moving away from a centralized type of government. Multi-level governance "directs attention to a complexity, cross-sectoral engagement and contestation of legitimate authority between actors organized at different territorial levels" (Bache and Flinders 2004: 32). However, in some regions multi-level governance remains weak while central governments remain prominent, since many of the arrangements characterized as multi-level governance are state-dominated (Bache 2010b). In addition, Multi-level governance also sheds light on the "multi-actorness" of the policy-making process (Littoz-Monnet 2010).

For another, regional governance could also take a form of multi-actor governance, which stands for "the interplay of multiple actors connected in a non-hierarchical way through network-based forms of coordination" (Antonsich 2010: 263). Regional governance is a collaborative process that involves both governmental and non-governmental actors, and not only governmental actors play a constructive role in the process of governance. Nevertheless, owing to the fact that governments still play a dominate role in the context of governance in China, this study will mainly focus on governmental actors. According to a research by the Organization for Economic Co-operation and Development (OECD) on China's governance in transition, China's progress in governance was "achieved in a relatively short period of time" and China still needs to sustain reform "in four key directions: the role of the state; the tools of government; relations between levels of government and the institutional framework for market forces" (OECD 2005: 2). If fact, almost all these reformatory efforts are closely connected with different levels of governments in China. Therefore, this study will focus on governmental actors for the analysis of regional governance, especially on the interplay of different levels of governments in shaping the development of regional governance as well as regional capability.

2.4.2 Regional planning as governance

Regional identity as a catchphrase has become a slogan for regional governance, marketing and economic development among policy makers since the 1980s (Paasi 2009: 137-138), while regional planning plays an important role in building regional

identity, and the effectiveness of regional planning practices as well as its implementation is influential to the improvement of regional governance in the process of regional development.

Planning and governance "have traditionally been concerned with order and control" (Hillier 2007: 76), yet planning should be understood as a tool of governance (Thomas 1999) or "a human discipline of governance" (Gunder and Hillier 2009: 71). Planning as "a style of governance" (Healey 1997: 248) is characterizd by "a policy-driven, co-ordinative, knowledge-rich and future-oriented approach to governance processes" (Healey 1997: 231). The significance of planning lies in that planning as well as governance could respond to pressures from territorial economic as well as political developments (Wannop 1995). As Healey (2005: 304) argues that:

> "Planning activity, with its focus on 'improving conditions' – whether in the built environment, or the delivery of services, or the promotion of environmental sustainability or social well-being, is inherently a governance activity, situated in a complex landscape of formal government organizations..." (Healey 2005: 304)

In this sense, practices of governance aimed to improve regional capability might be realized through the implementation of regional plans. In other words, regional planning is itself both an instrument towards improving regional capability and a tool for governance.

Regional planning could be viewed as a multi-factor process (e.g. economic, social-cultural, environmental and political-institutional) interrelated with various actors (both governmental and non-governmental), and planning may build networks that coordinate actors and mediate communication regarding a specific issue and thus creates institutional environments (Olsson 2009). For this reason, regional planning practices as well as the implementation of the plans are influential to regional governance.

Towards the goal of sustainable development for regional governance, 'governance for sustainability'[34] becomes a rapidly emerging field in environmental governance, and regional planning also inaugurates its new era in accordance with its governance nature. Whether regional sustainability could be achieved through the governance and planning processes will be discussed in the next part.

2.4.3 Regional governance and regional planning: towards regional sustainability

Sustainability, as "a characteristic or state whereby the needs of the present and local population can be met without compromising the ability of future generations or populations in other locations to meet their needs" (UNEP 2007: 524), is an essential goal for planning at all spatial scales. In light of the regional scale as the most appropriate for progressing sustainability (Graymore *et al* 2008: 362), sustainability appraisal has been assimilated into the core of regional planning processes and practices (Counsell and Haughton 2006).

[34] See, for example, Yencken (2002), Adger *et al* (2003), UNEP (2007: 361-394), Bosselmann *et al* (2008) and Focht (2008).

> "The region is a vitally important scale to sustainability planning. It makes sense to consider many planning challenges at a regional scale since they are regional in nature and cross the boundaries of local jurisdictions. At the same time regional planning has lagged behind the need for such solutions. There are some success stories to be sure, but in terms of dealing with sustainability concerns ..., regional governance has made relatively little headway ..." (Wheeler 2009: 864)

In regional planning practice, based on the assessment of regional assets, encountering main problems of past as well as present development of a region, a direction for future development will be discussed. Regional capability could be improved by planning practice through effective regional policy as well as projects or programs for future regional development. In light of the governance nature of planning, sustainable development as a common object for regional governance is also applicable to the practice of regional planning. Therefore, the key point lies in whether regional planning could facilitate regional sustainability and how to facilitate it.

Although sustainable development has been widely accepted as a common view for a region, how to achieve it remains a problem which has not been resolved until yet[35]. Nevertheless, regional planning as a part of a multi-level governance system matters for regional sustainable development (Haughton and Counsell 2004). In a planning process, there are conflicts between economic growth, political decision and environmental protection, and planners act as mediators to the conflicts and try to find a relative balance of goals towards sustainable development to evade these conflicts (Campbell 2003). In this sense, regional planning serves as a mediator in coordinating aspects of regional development towards sustainability.

And what's more, regional planning could contribute to regional sustainability through the improvement of regional capability. The aim of regional planning could be understood as to make a region improve its capability through indicating the region's development path properly. For a region, regional planning implies cooperation, coordination and interaction in different levels towards regional sustainable development. As a tool for regional governance, regional planning could define a path for future development. Led by the concept of sustainable development, regional planning will promote regional sustainability rather than regional growth and help educate the public.

Regional planning itself depends on several factors, for instance, the quality of planners and the planning objective. Moreover, how planners make a plan or whom do they make it for will also influence a planning project. Nevertheless, regional planning may coordinate different actors and different interests around a region by its implementation. It may harmonize different objectives from other planning programs and strategies as well by opening up a dialogue between different actors and scales. All these will be

[35] For instance, in Britain, regional planning is characterized by continual efforts to define and redefine its concept and scope, which often involves parallel and separate efforts to create mechanisms for regional land-use planning and regionally-based economic development (Baker *et al* 1999). "Sustainable development" is listed as the fifth objective of the Regional Development Agencies, yet there is little in legislation to suggest how it might be achieved (Gibbs 1998). Therefore, "...it is unclear how conflicts between sustainability, regional planning and economic development will be resolved" (House of Commons 1997: para 43).

benefit for development towards regional sustainability.

Although sustainable development already becomes one of the objectives of regional development, it remains little in the legislation on how to realize it, especially for developing countries like China. Dealing with the conflicts and problems during the course from an unsustainable towards a sustainable pattern might be a slow process. For example, the development-led priorities of governments and agencies are always difficult for planners to make a choice between economic development and environmental protection. Particularly in developing countries like China, presently economic development remains the main task for all the regions in the country, whilst ever-increasing environmental problems caused attention from home and abroad: water pollution, air pollution, land degradation, exhaustion of natural resources, and so forth.

Based on the analysis above, a consistent standard for regional development towards sustainability needs to be created, which might be achieved by regional planning. On account of its strategic and comprehensive characteristics, regional planning can serve as an effective tool for the region's regulation towards sustainability, and the key is the implementation of the planning.

2.4.4 Summary

Regional governance involves solving problems and implementing policies to promote regional development, which also serves as part of the formation and improvement process of regional capability. As a synergy of multi-level governance and multi-actor governance, regional governance involves both vertical and horizontal dimensions with conflicts as well as cooperation.

In the context of regional governance in China, governmental actors play a predominant role compared to non-governmental actors, and diverse governmental actors has formed power relations with one another. Both the multi-level (national, provincial and local) governments and the multiple (governmental and non-governmental) actors need more interplay and dialogues to improve regional governance. Although governmental actors predominate in policy-making, certain non-governmental actors such as research units may shed light on governmental decisions and policies on regional development.

Regional planning could be taken as both an instrument towards improving regional capability and a tool for governance. That is to say, planning interventions could interact with both the development process of regional capability and governance. Considering the governance nature of regional planning, sustainable development as a common object for regional governance is also applicable to the practices of regional planning. In this sense, regional planning may contribute to the process of regional governance towards regional sustainability.

2.5 Concluding remarks on the theoretical framework

This chapter attempts a theoretical synthesis of the interrelated concepts of regional development, regional capability, regional governance, regional planning and regional sustainability.

For a start, this chapter analyses the multi-perspectival turns in economic geography,

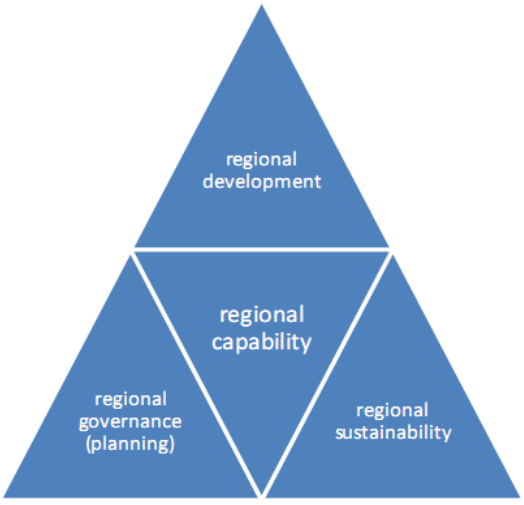
with a concluding remark on the application of a relational-dynamic perspective to a comprehensive understanding of regional economic development.

Then, it reviews the concept of contextuality, path dependence and contingency, and indicates this concept as a theoretical synergy of the multi-perspectival turns. Contextuality could be understood as actors/agents embedded in regional context, which reflects a relational perspective on regional development; path dependence and contingency reflect a dynamic perspective by taking a view that regional development is an evolutionary process with unpredictable contingent events. Given these points, it implies again that the understanding of regional development should follow a relational-dynamic perspective.

Next, it focuses on regional development and regional capability with the relational-dynamic perspective. It defines regional capability and regional assets in this study, explains the categories of analysis on regional capability, and argues that regional capability is shaped by regional assets and regional development path. Accordingly, regional development is constrained by the region's assets and its development path.

Finally, it comes to regional governance, which links up regional capability with regional development as well as regional sustainability. Regional governance as a synergy of multi-level and multi-actor governance involves both vertical and horizontal conflict as well as cooperation and collaboration towards regional sustainability. On account of its governance essence as well as strategic and comprehensive characteristics, regional planning may serve as an effective tool for a region towards sustainable development by improvement of regional capabilities, and the key is the implementation of the plan.

To sum up, there are two concluding remarks on the theoretical analyses: for one thing, a relational-dynamic perspective applies to the analyses of regional development and regional capability for a comprehensive understanding; for another, regional capability is the center of regional analysis in this study, which is interrelated with regional development, regional governance and regional sustainability (Figure 2.6).



Source: Yan Li

Figure 2.6 Regional capability as the center of regional analysis

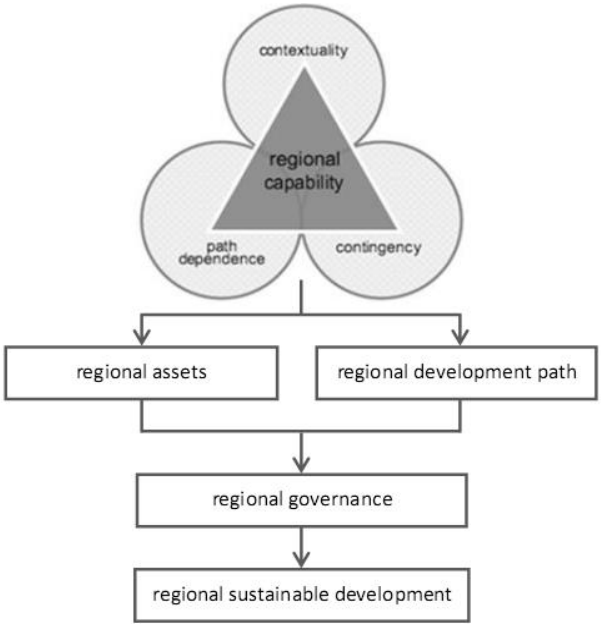
3 Analytical Framework, Methodology and Research Areas

This chapter serves as a bridge for connecting the theoretical framework (Chapter 2) and the empirical research (Chapter 4 to Chapter 8) in this study. It first introduces the research design, puts forward an analytical framework of path-assets analysis for analyzing regional capability in the empirical research (3.1.1) with explanation on the methodology (3.1.2) of this study, and then introduces the two regions of the Northeast (NE) and Yangtze River Delta (YRD) for case studies (3.2).

3.1 Analytical framework and methodology

3.1.1 Research design and analytical framework

This study is designed for a comprehensive understanding of the mechanism of regional development as well as the interrelations of regional capability, regional development, regional governance and regional sustainability (Figure 3.1).



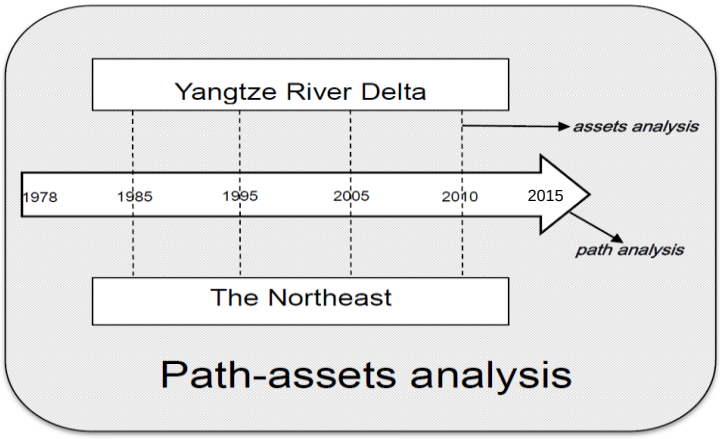
Source: Yan Li

Figure 3.1 Research design

According to the theoretical framework (Chapter 2) of this study, regional capability plays a crucial part in the process of regional development. Considering that regional capability is shaped by regional assets and the region's development path, analysing regional capability is realized by conducting a path-assets analysis in this study.

The path-assets analysis distinguishes from the existent regional research characterized only with either a dynamic path analysis or a relational assets analysis. Specifically, the path-assets analysis is designed as a synergy of the analysis on regional assets and regional development path, in accordance with the relational-dynamic perspective pursued in this study: the analysis of regional assets reflects a relational perspective while the regional development path reflects a dynamic

perspective. In addition to developing a theoretical concept of regional capability, this study intends to analyse regional capability with case studies of the two regions of the NE and YRD in China. With an attempt at combining description and explanation of the process of regional development in China, this study proposes a path-assets analysis as the focus of the analytical framework for the empirical research (Figure 3.2).



Source: Yan Li

Figure 3.2 Analytical framework: path-assets analysis

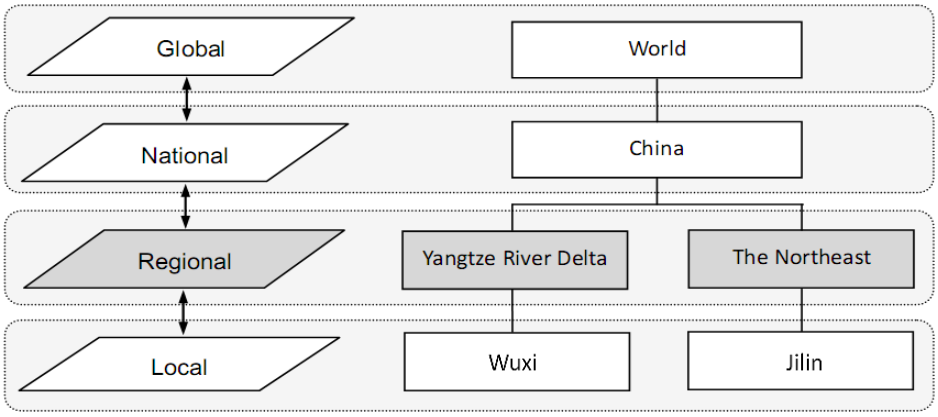
The path-assets analysis as a synergy of the analysis on regional assets and regional development path is a specific analysis proposed in this study designed for understanding regional capability under a relational-dynamic perspective, and the research methods for the path-assets analysis will be introduced in the next part.

3.1.2 Methodology

This study entails multiple methods of analysis to achieve a comprehensive understanding of regional development in China. It conducts both theoretical and practical analysis, namely literature review and case study.

Literature review is not only presented in the theoretical framework of Chapter 2 but also widely used as a research method for providing necessary theoretical analysis or context in other parts of the study, especially in Chapter 7 and Chapter 8, in order to achieve a better understanding of the development process of environmental governance and planning in China.

Case study as an approach of geographic analysis is pursued in this study with a multi-level analysis. This study takes the NE and YRD as the two regions for case studies and conducts a multi-level analysis with special focus at the regional level (Figure 3.3). In addition to the general focus of this study at the regional level, the local level and the national level are also important for the multi-dimensional path-assets analysis, especially for the analysis on the political-institutional dimension: Wuxi City in YRD and Jilin City in the NE are the emphases of analysis at the local level due to their serious environmental pollution accidents, while political decisions and policies at the national level become the focal point for regional development, governance and planning.



Source: Yan Li

Figure 3.3 Multi-level analysis with focus at the regional level

This study entails both qualitative methods and quantitative analysis for the path-assets analysis on regional capability.

Quantitative analysis mainly relies on official statistical data published by the National Bureau of Statistics of China (NBSC) as well as by provincial and municipal Statistical Bureaus, with statistical yearbooks as the main data sources data. Moreover, official online databanks are also important data sources for the quantitative analysis, especially the Online National Statistical Databank of the People's Republic of China (NBSC 2015) and the Online Data Centre of Environmental Protection of the People's Republic of China (MEP 2015). The main data sources for quantitative analysis in this study are listed in Table 3.1.

Table 3.1 Main data sources for quantitative analysis

Type	Sources	Availability
Statistical Yearbook	China Statistical Yearbook	1981-2015
	Liaoning Statistical Yearbook	1983-2015
	Jilin Statistical Yearbook	1991-2015
	Heilongjiang Statistical Yearbook	1987-2015
	Shanghai Statistical Yearbook	1981-2015
	Jiangsu Statistical Yearbook	1985-2015
	Zhejiang Statistical Yearbook	1984-2015
Online Statistical Databank	Online National Statistical Databank	NBSC (2015)
	Online Data Centre of Environmental Protection	MEP (2015)

Source: Yan Li

In addition, other official publications including official research reports such as the annual National Environmental Statistics Report and the Social Services Development Statistics Bulletin also provide official statistical data. Other documents, articles, books and newspapers will serve as complement to official statistical data.

Qualitative analysis primarily constitutes by interviews and talks. The structured expert interviews were mainly conducted with professors, scholars and governmental officials working on the topic of regional development, governance and planning or doing research on the similar topic. In addition, this study also conducts loosely structured interviews and informal talks with private firm managers of manufacturing industries with

pollution to or negative influence on its surrounding environment, volunteers of the environmental non-governmental organizations, people suffered from diseases originated in environmental pollution as well as citizens with consideration on education and regional development.

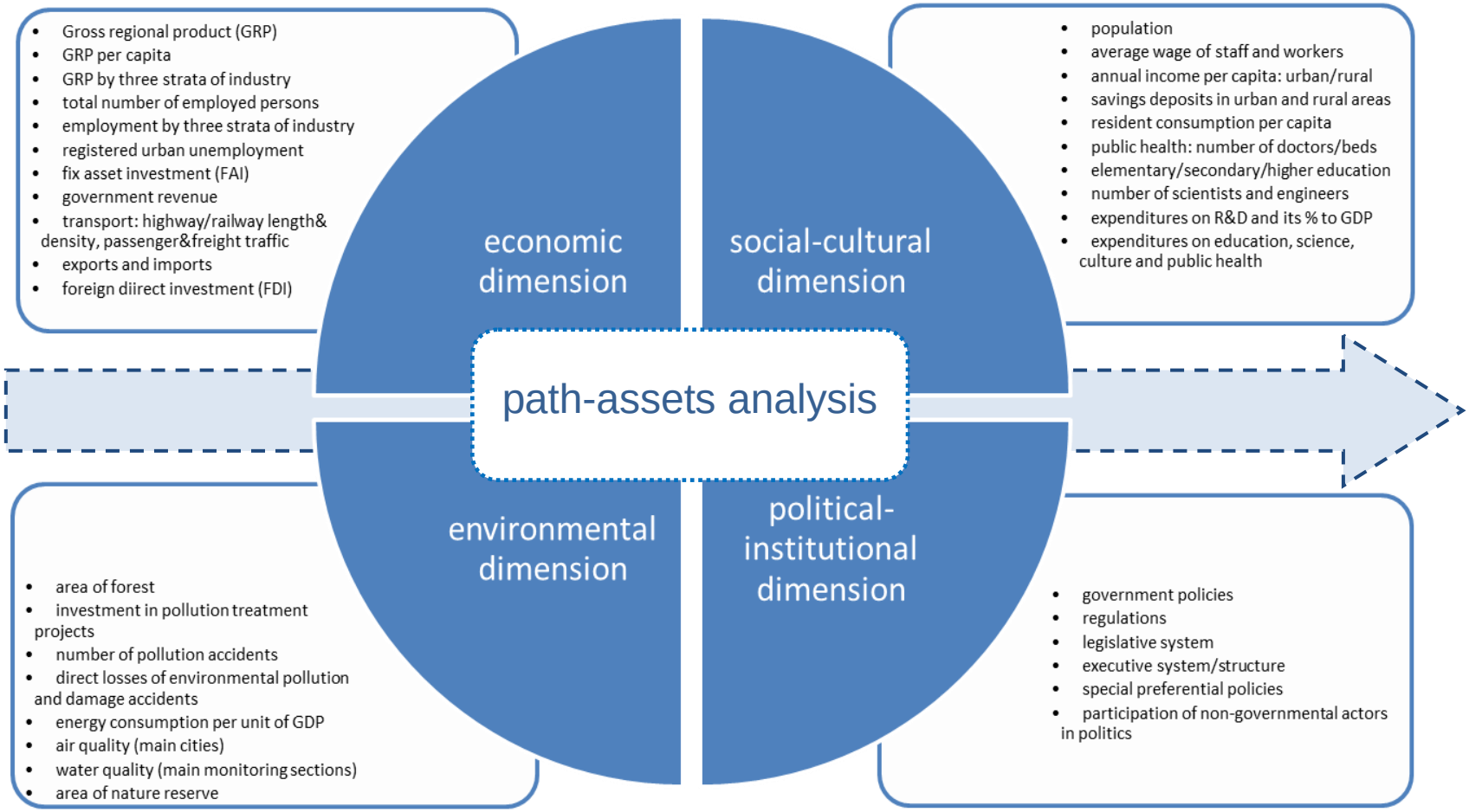
Considering that the nature of this study requires large amount of data at the regional level, which is difficult to collect by small surveys or interviews, official statistical data published by the NBSC and other national ministries such as the Ministry of Environmental Protection (MEP) remain as the main data sources for a comprehensive coverage of the economic, social-cultural, environmental and political-institutional dimensions in China. In other words, this study will mainly use official statistical data as well as data in the publications by scholars to carry out the quantitative path-assets analysis of the two regions for case studies on the economic, social-cultural and environmental dimension (Chapter 4-6), and will conduct a qualitative analysis on the political-institutional dimension (Chapter 7) based on expert interviews. In fact, other studies based on survey data at the provincial or local level could complement this research in a large degree.

As mentioned previously in 3.1.1, this study proposes a path-assets analysis designed for understanding regional capability, which integrates both a chronological sequence analysis and a multi-dimension analysis.

For one thing, this study conducts a chronological sequence analysis on regional assets mainly from 1978 to 2014[36], with a comparative study at selected years of 1985 (representative for the 1980s), 1995 (representative for the 1990s), 2005 (representative for the 2000s), 2009 and 2014 (representative for the present), in order to show the changes of the dynamic development path of each region (see Figure 3.2 in 3.1.1).

For another, on the consideration of regional development as a multi-dimensional process, this study applies a multi-dimension analysis for the path-assets analysis on regional capability and divides regional assets into the following four main dimensions: the economic dimension, the social-cultural dimension, the environmental dimension and the political-institutional dimension. For the analysis on each dimension, this study selects several indicators for the path-assets analysis, and the multi-dimensional path-assets analysis on regional capability with selected indicators are illustrated in Figure 3.4.

[36] Note: The latest data in the various statistical yearbooks 2015 in China are the data by the end of year 2014; for some indicators, the latest data are the data by the end of year 2013. Nevertheless, this study will also include the data for the year of 2015 for the quantitative analysis when the official statistical data for the indicators are available, for instance, published online by NBSC (2015).



Source: Yan Li

Figure 3.4 Multi-dimensional path-assets analysis with selected indicators

3.2 Research areas

This study selects two regions in China, namely Yangtze River Delta (YRD) and the Northeast (NE), for the empirical study due to their outstanding representative features of regional development among all of the Chinese regions.

YRD, one of the three most prosperous regions[37] in China functioning as engines of the national economy, has experienced quick industrialization and urbanization since the 1990s; the NE, used to be an old national manufacturing centre and served as an important part of Chinese regional economy since the 1950s, fell into problems from deindustrialization, a decline called "Northeast Phenomenon" (Li and Nipper 2009), and revitalizing the NE and other old industrial bases is one of the overall strategy of China to promote regional development (NDRC 2006). However, both regions still have a long way towards regional sustainable development. Actually, most of the Chinese regions, including the NE and YRD, have achieved temporary economic growth at the expense of the environment and resources during the process of industrialization in the past decades and further intensified the human-environment relationship with series of environmental problems (Zhang *et al* 2015b; Shapiro 2016) such as air pollution, water pollution and increasing occupancy of cultivated land for urban construction. Consequently, the problems mentioned above have seriously influenced regional development in the NE and YRD.

Before focusing on the NE (3.2.1) and YRD (3.2.2), this study provides an overview of the basic information of both regions by the end of year 2014 with reference to the national total (Table 3.2).

Table 3.2 Basic data of the NE, YRD and China (2014)

	NE	YRD	China
Area (10^4 km^2)	80.84	21.14	960
Percentage of area to the national total (%)	8.42	2.20	
Population (million persons)	109.76	158.94	1367.82
Percentage of population to the national total (%)	8.02	11.62	
Population density (person/ km^2)	136	752	142
GDP (billion Yuan)	5746.98	12880.28	63646.27
Percentage of GDP to the national total (%)	9.03	20.24	
GDP per capita (Yuan)	52359.48	81038.61	46531.17
Total value of exports and imports (Billion USD)	179.24	1385.32	4303.04

Note: 1 U.S. dollar = 6.51 Chinese yuan (State: March 2016)

Data source: calculated from NBSC (2015)

In addition to presenting the map of the NE (Figure 3.5) and the map of YRD (Figure 3.6), the geographic location of both regions in China is illustrated in Figure 3.7.

[37] The three regions are: YRD (with Shanghai as the leading mega-city), Pearl River Delta (part of Guangdong Province, nearby Hongkong, including main large cities like Guangzhou and Shenzhen), and Jingjinji (Beijing, the capital of the PRC, located in this region) (see Figure 3.5). There are many studies with focus on these three regions in Eastern China, see, for instance, Xue and Cai (2003), Yu and Jiang (2007) and Wang and Niu (2010).

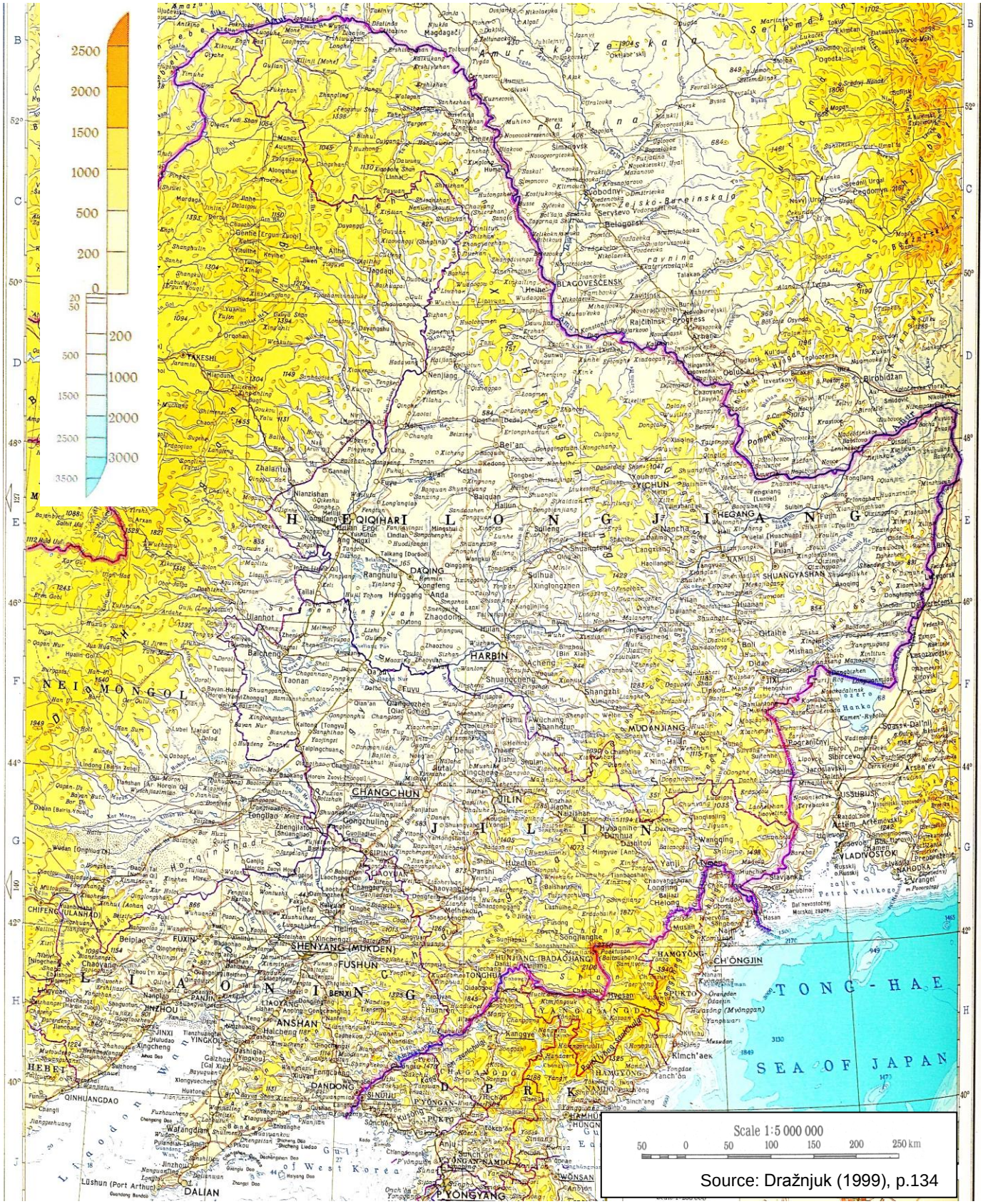


Figure 3.5 Map of the Northeast (NE)

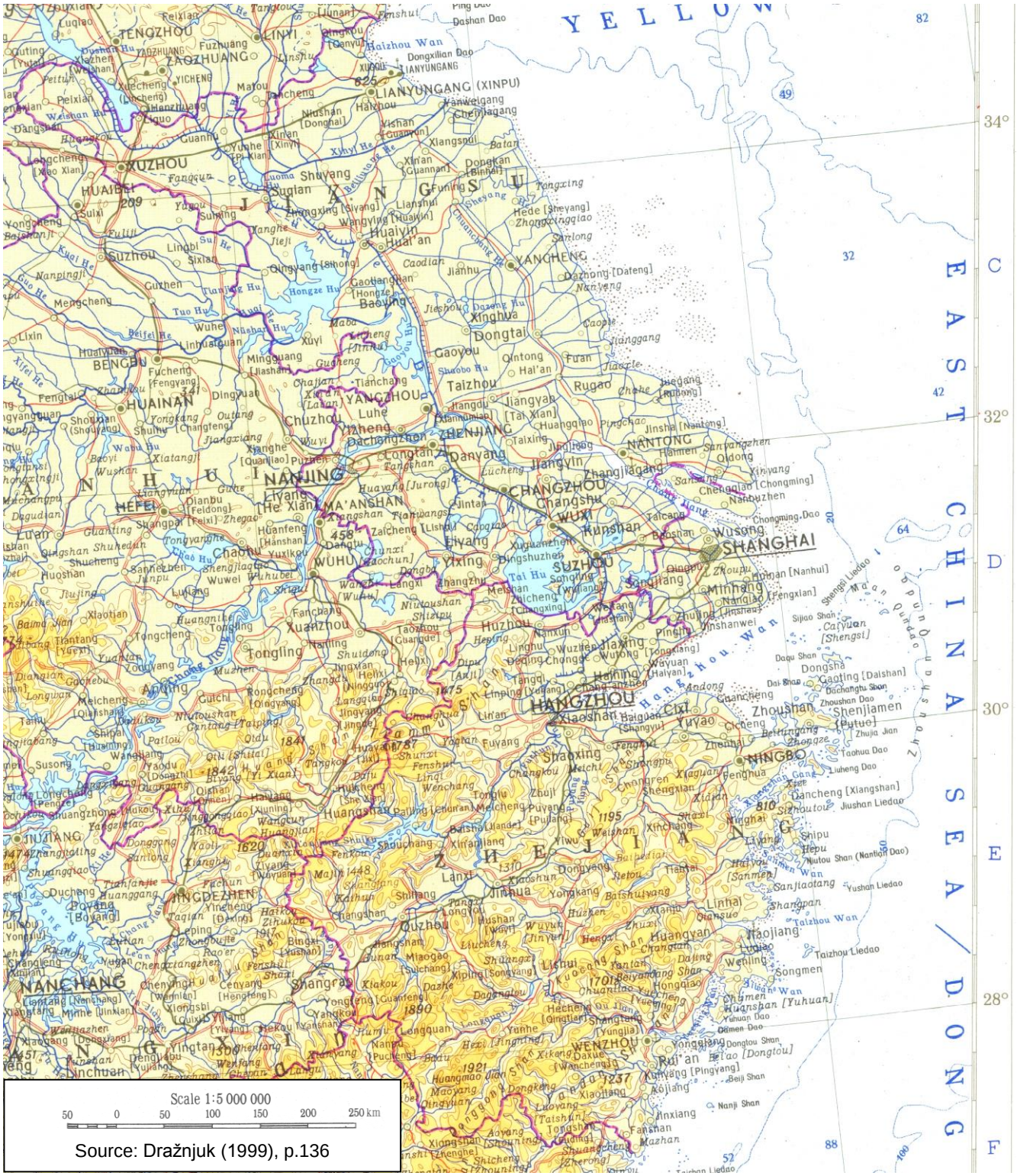


Figure 3.6 Map of Yangtze River Delta (YRD)

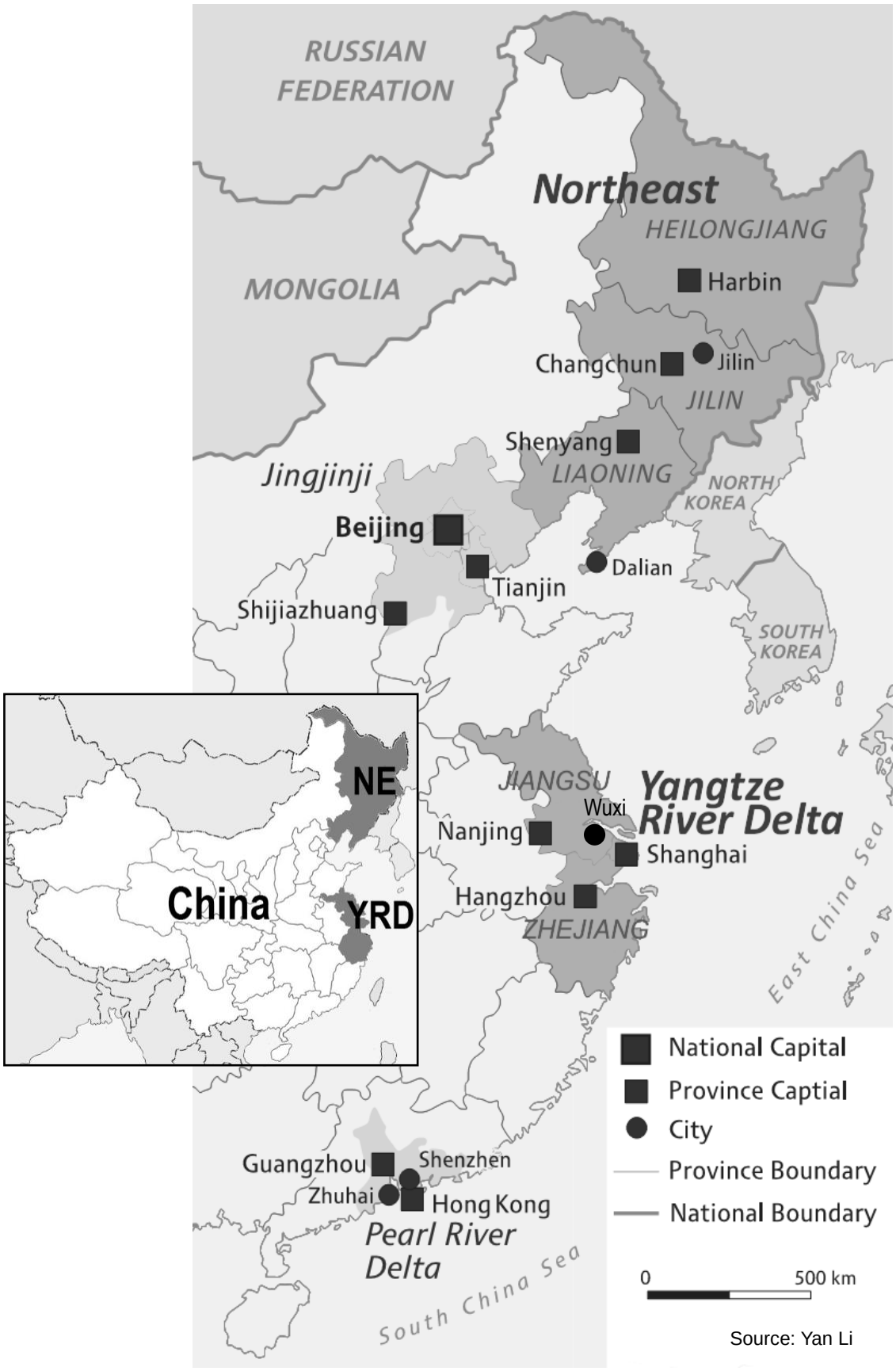


Figure 3.7 Geographic location of the NE and YRD

3.2.1 The Northeast (NE)

The region of Northeast (NE) includes the three provinces of Heilongjiang, Jilin and Liaoning located in northeast China (Figure 3.5 and Figure 3.7), with an area of 0.81 million km^2 (8.42% of the national total) and a population of 109.76 million (8.02% of the national total) at the end of 2014 (NBSC 2015).

After the foundation of People's Republic of China (PRC) in 1949, the NE became the first national heavy industrial base, and served as one of the most important national centres of heavy industry as well as the engine for national construction in the 1950s, which used to be the nation's industrial showpiece. During the period of the 1st five-year plan (FYP) (1953-1957) for national economic development, as a pioneer, the NE region thoroughly carried out the national system of a central-planned economy, and has formed a high concentration of state-owned heavy industries. At the end of the 1st FYP, 58 of the 156 national constructive projects designed under assistance of Soviet Union were established in the NE. Under the centrally planned economy, the NE made great contribution to foundation and development of national industrial modernization and created illustrious outstanding achievements: the first steel from steel-making furnace of China, the first motor vehicle, the first 10000-tons-ship, the first airplane and the first hydraulic press of the PRC have been born in the NE (Lu and Li 2005). After the implementation of several FYPs, the NE has formed relatively stronger ability in machine and equipment manufacture compared to other regions in China. Served as a traditional national industrial base since 1950s, the NE focuses mainly on equipment manufacturing, and the major manufacturing industries include the steel, automobile, shipbuilding, aircraft manufacturing and petroleum refining industries.

However, since the 1990s, the stagnation of the heavy-industry-based economy in the NE has come into being, accompanied by the liberalization as well as privatization of the Chinese economy. The term of "Northeast Phenomenon", put forward by Feng (1991), has been widely used for the description of regional economic recession as well as regional economic decline in the NE. Actually, since the 1980s, the region of NE has increasingly lost its position as a national manufacturing base due to its poor performance in the arena of market-oriented economy. The share of the NE in national gross output value of industry has continually declined from 14.5% in 1986 to 7.7% in 2006. Being used to the central-planned economy has made it rather painful for the NE as it fails to adapt itself in a timely way to new market conditions, which has become its economic problems since the 2000s. Government figures show that in 2004 the NE's GDP per capita, however, made up only one third of that of the Pearl River Delta (see Figure 3.7) in south China.

Chinese central government has attached great importance to the revitalization of the NE since 2003, with both preferential policies and institutional instruments. On the one hand, revitalization of the NE has served as a national policy of China since October 2003 (State Council 2003a, 2009, 2014)[38]. Revitalizing the NE and other old industrial

[38] In fact, there is also critique on the national policy of revitalization of the NE. For one thing, the policy "does not add anything new to the reform package already being implemented" (Wall 2004: 9), though "it does offer a limited

bases was not only written in the Outline of the 11th FYP for National Economic and Social Development (2006-2010) in 2006, but also pointed out by Chinese President Hu Jintao as a national policy in his report at the 17th CPC National Congress in 2007: to "rejuvenate the NE and other old industrial bases in an all-round way" and to "help transform the economies of areas where natural resources are exhausted" (Hu 2007a). On the other hand, the State Council established the Leading Group for Revitalizing the Northeast and Other Old Industrial Bases in December 2003, with the Chinese Premier as the chairman (State Council 2003b). In 2008, after the institutional reform of the State Council, the duties of the Leading Group have been transferred into the NDRC with the establishment of the Department of Northeastern Region Revitalization, NDRC[39] (Zhu 2009).

Moreover, after more than a decade's efforts for revitalizing the NE, presently the revitalization of the NE remains a national focus on regional sustainable development (Jin 2015), particularly after the State Council published its opinions on recent major policies and measures to support the revitalization of the NE in 2014 (State Council 2014). For example, the Forum for Innovative Development and Revitalization of the Northeast (the first phase) held on 8-9 January 2016 in Changchun, Jilin Province is one of the recent symposia on the revitalization of the NE.

Overall, the three provinces of the NE have traced out their common economic decline after their boom since the foundation of the PRC in 1949 due to the transition of economic system from central-planned economy to market-oriented economy, which has formed a unique path of regional economic development in China. And what's more, the region of NE as well as the Northeast Phenomenon has not been much discussed in international research on regional development in China (Li and Nipper 2009), though some studies focus on strategies of revitalization of the NE (Chen 1996; Chen 2003; Yu and Yu 2006; Mei *et al* 2006; Jin 2015), such as adjustment of economic structure, regional coordination and institutional innovation, and tries to change the fortune of the old national manufacturing base.

Recent research on regional development in the NE shows a tendency of sustainable regional development and relates to several aspects, for instance, economic transformation of mining cities (Li *et al* 2015), rural development inequality (Cheng *et al* 2015), energy saving and emission reduction of electric power industries (Liu 2015), spatial distribution of the population, economy and water resources (Zhang *et al* 2015a), land use and land cover changes (Liu *et al* 2011) as well as urban agglomeration and urbanization (Sun *et al* 2011, 2012).

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increase in the flow of resources from the center to finance the implementation of the reforms" (Wall 2004: 9-10). For another, the concentration on the reform of the SOEs in the policy is controversial, since many obstacles to the speedy, efficient and effective reform of the SOEs will prevent the successful implementation of the policy (Wall 2004: 12).

[39] The Department of Northeastern Region Revitalization of the NDRC "is responsible for formulating strategies, plans and key policies to promote the revitalization of Northeast China and other old industrial bases, and coordinating major key issues; making proposals on adjustment and upgrade of old industrial bases, sustainable development of natural resource-based cities and layout of major projects, and coordinating the implementation of these proposals". (Source: Main Functions of the Department of Northeastern Region Revitalization of the NDRC. http://en.ndrc.gov.cn/mfod/200812/t20081218_252191.html, accessed on 15 December 2015.)

3.2.2 Yangtze River Delta (YRD)

The region of Yangtze River Delta (YRD) refers to the administrative areas around the delta of the Yangtze River including two provinces and one municipality (State Council 2008), namely Jiangsu Province, Zhejiang Province and Shanghai Municipality (Figure 3.6 and Figure 3.7), with total area of 0.21 million km^2 (2.20% of the national total) and a population of 158.94 million in 2014 (NBSC 2015).

Over the past century, as part of the eastern monsoon China zone with a humid subtropical climate, abundant annual precipitation, bountiful surface water resources, varied vegetation types and a long agricultural history, YRD becomes the cradle of Chinese agricultural civilization and consequently an economic centre of China due to its pleasant climate, geographic location, natural environment and educated residents (Gu *et al* 2011: 545).

YRD is located at the middle of China's east coastal belt with an advantageous geographic location, where the longest river of China — the Yangtze River flows into the Pacific Ocean. Known as China's 'Golden Triangle', located at the intersection of the Coastal Industrial Belt and the Yangtze Industrial Belt, spearheaded by Shanghai, YRD is one of the most vibrant and important region of the Chinese economy. Along with the implementation of the opening and reform policy in this region, especially since the 1990s, the region of YRD is a favourite investment destination for transnational corporations (TNCs) due to comparative advantage in skilled workforce and good infrastructure. As a result, it is among the most prosperous regions of China with prosperity levels growing at a much faster rate than the interior of the country.

As an old industry base, the YRD not only plays a very important role in the national economic development, but also has a well-developed integrated urban system in the country, which forms the YRD megalopolitan region as one of the most highly populated and developed regions of China and one of the six megalopolitan regions in the world (Tian *et al* 2011: 866).

Largely insulated from China's opening-up process during the 1980s, provincial and municipal governments in YRD began to implement far-reaching reforms at the start of this decade, even before Deng Xiaoping's seminal visit to Shanghai in 1992. The result has been tremendous economic growth rates in the 1980s and 1990s.

Nevertheless, problems arising from massive industrialization have put pressure on sustainable development in YRD since the 1990s, for instance, an ever-increasing proportion of construction land and an ever-increasing number of environmental accidents.

On the one hand, in the process of rapid urbanization and industrialization, the proportion of construction land in YRD has been ever-increasing since 1991, from 4.18% in 1991 to 21.72% in 2008, which was much higher than the national average of 3.45% in 2008 (Wang *et al* 2015), whilst the percentage of cultivated land in YRD has been continuously decreasing. Many farm land has been changed into construction land or industrial park due to urbanization and industrialization since 1978.

On the other hand, environmental pollution accidents has significantly increased in YRD. The worsening pollution of major rivers and lakes and atmospheric pollutants such as sulphur dioxide, which causes acid rain, have become major environmental problems in the YRD (China Daily 2005). In 2013, there were 402 environmental pollution accidents in YRD, which accounted for more than half of the 712 environmental pollution accidents happened in China in the same year (NBSC 2014).

Despite of its performance economic development, the present pattern of regional development in YRD is in a certain degree unsustainable, shortages of natural resources and worsening environmental conditions becoming more and more obvious since 2000s, which implies intensified human-environmental relationship in YRD.

Regional development of YRD has caught attention from the Chinese central government since the 2000s. YRD was selected by the central government besides Jingjinji (see Figure 3.7) as one of the two key regions targeted by the 11th FYP (2006-2010) for regional planning, and the Chinese central government "will continue to support the eastern region in taking the lead in development" (Hu 2007a). The State Council has attached more importance to prospects of the YRD region and intends to promote integration in this region (People's Daily Online 2008).

In the past decade, the formation of a polycentric urban network in YRD promotes research on urban growth pattern (Tian *et al* 2011) and polycentric structure of mega-city region of YRD (Yu and Wu 2006; Luo 2010; Zhao 2011; Zhao and Chen 2011). Recently, regional inter-city cooperation as a new phenomenon has received much governmental and scholarly attention in the YRD region (Luo and Shen 2009), which reflects the dynamics of China's economic decentralization, political centralization and the market logic interwoven with state authority (Chan and Xian 2012).

Recent academic research on regional development of YRD relates to diversified topics including regional planning (Li and Wu 2013), climate change and environmental consequences of rapid urbanization (Gu *et al* 2011; Haas and Ban 2014; Yang *et al* 2014; Liao *et al* 2015), environmental quality and economic development (Zhang and Gangopadhyay 2015), economic transition and corporate networks (Yuan *et al* 2014), land use and construction land potentials (Wang *et al* 2015), carrying capacity of urban agglomeration (Liu 2012) and social vulnerability to natural hazards (Chen *et al* 2013; Ge *et al* 2013).

Although many studies mentioned above relate to the issue of regional development in the NE and YRD, most of them only focus on one or two aspects in the process of regional development and fail to bring a comprehensive understanding of the region. This study tries to analyze the regions of the NE and YRD in a comprehensive way, and the analytical framework for the empirical research in this study is featured with a path-assets analysis described in 3.1.1 for analysing regional capability under a relational-dynamic perspective. Following with this chapter, this study will shift to empirical research with the NE and YRD as case studies and will conduct a multi-dimensional path-assets analysis on the economic dimension (Chapter 4), the social-cultural dimension (Chapter 5), the environmental dimension (Chapter 6) and the political-institutional dimension (Chapter 7).

4 Path-Assets Analysis I: Economic Dimension

In China, regional economic analysis has contributed to the political decisions on national and regional policies as well as development strategies, and this chapter intends to show how to apply the method of path-assets analysis in practical research on regional economic development.

For the economic dimension of the path-assets analysis in the NE and YRD, this chapter mainly analyses the indicators representative for regional economy and structure (4.1), employment and unemployment (4.2), fixed asset investment (FAI) (4.3), government revenue (4.4), transport (4.5) and foreign trade (4.6) since 1978, and comes to the conclusion at the end of this chapter (4.7). The main data source is the annual official statistical data published in NBSC (2015), and the data for the NE and YRD are calculated from provincial statistical data.

In light of the quantitative analysis based on official statistical data in this chapter, other research with emphasis on a qualitative analysis of regional economic development in the NE, YRD and China could serve as complement to the quantitative path-assets analysis in this study.

4.1 Regional economy and structure

Enterprises are important actors for regional economy and structure, whilst there is few official statistical data specialized in enterprises. The only available data on enterprises published by NBSC (2015) are the number of enterprises by status of registration. Nevertheless, it is helpful to have a general view of the number and the status of registration of enterprises in the NE and YRD before starting the path-assets analysis, since it also sheds light on regional economy and structure.

As for the total number of enterprises, by the end of 2014, about one quarter of all the enterprises in China are located in YRD, while only less than one tenth located in the NE (Table 4.1). Furthermore, for the number of enterprises by status of registration, the NE fell behind of YRD almost on all kinds of registration except on state-owned enterprises (SOEs) (Table 4.1).

In fact, the SOEs are the most powerful actors among all kinds of enterprises by status of registration in the NE. Consequently, the SOEs in the NE have deep-rooted influence on the regional economy, and the NE fail to adapt itself in a timely way to new market conditions due to the fact that the SOEs were used to the central-planned economy (see 3.2.1).

As to YRD, the SOEs only make up to 0.49% of the total number of enterprises in the YRD, less than half of the national average of 1.23%, compared to the NE with an SOE ratio of 2.29%, which is almost two times of the national average. On the contrary, YRD features in higher ratios of private enterprises and enterprises with foreign investment: almost one third of the Chinese private enterprises and nearly half of the enterprises with foreign investment in China are located in YRD (Table 4.1).

Table 4.1 Number of enterprises by status of registration, NE, YRD and China (2014)

	NE	YRD	China	NE/China (%)	YRD/China (%)
Number of enterprises	647740	2667901	10617154	6.10	25.13
Domestic funded enterprises	637247	2577711	10385200	6.14	24.82
State-owned enterprises	14827	13128	130216	11.39	10.08
Private enterprises	387780	2236778	7266188	5.34	30.78
Enterprises with funds from Hongkong, Macao & Taiwan	2866	37139	112076	2.56	33.14
Enterprises with foreign investment	7627	53051	119878	6.36	44.25

Data source: NBSC (2015)

In a word, the regional economy of the NE is more influenced by the SOEs, while the YRD features in fecund private economy and foreign investment, and this character is a hint of the path-assets analysis on regional economy and structure of the NE and YRD in the following part of this chapter.

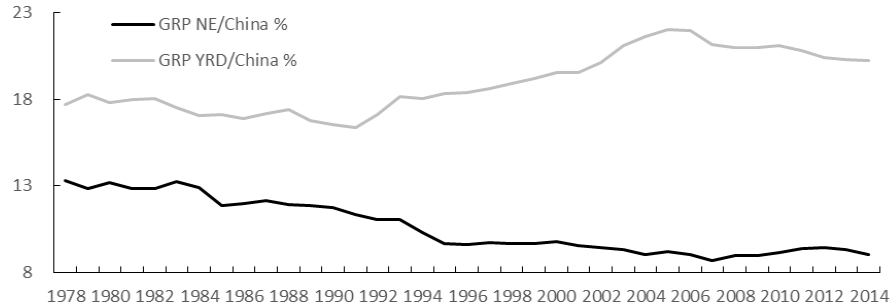
4.1.1 Gross regional product (GRP)

Gross regional product (GRP), or regional GDP, is the gross domestic product (GDP) for a region, which refers to the final products at market prices produced by all resident units in a region during a certain period of time, and reflects the total amount of regional economy (NBSC 2014). Although the total amount of GRP has increased in both areas since 1978, the percentage of GRP to the total amount of national GDP changes significantly, especially the percentage of the NE decreases almost year by year comparing to the increase in percentage of YRD (Table 4.2 and Figure 4.1).

Table 4.2 GRP of the NE and YRD and their percentage to the national total

Year	GRP (billion Yuan)		Percentage of GRP to the national total	
	NE	YRD	NE	YRD
1978	48.60	64.58	13.31%	17.69%
1985	107.40	154.77	11.88%	17.12%
1995	592.20	1121.22	9.69%	18.34%
2005	1714.08	4089.77	9.22%	22.00%
2009	3107.82	7249.41	8.99%	20.97%
2014	5746.98	12880.28	9.03%	20.24%

Data source: NBSC (2015)



Data source: NBSC (2015)

Figure 4.1 Percentage of GRP to the GDP of China, NE and YRD, 1978-2014

Figure 4.1 shows that compared to the beginning of the opening and reform policy applied in 1978, the percentage of the GRP of the NE to the GDP of China decreased about 4.28% while the percentage of the GRP of the YRD increased about 2.55% in 2014. Moreover, compared to the NE, YRD keeps lead on regional economic growth,

and the gap between the two regions is getting wide especially since 1992. The disparity on the percentage of the GRP to the GDP of China between the NE and the YRD has increased about 5.83% in the past 36 years, from 4.38% in 1978 to 10.21% in 2014.

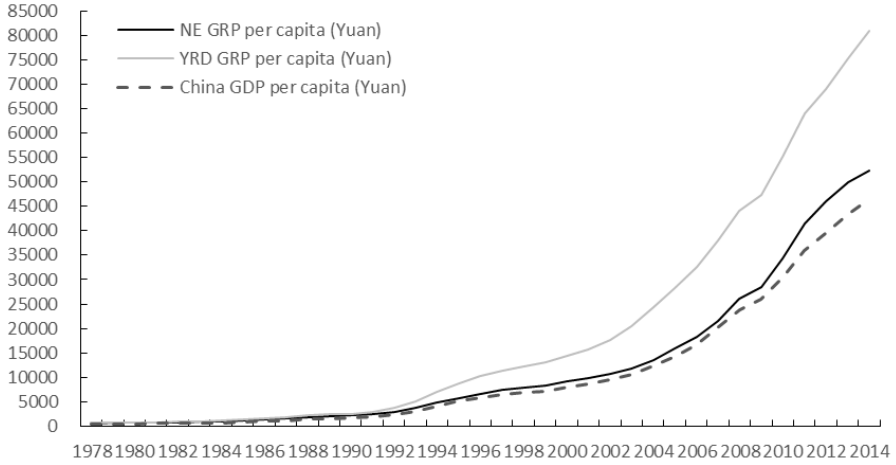
4.1.2 GRP per capita

Since 1978 GRP per capita increases in both areas, though YRD increases much faster that the NE (Table 4.3 and Figure 4.2). In general, the GRP per capita of both regions has remained ahead of the GDP per capita of China since 1978, and the YRD has better performance than the NE since 1978.

Table 4.3 GDP per capita (Yuan)

Year	NE	YRD	China
1978	506.61	604.45	382
1985	1155.43	1350.57	860
1995	5702.48	8759.55	5074
2005	15934.54	28265.73	14259
2009	28493.85	47394.16	25963
2014	52359.48	81038.61	46652

Data source: NBSC (2015)



Data source: NBSC (2015)

Figure 4.2 GRP per capita and China GDP per capita, NE and YRD, 1978-2014

4.1.3 GRP by three strata of industry

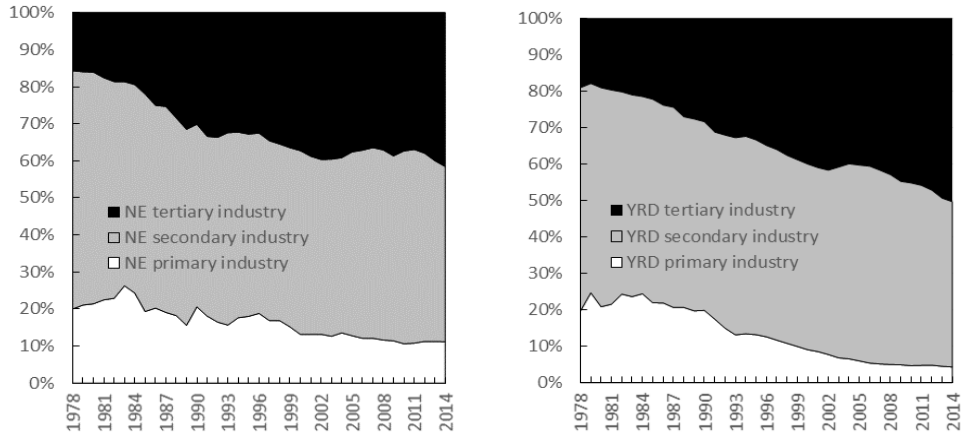
In China, economic activities are categorized into the following three strata of industry: primary industry refers to agriculture, forestry, animal husbandry and fishery industries; secondary industry refers to mining and quarrying, manufacturing, production and supply of electricity, water and gas, and construction; tertiary industry refers to all other economic activities not included in the primary or secondary industries (NBSC 2014).

From 1978 to 2014, in both regions of the NE and YRD, the percentage of the first industry keeps decreasing while the percentage of the tertiary industry keeps increasing, and the percentage of the secondary industry remains relatively stable with a slight decrease (Table 4.4 and Figure 4.3). The main difference between the two regions lies in that YRD has a higher percentage of the third industry while the NE has a relatively higher percentage of the primary industry (Table 4.4 and Figure 4.3).

Table 4.4 GRP by three strata of industry

Year	NE	YRD
1978	20.0 : 64.3 : 15.7	19.6 : 61.3 : 19.1
1985	19.3 : 58.7 : 22.0	21.9 : 55.8 : 22.3
1995	18.0 : 49.2 : 32.8	13.2 : 53.4 : 33.4
2005	12.8 : 49.6 : 37.6	6.0 : 53.7 : 40.3
2009	11.4 : 49.9 : 38.7	4.9 : 50.3 : 44.8
2014	11.2 : 47.3 : 41.5	4.3 : 45.3 : 50.4

Data source: NBSC (2015)



Data source: NBSC (2015)

Figure 4.3 GRP by three strata of industry, NE and YRD, 1978-2014

4.2 Employment and unemployment

This section analyses two indicators of employment in the NE and YRD: total number of employed persons (4.2.1) and structure of employment by three strata of industry (4.2.2), and then analyses the indicator of registered urban unemployment rate (4.2.3) for unemployment in the NE and YRD owing to the fact that it is the only indicator on unemployment rate published officially in statistical yearbooks and in national statistical data bank in China. Due to availability of the official statistical data, this study conducts the analysis on regional employment and unemployment from 1978 to 2013.

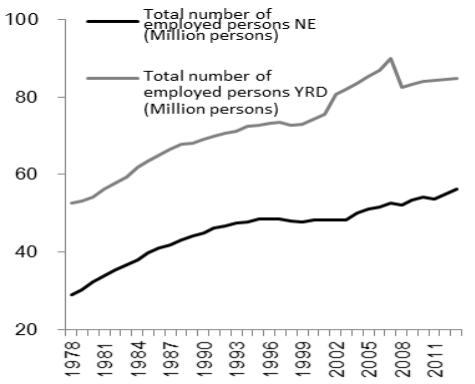
4.2.1 Total number of employed persons

The total number of employment has almost been increasing in both regions from 1978 to 2013 (Table 4.5 and Figure 4.4), and the region of YRD experienced decrease in total employment in 1998 and 2008 due to international financial crises (Figure 4.4). The percentage of employed persons to the national total remains relatively stable since the 1990s: the NE around 7% and YRD around 11% (Table 4.5 and Figure 4.5).

Table 4.5 Total number of employed persons and percentages to the national total, NE and YRD

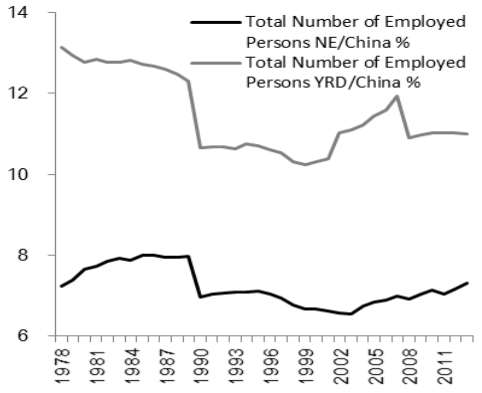
Year	NE (Million persons)	YRD (Million persons)	NE/China (%)	YRD/China (%)
1978	29.06	52.71	7.24	13.13
1985	39.85	63.47	7.99	12.73
1995	48.42	72.82	7.11	10.70
2005	51.08	85.35	6.84	11.43
2009	53.35	83.19	7.04	10.97
2013	56.36	84.69	7.32	11.00

Data source: NBSC (2015)



Data source: NBSC (2015)

Figure 4.4 Total number of employed persons, NE and YRD, 1978-2013



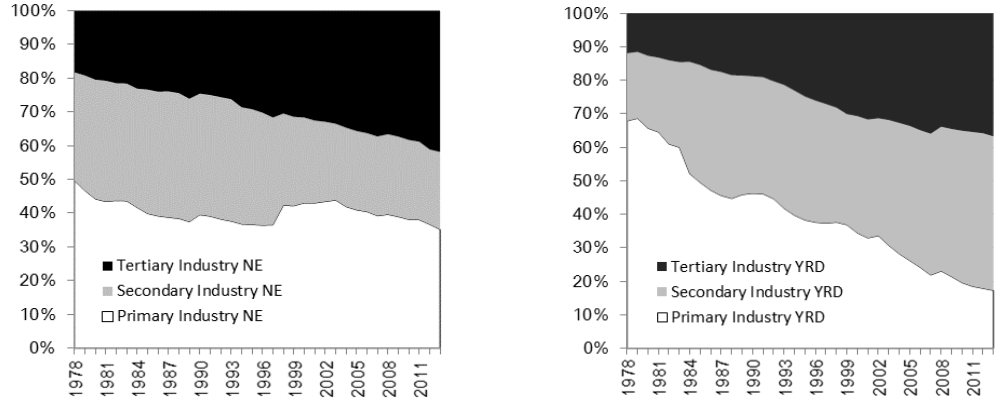
Data source: NBSC (2015)

Figure 4.5 Percentage of total number of employed persons to the national total, NE and YRD, 1978-2013

4.2.2 Employment by three strata of industry

The structure of employment has changed by three strata of industry in the NE and YRD from 1978 to 2013 with the following three characteristics.

First, the percentage of employment in primary industry to the total number of employment in the NE is around 40% in average, with 35.16% at the end of 2013 as the minimum from 1978 to 2013, which is higher than YRD with an average of less than 30% since 2004 and even less than 20% since 2010, with the minimum of 17.28% at the end of 2013 (Figure 4.6).



Data source: NBSC (2015)

Figure 4.6 Structure of employment by three strata of industry, NE and YRD, 1978-2013

Second, the percentage of employment in secondary industry has almost continuously decreased in the NE while increased in YRD from 1978 to 2013 (Figure 4.6). With reference to the structure of GRP by three strata of industry (Figure 4.3 in 4.1.3), the employment in secondary industry in the NE has decreased much faster than the percentage of the secondary industry to the GRP. On the contrary, the employment in secondary industry in YRD has increased much faster than the percentage of the secondary industry to the GRP.

Third, in the NE and YRD, the percentage of employment in tertiary industry to the total regional employment has almost continuously ascended from 1978 to 2013, with minimum of 18.24% in the NE as well as 11.92% in YRD in 1978 and with maximum of

41.84% in the NE as well as 36.72% in YRD at the end of 2013 (Figure 4.6).

4.2.3 Registered urban unemployment rate

Registered urban unemployment rate is the only indicator on unemployment rate published officially in statistical yearbooks and in national statistical data bank in China. This part introduces China's present statistical criteria for registered urban unemployment rate before conducts the relative analyses on this indicator in the NE and YRD, with reference to the national average.

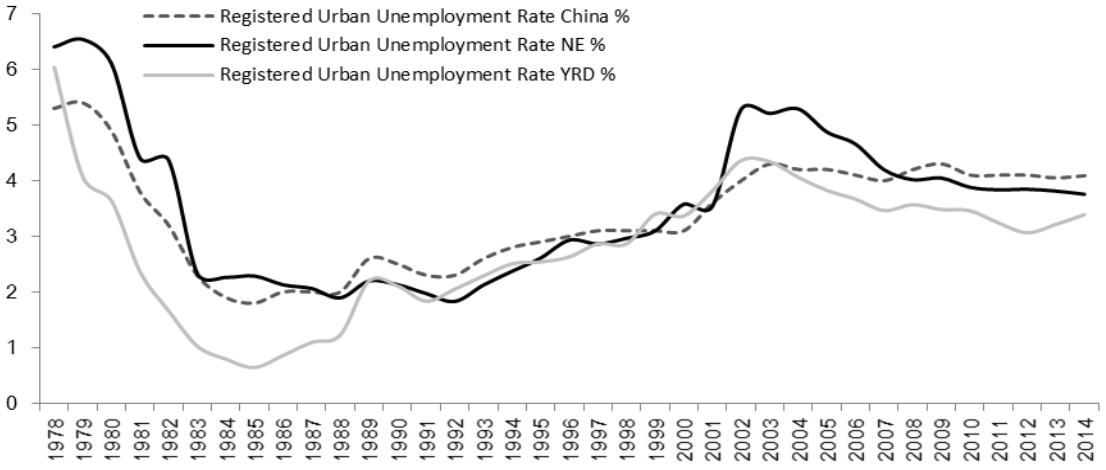
Registered urban unemployment rate refers to "the ratio of the number of the registered unemployed persons[40] to the sum of the number of persons employed in various units (minus the employed rural labor force, re-employed retirees, and Hong Kong, Macao, Taiwan or foreign employees), laid-off staff and workers in urban units, owners of private enterprises in urban areas, owners of self-employed individuals in urban areas, employees of private enterprises in urban areas, employee of self-employed individuals in urban areas, and the registered unemployed persons in urban areas" (NBSC 2014). From this definition, at least two kinds of actual unemployment are not included in the statistics of registered urban unemployment: one kind is the persons who are actually unemployed but did not register at local employment agencies, and the other kind is the laid-off staff and workers in urban units. That is to say, the real urban unemployment rate should be higher than the official statistical data of registered urban unemployment rate analyzed below, especially for the NE with a lot of workers and staff being laid-off during the reform process of the SOEs.

This part analyses the registered urban unemployment rate of the NE and YRD from 1978 to 2014 based on official statistical data with NBSC (2015) as the main data source. The data of the registered urban unemployment rate of the NE and YRD are calculated from provincial statistical data and represent the following two characteristics.

On the one hand, the NE has a higher registered urban unemployment rate than YRD in most of the years from 1978 to 2014 with only 5 years as exception with annual disparities of no more than 0.3% in the year of 1992, 1993, 1994, 1999 and 2001 (Figure 4.7). Moreover, the registered urban unemployment rate of YRD keeps lower than the NE since 2002, with annual disparities of 0.73% in average. In 2014, the registered urban unemployment rate is 3.76% in the NE and 3.39% in YRD.

On the other hand, compared to the registered urban unemployment rate of China from 1978 to 2014, YRD remains below the national average in most of the years from 1978 to 2014 (Figure 4.7). Furthermore, the registered urban unemployment rate in both regions keep below the national average since 2008. In addition, in the past 37 years from 1978 to 2014, there are 18 years (1978-1987, 2000 and 2002-2007) of the NE with a higher registered urban unemployment rate than the national average, which account for almost half of the time period (Figure 4.7).

[40] According to the official statistical criteria in China, registered urban unemployed persons refer to "the persons with non-agricultural household registration at certain working ages (16 years old to retirement age), who are capable of working, unemployed and willing to work, and have been registered at the local employment service agencies to apply for a job" (NBSC 2014).



Data source: NBSC (2015)

Figure 4.7 Registered urban unemployment rate, NE, YRD and China, 1978-2014

4.3 Fixed asset investment (FAI)

Fixed asset investment (FAI) is an indicator for how much investment is occurring in a country or region. FAI is investment in physical assets such as machinery, land, buildings, installations, vehicles or technology, with contrasts to investments in labour, ongoing operating expenses, materials or financial assets[41]. Total investment in fixed assets (or abbreviated as the total FAI) is an important indicator for FAI in China, which "refers to the volume of activities in construction and purchases of fixed assets … and related fees expressed in monetary terms during the reference period, reflects the size and growth of the investment in fixed assets, and provides a basis for observing the progress of construction projects and evaluating results of investment" (NBSC 2014).

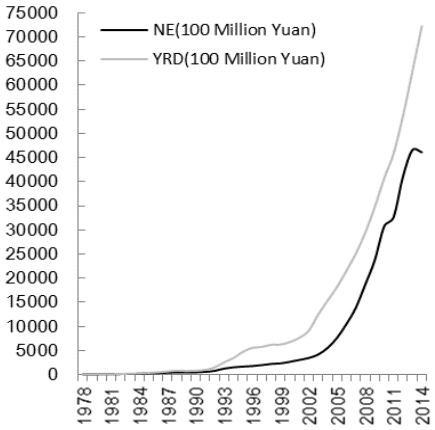
This part analyses the absolute amount of regional FAI in the NE and YRD and its percentage to national total FAI from 1978 to 2014 (4.3.1), the percentage of FAI to GDP from 1978 to 2014 (4.3.2) and the regional FAI by sector from 2003 to 2014 (4.3.3), with NBSC (2015) as the main data source.

4.3.1 Regional total FAI and its percentage to national total FAI

The absolute amount of total FAI almost keeps increasing in the NE and YRD since 1978, except the NE with a slight decrease in 2014 (Figure 4.8). As for the relative percentage of regional FAI to the national total, YRD keeps higher than the NE since 1979 (Figure 4.9). The percentage of the regional FAI of the YRD to the national total is only 10.90% in 1978, even a little bit less than the NE of 10.92%. Nevertheless, after Deng Xiaoping's southern tour in 1992 and the development of the Pudong New District in Shanghai with favourable policies on investment, YRD has covered around 20% of the national total FAI from 1993 to 2005, while the NE with less than 10% during the same period (Figure 4.9). YRD makes 16.36% of the national total FAI in 1985 (compared to 12.29% of the NE), 23.78% in 1995 (compared to 8.51% of the NE), 20.50% in 2005 (compared to 8.65% of the NE) and 14.08% in 2014 (compared to 8.99% of the NE). Even if there is an increase in the NE while a decrease in YRD on the percentage of regional FAI to the national total since 2003, generally, YRD has been

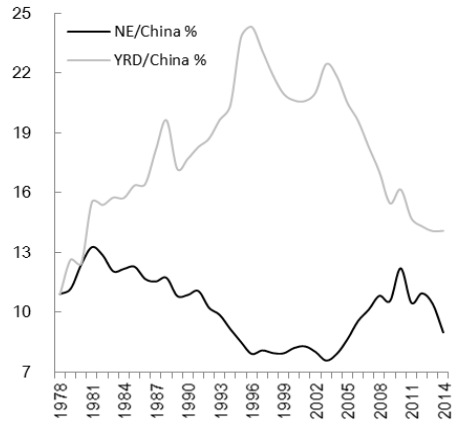
[41] Source: Wikipedia. https://en.wikipedia.org/wiki/Fixed_investment, accessed on 15 December 2015.

more favourable than the NE on FAI since 1978 (Figure 4.9).



Data source: NBSC (2015)

Figure 4.8 Total FAI, NE and YRD, 1978-2014

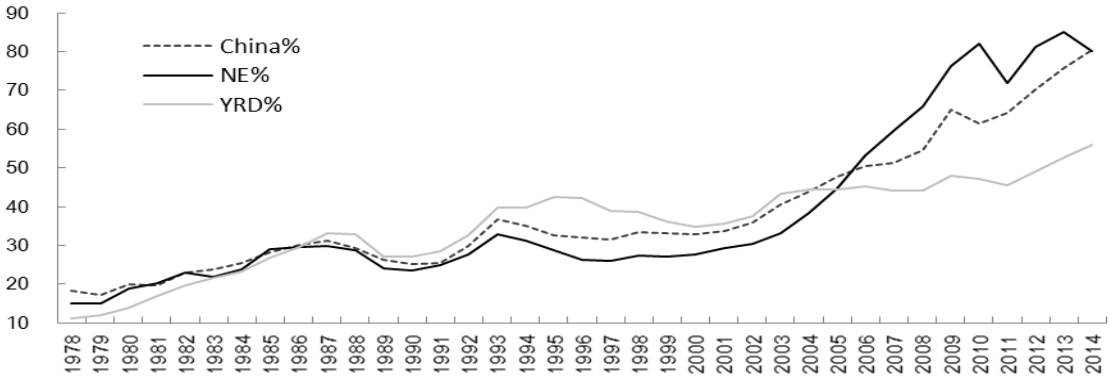


Data source: NBSC (2015)

Figure 4.9 Percentage of regional FAI to the national total, NE and YRD, 1978-2014

4.3.2 The percentage of FAI to GDP

The percentage of FAI to GDP or GRP reflects the pull-effect on economic growth from investment. The percentage of YRD is lower than the national average from 1978 to 1986, and then it goes beyond the national average from 1987 to 2004, but follows with a decrease again since 2005. Instead, the percentage of the NE is lower than the national average from 1986 to 2005, but it goes beyond the national average and keeps more than 50% since 2006. In 2009 the percentage of total FAI to GRP of the NE is 76.37%, over 10 percent of the national average (64.98%) and more than 20 percent of YRD (47.92%). Moreover, this indicator of the NE reaches 81.95% in 2010, 81.31% in 2012, 85.06% in 2013 and 80.21% in 2014, which reflects regional economic growth of the NE predominantly driven by the FAI (Figure 4.10).



Data source: NBSC (2015)

Figure 4.10 Percentage of FAI to GDP, NE, YRD and China, 1978-2014

4.3.3 FAI by sector

FAI by sector reflects the structure of the FAI by the classification of sector, which “is determined by the major products or the purpose of the projects when they are put into production or use, and by the nature of their social economic activities, instead of being determined by industrial classification of the project enterprises” (NBSC 2014). The project is “classified according to major product if there are several kinds of products yielded”, and “one project can only be classified into one sector” (NBSC 2014).

According to NBSC (2014), there are 20 FAI classifications of sectors in China since 2003: (1) agriculture, forestry, animal husbandry and fishery (abbreviated as “Agriculture, etc.”); (2) mining; (3) manufacturing; (4) production and supply of electricity, heat, gas and water (abbreviated as “Electricity, etc.”); (5) construction; (6) wholesale and retail trades (abbreviated as “Trades, etc.”); (7) transport, storage and post (abbreviated as “Transport, etc.”); (8) hotels and catering services; (9) information transmission, software and information technology (abbreviated as “Information, etc.”); (10) financial intermediation; (11) real estate; (12) leasing and business services (abbreviated as “Leasing, etc.”); (13) scientific research and technical services; (14) management of water conservancy, environment and public facilities (abbreviated as “Environment, etc.”); (15) services to households, repair and other services; (16) education; (17) health and social service; (18) culture, sports and entertainment; (19) public management, social security and social organizations (abbreviated as “Public, etc.”); (20) international organizations.

Among the 20 FAI sectors mentioned above, manufacturing and real estate are the most important sectors for FAI in the NE, YRD and China. Particularly, manufacturing is the leading sector ahead of real estate on FAI in the NE, YRD and China from 2003 to 2014, and the two sectors of manufacturing and real estate contribute to more than half of the total FAI in the NE, YRD and China, with an average annual contribution of 54.69% in the NE, 67.65% in the YRD and 55.86% in China from 2003 to 2014 (Table 4.6). Furthermore, Table 4.6 lists the top 10 FAI sectors and their average contribution to the annual total FAI in the NE, YRD and China from 2003 to 2014.

Table 4.6 Top 10 sectors by the average contribution to the total FAI, NE, YRD and China, 2003-2014

	NE		YRD		China	
1st	Manufacturing	33.45%	Manufacturing	39.51%	Manufacturing	31.58%
2nd	Real estate	21.25%	Real estate	28.14%	Real estate	24.28%
3rd	Transport, etc.	7.72%	Environment, etc.	8.00%	Transport, etc.	10.12%
4th	Environment, etc.	7.21%	Transport, etc.	7.76%	Environment, etc.	8.06%
5th	Mining	5.59%	Electricity, etc.	4.75%	Electricity, etc.	6.30%
6th	Electricity, etc.	4.87%	Trades, etc.	1.77%	Mining	3.80%
7th	Agriculture, etc.	4.42%	Education	1.42%	Agriculture, etc.	2.87%
8th	Trades, etc.	3.09%	Information, etc.	1.24%	Public, etc.	2.36%
9th	Public, etc.	2.22%	Leasing, etc.	1.21%	Trades, etc.	2.28%
10th	Education	1.62%	Public, etc.	1.12%	Education	1.82%

Data source: calculated from NBSC (2015)

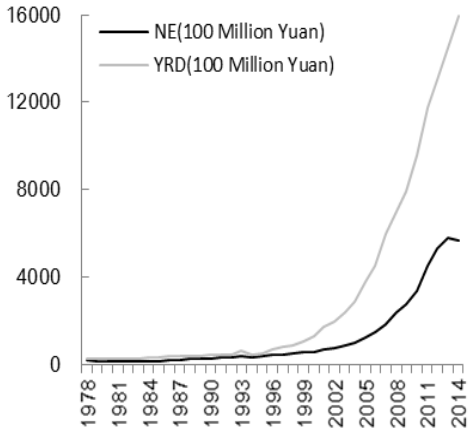
As for the relation between FAI and employment, the NE and YRD have their own features. As to the NE, the FAI in the sectors of mining and agriculture in the NE are higher than the national average, which is in accord with a relative higher percentage of employment in primary industry in the NE analysed before in this chapter in 4.2.2. In contrast, as to YRD, the FAI in the sectors of information transmission, software and information technology (abbreviated as “Information, etc.”) as well as leasing and business services (abbreviated as “Leasing, etc.”) are higher than the national average and the NE in accord with the ascending percentage of employment in tertiary industry in YRD (see Figure 4.6 in 4.2.2).

4.4 Government revenue

The government revenue[42] of the NE and YRD are calculated from the respective provincial government general budget revenue[43] from 1978 to 2014 with NBSC (2015) as the main data source.

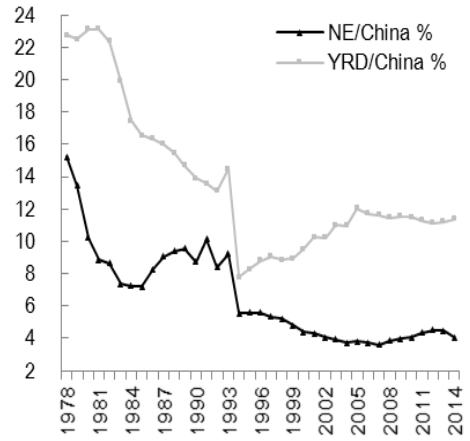
For one thing, the absolute government revenue increases in the NE and YRD since 1978, whilst YRD has grown much faster than the NE (Figure 4.11). The government revenue of the NE is only equivalent to 31.54% of YRD in 2005, 34.48% in 2009 and 35.73% in 2014, which demonstrates stronger capability of the region of YRD compared to the NE on managing financial resources since 1978.

For another, the common trend of the decrease in the percentage of regional government revenue of both regions to the national total since 1978 (Figure 4.12) reflects the national policy on decentralization, which also sheds light on nationwide inter-regional economic competition in China. Although the gap between the two regions decreased from 1985 to 1994, a widening gap happened from 1995 to 2005. Since 2010 the gap between two regions keeps relative stable around 7% (Figure 4.12).



Data source: NBSC (2015)

Figure 4.11 Government revenue, NE and YRD, 1978-2014



Data source: NBSC (2015)

Figure 4.12 Percentage of regional government revenue to the national total, NE and YRD, 1978-2014

4.5 Transport

Transport as an important aspect of regional economic dimension reflects regional capability in regional infrastructure and accessibility. The basic information on transport in the NE, YRD and China at the end of 2014 are listed in Table 4.7.

[42] Government revenue as the financial resources for ensuring the government to function, "refers to the revenue of the government finance by means of participating in the distribution of the social products" (NBSC 2014).

[43] According to the explanatory notes of indicators by NBSC (2015), the provincial government revenue in this study refers to the provincial government general budget revenue, which "includes total tax revenue and total non-tax revenue. Total tax revenue includes value-added tax, business tax, corporate income tax, individual income tax, resource tax, city maintenance and construction tax, house property tax, stamp tax, urban land use tax, land appreciation tax, tax on vehicles and boat operation, farm and land occupation tax, deed tax, tobacco leaf tax, other tax revenue. Total non-tax revenue includes special program receipts, charge of administrative and institutional units, penalty receipts and other non-tax receipts."

Table 4.7 Basic information of transport, NE, YRD and China (2014)

	NE	YRD	China	NE/China(%)	YRD/China(%)
Length of transport routes (10000 km)					
Railways in operation	1.56	0.55	11.18	13.95	4.92
Highways	37.39	28.68	446.39	8.38	6.42
Navigable inland waterways	0.70	3.63	12.63	5.52	28.75
Railway network density (km/10000 km^2)	193.83	259.71	116.46		
Highway network density (km/km^2)	0.46	1.36	0.46		
Total passenger traffic (10000 persons)	176017	298669	2209391	7.97	13.52
Railways	29872	38216	235704	12.67	16.21
Highways	145034	253939	1908198	7.60	13.31
Waterways	1111	6513	26293	4.23	24.77
Total passenger-kilometers (100 million passenger-km)	1908.78	2741.84	30097.4	6.34	9.11
Railways	1121.49	1197.77	11604.8	9.66	10.32
Highways	780.11	1534.4	12084.1	6.46	12.70
Waterways	7.17	9.65	74.3	9.65	12.99
Total freight traffic (10000 tons)	330662	480383	4386800	7.54	10.95
Railways	37005	11268	381334	9.70	2.95
Highways	278177	274367	3332838	8.35	8.23
Waterways	15479	194748	598283	2.59	32.55
Total freight ton-kilometers (100 million ton-km)	15750.61	38590.92	185837	8.48	20.77
Railways	2487.63	587.83	27530	9.04	2.14
Highways	5274.14	3698.77	61017	8.64	6.06
Waterways	7988.85	34304.32	92775	8.61	36.98
Main coastal ports above designated size*					
Volume of handled freight (10000 tons)	75410	173938	769557	9.80	22.60
Length of quay line (m)	60773	224010	778579	7.81	28.77
Number of berths	327	1969	5923	5.52	33.24
Number of berths above 10000-ton class	152	373	1633	9.31	22.84
Main ports of inland rivers above designated size**					
Length of quay line (m)	0	210624	938553	0	22.44
Number of berths	0	2855	14593	0	19.56
Number of berths above 10000-ton class	0	270	406	0	66.50

* coastal ports above designated size: annual handled freight volume ≥ 10 million tons

** ports of inland rivers above designated size: annual handled freight volume ≥ 2 million tons

Data source: NBSC (2015)

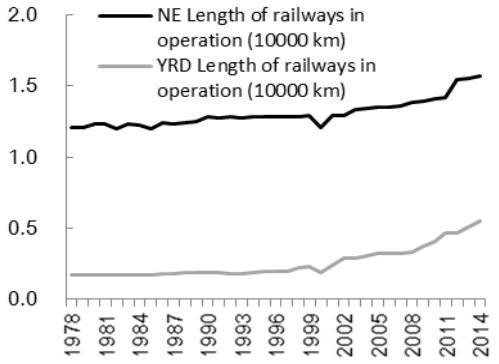
In light of the fact that YRD has more competitiveness on ports (both coastal ports and ports for inland rivers) compared to the NE (Table 4.7), the path-assets analysis in this section will mainly focus on the regional inland transport in the NE and YRD from 1978 to 2014. On the consideration of the significant role of railways and highways in regional inland transport in the NE and YRD (Table 4.7), this section will mainly analyse the length of railways and highways (4.5.1), railway and highway network density (4.5.2) and passenger and freight traffic (4.5.3). The main data source is NBSC (2015), and the data for the NE and YRD are calculated from the provincial statistical data.

4.5.1 Length of railways and highways

This part analyses the length of railways and highways in the NE and YRD from 1978 to 2014 with investigation into the changes of the length and its percentage to the national

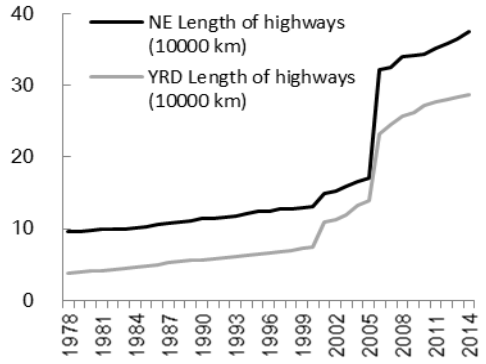
total. The length of railways in operation and the length of highways are the two main indicators for the analysis in this part, with NBSC (2015) as the data source.

On the one hand, the length of railways in operation and the length of highways has increased in the NE and YRD from 1978 to 2014 (Figure 4.13 and Figure 4.14). Particularly, in Figure 4.14, there is a sudden increase in the length of highways in 2005 in both regions due to a change of the national statistical criteria: the length of highways has included the village road since 2005 (NBSC 2015). Under this new statistical criteria, the length of highways in China was 3.35 million km in 2005, compared to only 1.87 million km in 2004. Nevertheless, this change doesn't bring much influence to the general situation of the transport in the NE and YRD. In fact, the area of the NE (0.81 million km^2) is almost four times as YRD (0.21 million km^2), which is helpful to understand why the NE takes lead on the lenth of railways and highways than YRD.



Data source: NBSC (2015)

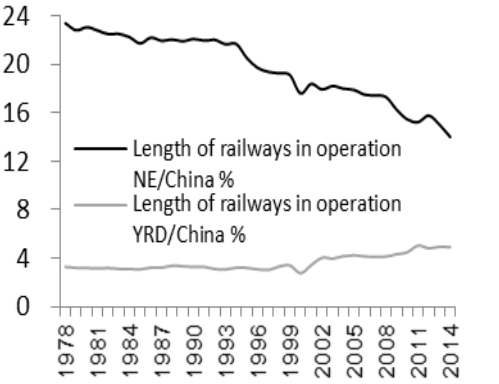
Figure 4.13 Length of railways in operation, NE and YRD, 1978-2014



Data source: NBSC (2015)

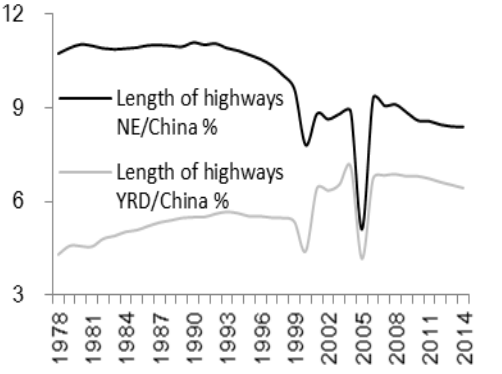
Figure 4.14 Length of highways, NE and YRD, 1978-2014

On the other hand, as for the percentage of regional railways and highways to the national total, the NE expresses an obvious decline in the percentage of the length of both railways and highways (Figure 4.15 and Figure 4.16). There is a gap in Figure 4.16 due to the change of national statistical criteria since 2005 mentioned above. Nevertheless, YRD presents a slightly ascent on the percentage of the length of both railways and highways, while the percentage of the NE has been almost continuously decreasing since 1978 (Figure 4.15 and Figure 4.16).



Data source: NBSC (2015)

Figure 4.15 Percentage of the length of railways to the national total, NE and YRD, 1978-2014

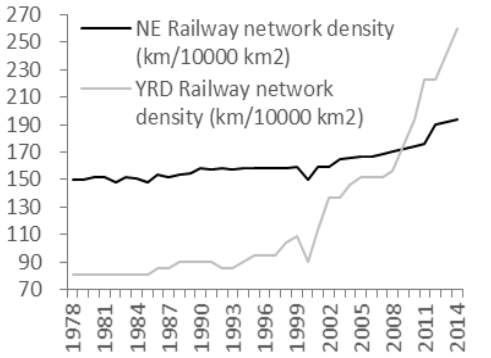


Data source: NBSC (2015)

Figure 4.16 Percentage of the length of highways to the national total, NE and YRD, 1978-2014

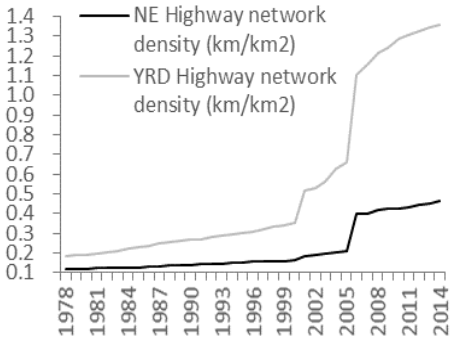
4.5.2 Regional inland transport network density

This part analyses the regional railway network density and the regional highway network density. Although the NE and YRD have increased in both the railway and highway network density from 1978 to 2014, the regional transport infrastructure construction of YRD has been at a fast pace since the 1990s: the railway network density of YRD has exceeded the NE since 2009 (Figure 4.17) and the disparity on highway network density has expanded between the NE and YRD since 2006 (Figure 4.18).



Data source: NBSC (2015)

Figure 4.17 Railway network density, NE and YRD, 1978-2014



Data source: NBSC (2015)

Figure 4.18 Highway network density, NE and YRD, 1978-2014

Particularly, YRD demonstrates its high capacity on the development of regional rail and highway transport in China. In 2014, the railway network density of the YRD is 259.71 km/10^4km^2, compared to the NE with 193.83 km/10^4km^2 and national average of 116.46 km/10^4km^2. Moreover, the highway network density of the YRD is 1.36 km/km^2, almost three times as the density of the NE and China (0.46 km/km^2) (Table 4.7). The higher density ratios of YRD are in accordance with its process on industrialization and urbanization since 1978, especially since the 1990s along with the establishment of Pudong New District in Shanghai with preferable national policy for promoting investment and economy in YRD. Shanghai as the leading network nodes has contributed to the regional transport infrastructure in YRD, and several network nodes have developed in the metropolitan areas in YRD such as Shanghai, Nanjing, Hangzhou, Suzhou and Wuxi in order to meet the high demand for rail and road transport originating from these metropolitan areas. Consequently, regional transport system of YRD is one of the most developed regional transport systems in China that benefits to the regional economic and social development in the region of YRD.

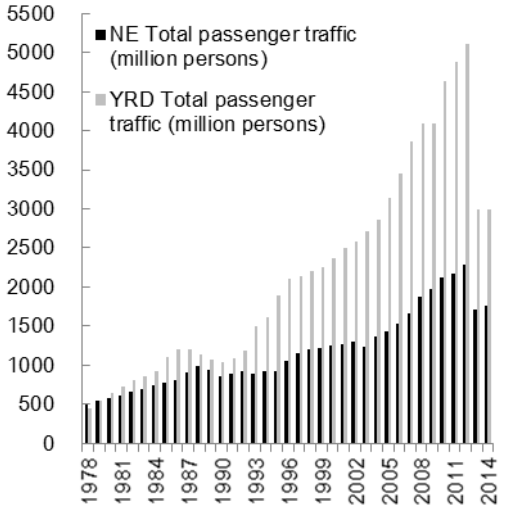
4.5.3 Passenger and freight traffic

This part mainly analyses two indicators for passenger and freight traffic[44] in the NE and

[44] According to the explanation on statistical indicator by NBSC (2015), "Freight (Passenger) Traffic refers to the weight of freight (number of passenger) transported with various means within a specific period of time. This indicator reflects the service of the transport industry towards the national economy and people's living conditions. The statistical criteria has been changed several times from 1978 to 2014: "(1) Since 2008, statistical coverage of passenger traffic and freight traffic and passenger-kilometers and freight tons-kilometers of national railways and joint-venture railways have been adjusted, which national railways include those of state-holding joint-venture railways, and joint-venture railways only refer to non-state-holding joint-venture railways. In 2010 and 2011, statistical coverage of passenger traffic of joint-venture railways is different from before. (2) Since 1979, freight traffic by highways has included the quantities transported by trucks of non-highway departments. Since 1984, it has

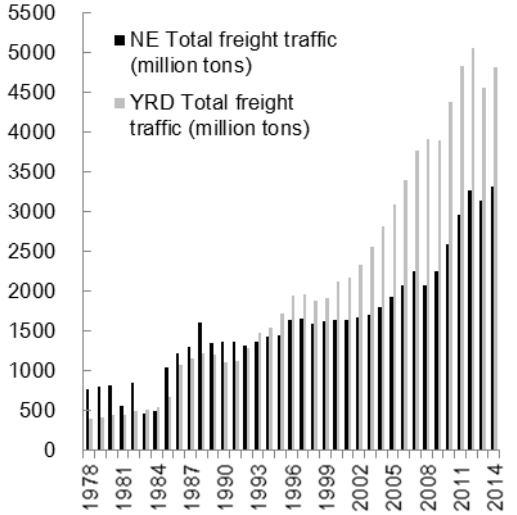
YRD: the total passenger traffic and the total freight traffic, with reference to the national total passenger and freight traffic.

For one thing, the total passenger and freight traffic keeps on increasing from 1978 to 2014 in the NE and YRD, and YRD increases much faster than the NE (Figure 4.19 and Figure 4.20). As for the total passenger traffic in both regions from 1978 to 2014, the NE only achieved more passenger transport than YRD in 1978 (516.03 million persons for the NE and 451.67 million persons for YRD). From 1979 to 2014, YRD takes the lead from the NE on total passenger traffic (Figure 4.19). Concerning total freight traffic in both areas from 1978 to 2014, the NE had more total freight traffic than YRD from 1978 to 1992. However, YRD has achieved much more total freight traffic than the NE from 1993 to 2014, which reflects more demand as well as more efficiency in the regional transport system of YRD than the NE (Figure 4.20).



Data source: NBSC (2015)

Figure 4.19 Total passenger traffic, NE and YRD, 1978-2014



Data source: NBSC (2015)

Figure 4.20 Total freight traffic, NE and YRD, 1978-2014

For another, as for the role of regional transport in the national transport system of China, the NE has been almost continuously decreasing compared to YRD (Figure 4.21 and Figure 4.22). The percentage of total passenger and freight traffic of the NE to the national total exposes an obvious decline since 1978, while YRD represents "up-down-up-down" characteristics (Figure 4.21 and Figure 4.22). From 1990 to 2007, the total passenger and freight traffic of YRD grows fast due to rapid pace of development in this area, in particular after the national decision on establishing the Pudong New District in Shanghai with favorable policy. Influenced by international financial crisis and economic crisis in 2008 as well as national macro-control policies to prevent the overheating investment, the percentage of the total passenger and freight traffic of YRD to the national total demonstrates a decrease tendency since 2008 (Figure 4.21 and Figure 4.22).

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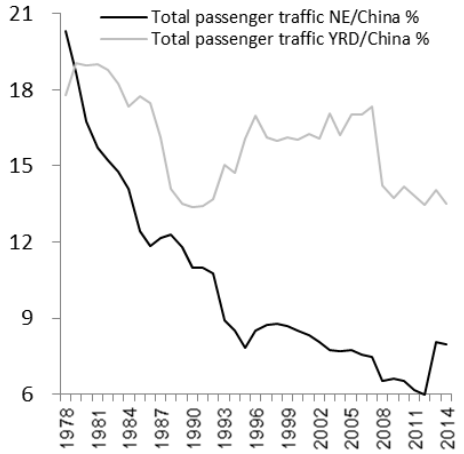
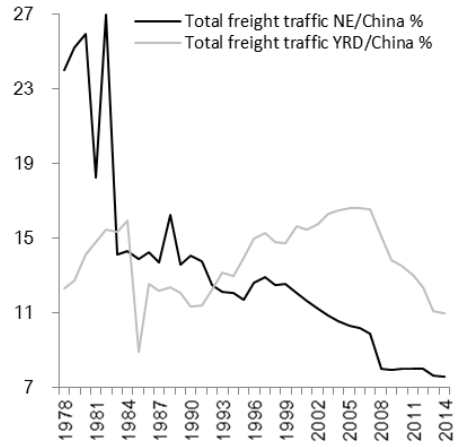
also included the quantities transported by private trucks. Since 2008, freight traffic by highways referred to the vehicles under operation. Statistical coverage of freight traffic by waterways is vessels engaged in passengers and goods transport for business purpose, and approved, registered by the department of transportation. The indicator of railways freight has increased the freight of package since 1993. (3) In 2008, data on total passenger traffic and freight traffic of highway and waterways have changed." (NBSC 2015)



Data source: NBSC (2015)

Figure 4.21 Percentage of total passenger traffic to the national total, NE and YRD, 1978-2014



Data source: NBSC (2015)

Figure 4.22 Percentage of total freight traffic to the national total, NE and YRD, 1978-2014

4.6 Foreign trade

This study mainly analyses two aspects for foreign trade: one is imports and exports (4.6.1), and the other is foreign direct investment (FDI) (4.6.2).

4.6.1 Imports and exports

The total value of imports and exports at customs is an important indicator to observe the total size of foreign trade in a country or a region, and this study will mainly analyse the total value of imports and exports of the NE and YRD as well as the percentage to the national total from 1978 to 2015.

The total value of imports and exports of the NE and YRD are calculated from provincial data on total value of imports and exports by location of exporters and importers[45] from 1978 to 2015 with the following three main data sources: the data source for the period from 1978 to 1992 are provincial statistical yearbooks at various years, the data source for the period from 1993 to 2014 is NBSC (2015) and the data source for 2015 is MOC (2016) with the statistical data on imports and exports published by the Ministry of Commerce (MOC) of China.

The changes on imports and exports of the NE and YRD from 1978 to 2015 have the following two main characteristics.

On the one hand, YRD maintains the lead on total value of imports and exports since 1978, and the disparity between the NE and YRD has exaggerated since the 1990s (Figure 4.23). The establishment of Pudong New District in Shanghai in YRD contributes to this disparity. Benefited from the favorable national policy for imports and exports in Pudong New District by the Chinese central government, YRD has achieved significant performance on foreign trade. From 1992 to 2007, the total value of imports and exports of YRD maintained an annual growth rate of 27.28%, which almost doubles

[45] "Import or export value by location of China's foreign trade managing units refers to actual value of imports and exports carried out by corporations which have been registered by the local Customs house and are vested with right to run import export business."(NBSC 2014)

the annual growth rate of the NE (13.84%) in the same period. However, influenced by the international financial as well as economic crisis in 2008, the annual growth rate of total value of imports and exports in YRD decreased to 14.37% in 2008 and -13.01% in 2009. Particularly, under the national macro-economic background of the new normal of slow growth in 2015, the total value of imports and exports of the NE, YRD and China all experienced decrease in 2015 with respectively -24.18%, -3.11% and -8.04% compared to 2014 (MOC 2016). Nevertheless, YRD still achieved 13421.90 billion US Dollar on total value of imports and exports in 2014, which is equivalent to more than one third (33.92%) of the national total (Figure 4.24).

On the other hand, the percentage of the total value of imports and exports to the national total of YRD also keeps ahead of the NE, with down-up-down characteristics (Figure 4.24). In Figure 4.24, YRD descends firstly from 1978 to 1985, then ascends continuously from 1985 to 2007, with adjustment in 2008 and 2009, and descends once again since 2010, though rebounds a little bit in 2014 and 2015. On the contrary, the ratio of the NE ascends from 1978 to 1984 and then almost descends continuously since 1985 (Figure 4.24). And what's more, the gap between the two regions keeps widening since 1985. In 2009, YRD with a total amount of 804.18 billion US Dollar accounts for 36.43% of the national total value of imports and exports, almost 9 times of the NE (90.91 billion US Dollar, 4.12% of the national total). In 2015, the total value of imports and exports of the NE is only equivalent to about one tenth (10.12%) of YRD. It is obvious that YRD has been playing an important role in China's foreign trade on imports and exports, and especially since 2003, YRD has been making great contribution to the national total value of imports and exports with an annual contribution of more than 30% (35.13% in average from 2003 to 2015). In contrast, from 2003 to 2015, the annual contribution of the NE to the national total is only 4.12% in average, which reflects the insufficiency of the NE in foreign trade.

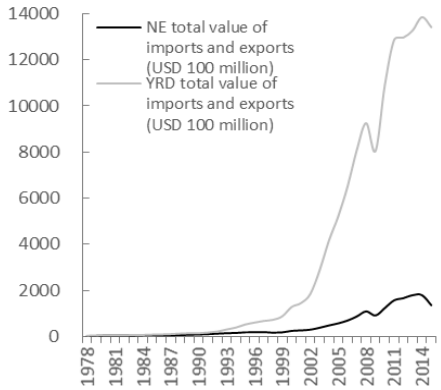


Figure 4.23 Total value of imports and exports, NE and YRD, 1978-2015

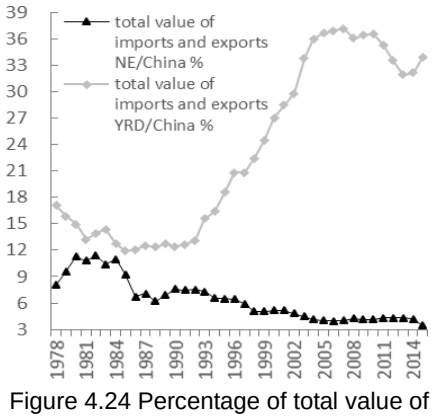


Figure 4.24 Percentage of total value of imports and exports to the national total, NE and YRD, 1978-2015

4.6.2 Foreign direct investment

According to NBSC (2014), foreign direct investment (FDI) refers to "foreign investment in China through the establishment of foreign invested enterprises, cooperative exploration and development of petroleum resources with domestic investors and the establishment of branch organization of foreign enterprises". Particularly, along with the

implementation of the opening and reform policy in China as well as the process of economic globalization since 1990s, FDI becomes an important indicator on actual utilization of foreign capitals.

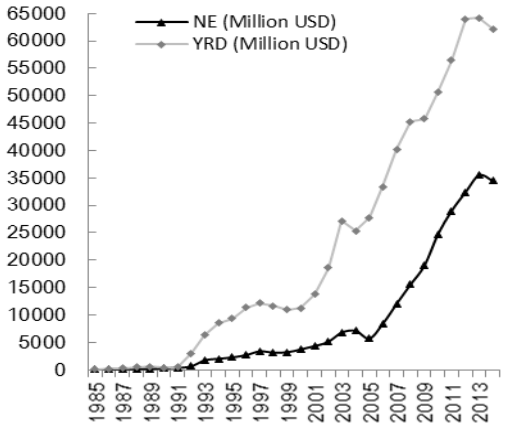
In this study, the FDI data of the NE and YRD are the annual actual-used FDI, which are calculated by the provincial statistical data. This study mainly analyzes the FDI of the NE and YRD from 1985 to 2014 due to the availability of provincial statistical data on annual actual-used FDI[46], and the main data sources are the national and provincial statistical yearbooks at various years.

Both regions almost maintain the growth on annual actual-used FDI as well as the percentage of regional FDI to the national total since 1985 (Table 4.8, Figure 4.25 and Figure 4.26).

Table 4.8 FDI of the NE and YRD and their percentage to the national total

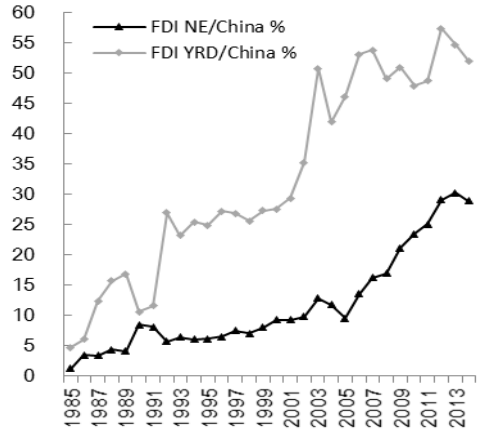
Year	FDI (billion US Dollar)		Percentage of FDI to the national total	
	NE	YRD	NE	YRD
1985	0.02	0.09	1.17%	4.64%
1995	2.26	9.29	6.03%	24.75%
2005	5.70	27.76	9.45%	46.01%
2009	18.95	45.76	21.04%	50.87%
2014	34.47	62.13	28.83%	51.97%

Data source: national and provincial statistical yearbooks



Data source: national and provincial statistical yearbooks

Figure 4.25 FDI of the NE and YRD, 1985-2014



Data source: national and provincial statistical yearbooks

Figure 4.26 Percentage of FDI to the national total, NE and YRD, 1985-2014

Compared to the NE, YRD takes the lead and plays a more important role on FDI to the national economy of China, which implies that the regional economy in YRD relates more to foreign economies as well as global markets. In fact, FDI could contribute to regional economic development and it is particularly obvious in the region of YRD. In YRD, there is a positive spill-over effect generated by foreign firms on the productivity of domestic firms in similar counties and industries through the interactions among

[46] There were no provincial statistical data on annual actual-used FDI before 1985 but only with the data of "1978-1984" as a total. The main reason might be that China began to implement the opening and reform policy in 1978 and FDI was not so popular at the beginning of the implementation of this policy but only with quite limited FDI before 1985. Afterwards, especially after the deepening reform towards a market-oriented economy since the 1990s, FDI became popular in China and has developed fast since the 1990s.

domestic and foreign firms (Tanaka and Hashiguchi 2015). Nevertheless, along with the FDI concentration in YRD since the 1990s, local firms also have to face the challenges of the ever-increasing cost of labour and land as well as higher expectations on the quality of products from the customers, which also promote the transition of YRD from a global manufacturing centre to a global innovation centre (Liu and Li 2015).

4.7 Conclusion

This part comes to the conclusion of the regional economic performance of the NE and YRD by reviewing the path-assets analysis on the economic dimension conducted in this chapter with major consideration on national macro-economic environment, regional economic structure, employment, investment, transport and foreign trade.

Since 2014, the national macro-economic environment for regional development in China has been the 'new normal' of slow growth. Consequently, regional economy in the NE and YRD has faced some kind of slowdown since 2014. Nevertheless, YRD still leads on regional economic development in China. With an area of 2% and a population of 12% to the national total, YRD contributes to 20% of the GDP, 11% of the government revenue, 14% of the FAI, 32% of imports and exports as well as 52% of the FDI of China in 2014. In contrast, the NE with an area of 8% and a population of 8% contributes to 9% of the GDP, 4% of the government revenue, 9% of the FAI, 4% of the imports and exports and 29% of the FDI of China in 2014.

The tertiary industry has been developing in the NE and YRD from 1978 to 2014 with ever-increasing employment and has become the mainstay industry of YRD since 2013. Furthermore, in 2014, the tertiary industry accounts for more than half of the regional economy in YRD (50.4%) for the first time. In the NE, second industry is still ahead of the tertiary industry on the contribution to GRP. In addition, the NE has more employment in the primary industry compared to YRD, which suggests the NE is still important for national agricultural production and national food security.

YRD has demonstrated a faster development on regional infrastructure construction since the 1990s with significant increase in both railway and highway network density: the railway network density of YRD has exceeded the NE since 2009, and the disparity between the two regions on highway network density has expanded since 2006. The higher density ratios of YRD is in accordance with its industrialization and urbanization. Moreover, YRD has played an important role in the national transport network in China, which composed 13.5% of the national total passenger traffic and 11% of the national total freight traffic with only 5% of the length of railway in operation and 6.5% of the length of highways to the national total in 2014. On the contrary, the importance of the NE in the national transport system has been almost continually decreasing since 1978. With 15% of the length of railway in operation and 8.4% of the length of highways to the national total, the NE only composed 8% of the national total passenger traffic and 7.6% of the national total freight traffic in 2014.

YRD as one of the leading runners in the arena of foreign trade in China since the 1990s has taken lead on imports and exports as well as on FDI, which is in a certain degree owing to the fact that Shanghai as a global mega-city as well as the largest city

in YRD has excellent international harbor and airport with convenient connection to many global destinations. In addition, Yangtze River provides river transport from Shanghai to Nanjing besides rail and highway network with several large inland river harbors such as Zhangjiagang, Jiangyin and Nanjing, which contributes to form a diversified regional transport system in YRD. And what's more, YRD has also benefited a lot from favorable national policies for foreign trade and investment, especially for the Pudong New District since the 1990s and the China (Shanghai) Pilot Free-Trade Zone[47] established on 29 September 2013.

Compared to YRD, regional economic growth in the NE relies heavily on FAI. Particularly, in recent years, the FAI in the NE has increased much faster than YRD and the national average. As a result, in 2014, FAI contributes to 80.21% of the GRP of the NE, which reflects somehow unsustainable regional economic growth of the NE by relying excessively on the FAI. As for FAI by sector, manufacturing is the leading sector ahead of real estate on FAI in the NE and YRD, and the two sectors of manufacturing and real estate contribute to more than half of the FAI in both regions. However, relying too much on manufacturing and real estate implies not only an unsustainable structure of FAI but also an unsustainable growth pattern in both regions.

In a word, the quantitative path-assets analysis on the economic dimension of the NE and YRD based on official statistical data in this chapter concludes that YRD takes lead on regional economic development of the NE with more economic vitality, though the sustainability of both regions on economic development still needs to be further improved. Chapter 5 will go on with the path-assets analysis of both regions with focus on the social-cultural dimension.

[47] Homepage: http://en.shftz.gov.cn/, accessed on 15 December 2015.

5 Path-assets analysis II: Social-cultural Dimension

Social development becomes more and more important for China's harmonious regional development under the Scientific Development Concept of putting people first and aiming at comprehensive, coordinated and sustainable development (Xinhua 2007; Hu 2007a). Particularly, many problems arise along with the process of regional industrialization and urbanization such as widening urban-rural gaps, insufficiency of public health infrastructure and service, intensified income disparities within a region as well as between different regions and social instability caused by rapid growth of the immigrant population with increasing social friction.

Culture is at the core of China's rich heritage over five thousand years and has played an important role in enhancing the attractiveness of places and strengthening regional identity. In this sense, culture contributes to increase tourism revenue, which in turn may increase local residents' income and improve local standard of living. Furthermore, culture as well as creativity could become an important enabler of innovation as well as source for entrepreneurship, which is well-reflected in the NE and YRD with the regional economy more influenced by the SOEs in the NE while by private enterprises and foreign investment in YRD analyzed in Chapter 4.

This chapter mainly conducts a quantitative path-assets analysis of the NE and YRD on the social-cultural dimension from 1978 to 2014 based on official statistical data with NBSC (2015) as the main data source, and other data sources are provincial statistical yearbooks at various years as well as department statistical data of ministries. Data for the NE and YRD are calculated from the provincial data.

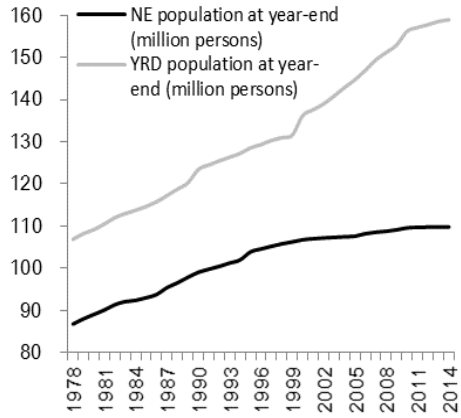
Due to the availability of statistical data, this chapter mainly analyses indicators in the following six aspects of the social-cultural dimension: population (5.1), people's living conditions (5.2), public health service (5.3), education (5.4), science and techonology, especially the expenditures on research and development (R&D) (5.5) and governmental financial funds on social-cultural expenditures (5.6), and reaches the conclusion (5.7) at the end of this chapter.

5.1 Population

This part mainly analyses the following indicators on population in the NE and YRD from 1978 to 2014: population at year-end (5.1.1), natural growth rate and total fertility rate (TFR) (5.1.2), population density (5.1.3), population change beside natural growth (5.1.4), average life expectancy (5.1.5) and urbanization rate (5.1.6). In addition, this study also provides a brief introduction on the ethnic groups and religions in the NE and YRD (5.1.7) besides the quantitative analysis mentioned above.

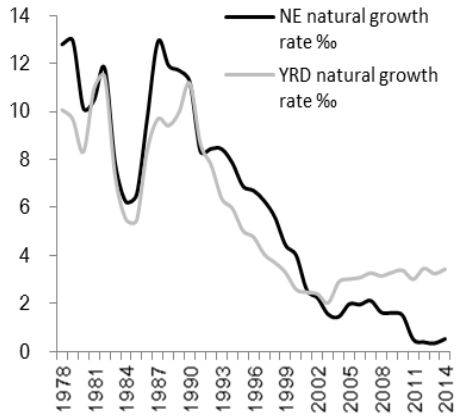
5.1.1 Population at year-end

Population at year-end has increased in both regions from 1978 to 2014, and population in YRD has increased much faster than the NE since the 1990s (Figure 5.1). As a result, the gap between the two regions on total population keeps on widening (Figure 5.1).



Data source: NBSC (2015)

Figure 5.1 Population at year-end, NE and YRD, 1978-2014



Data source: NBSC (2015)

Figure 5.2 Natural growth rate of population, NE and YRD, 1978-2014

5.1.2 Natural growth rate and total fertility rate

As for the natural growth rate in the NE and YRD, in 2014, there is a decrease of 12.28‰ in the NE and 6.63‰ in YRD compared to 1978 (Figure 5.2). Moreover, the natural growth rate of the NE seems to represent a tendency of decrease since 1989, while the annual natural growth rate of YRD seems to be on the increase since 2003 after a decrease from 1990 to 2003 (Figure 5.2). Although YRD almost remained lower than the NE on annual natural growth rate from 1978 to 2001, the natural growth rate of YRD has been higher than the NE since 2002 (Figure 5.2).

The decrease in natural growth rate of population in the past decades is mainly due to China's family planning policy, especially the one-child policy[48] since 1979, which has played an important role in slowing of China's population growth. Nevertheless, as a result of China's one-child policy and low mortality, the proportion of elderly population has been increasing rapidly since 2010[49], along with a lower total fertility rate (TFR)[50].

As for the TFR, according to Table 6-4 of the Tabulation on the 2010 National Population Census of the PRC (NBSC 2010a), the provincial TFR was respectively 0.74, 1.05 and 1.02 for Shanghai Municipality, Jiangsu Province and Zhejiang Province in

[48] "The one child policy, a part of the family planning policy, was a population control policy of China which was introduced between 1978 and 1980 and began to be formally phased out in 2015." "On 29 October 2015, Xinhua, China's state news agency, reported a change in the existent law to a two-child policy, citing a statement from the Communist Party of China, and the new law is effective from 1 January 2016 after it was passed in the standing committee of the National People's Congress on 27 December 2015." (Source: Wikipedia, One-child policy. https://en.wikipedia.org/wiki/One-child_policy, accessed on 28 February 2016)

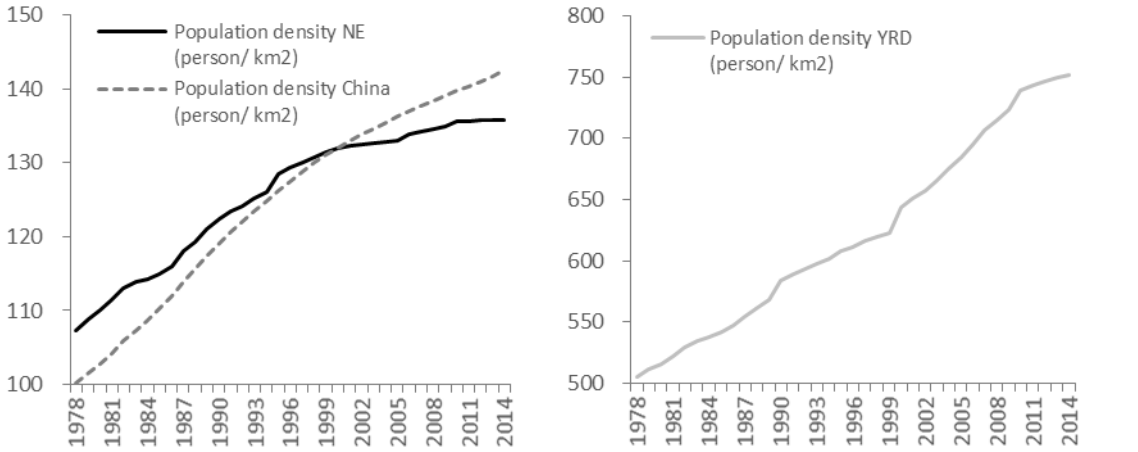
[49] China's Rapidly Aging Population. In: Today's Research on Aging: Program and Policy Implications, Issue 20, July 2010. http://www.prb.org/pdf10/todaysresearchaging20.pdf, accessed on 16 January 2016.

[50] Total fertility rate (TFR) "gives a figure for the average number of children that would be born per woman if all women lived to the end of their childbearing years and bore children according to a given fertility rate at each age". The TFR "is a more direct measure of the level of fertility than the crude birth rate, since it refers to births per woman. This indicator shows the potential for population change in the country. A rate of two children per woman is considered the replacement rate for a population, resulting in relative stability in terms of total numbers." "Rates below two children indicate populations decreasing in size and growing older." (Source: Total fertility rate definition from Central Intelligence Agency The World Factbook. https://www.cia.gov/library/publications/the-world-factbook/docs/notesanddefs.html?countryName=France&countryCode=fr&regionCode=eu#2127, accessed on 28 February 2016)

YRD in 2010, lower than the national average of 1.18. In fact, the TFR in the NE was even lower than YRD, and the three provinces of Liaoning, Jilin and Heilongjiang in the NE recorded the lowest provincial TFR among all the Chinese provinces with respectively 0.74, 0.76 and 0.75 in 2010. Particularly, the lowest TFR recorded anywhere in the world in recorded history is for Xiangyang District of Jiamusi City, Heilongjiang Province in the NE with a TFR of 0.41[51]. The lower TFR in the NE is in accord with its lower natural growth rate of population since 1989 (Figure 5.2), and the lower natural growth rate and lower TFR of population might become a challenge for regional sustainable development in the NE.

5.1.3 Population density

The population density has increased in the NE, YRD and China from 1978 to 2014. Nevertheless, compared to the national average, the population density in the NE became lower than the national average since 2001 with expanded disparities, while the population density in YRD has been more than five times of the national average since 1978 (Figure 5.3).



Data source: NBSC (2015)

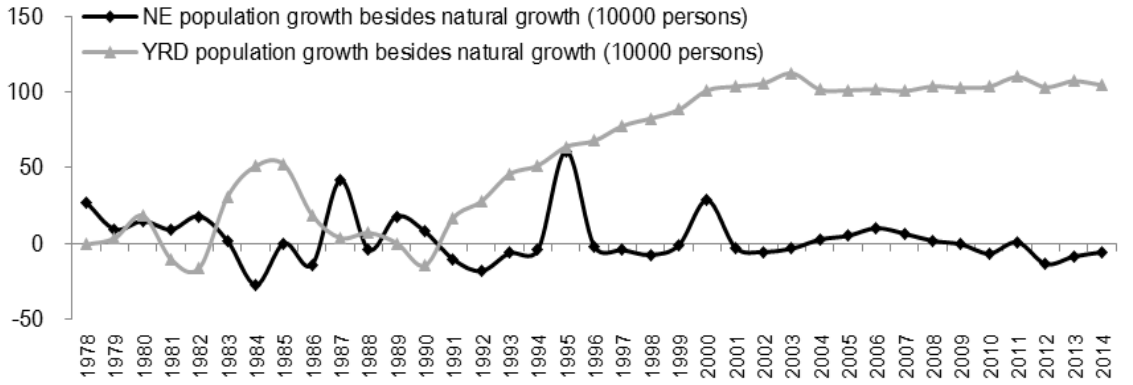
Figure 5.3 Population density, NE, YRD and China, 1978-2014

The changes on population density of the NE and YRD implies that people might have moved from other regions of China to YRD, whilst people who lived in the NE might have moved to other regions from 1978 to 2014, especially since the 1990s.

5.1.4 Population change besides natural growth

Population change besides natural growth reflects the annual population change related to the immigrant population. YRD demonstrates a positive tendency on annual population change besides natural growth from 1991 to 2014, which indicates that people keep on migrate from other regions to YRD since 1991 (Figure 5.4). However, as to the NE, there are 19 years of the 36 years from 1978 to 2014 with a negative growth in the NE, which suggests that people probably migrated from the NE to other regions of China in these years, which indicates weak attractiveness of the NE on the immigrant population compared to the region of YRD (Figure 5.4).

[51] Source: Wikipedia, Total fertility rate. https://en.wikipedia.org/wiki/Total_fertility_rate, accessed on 28 February 2016.



Data source: NBSC (2015)

Figure 5.4 Annual population change besides natural growth, NE and YRD, 1978-2014

5.1.5 Average life expectancy

According to NBSC (2015), the average life expectancy was calculated based on the data of national population census at the end of 1990, 2000 and 2010. Consequently, the data for average life expectancy are only available in 1990, 2000 and 2010.

The average life expectancy had increased in the NE, YRD and China from 1990 to 2010. For one thing, at the end of 1990, 2000 and 2010, the average life expectancy in the NE and YRD was longer than the national average, and the life expectancy in YRD was longer than the NE (Table 5.1). Additionally, the disparity of the average life expectancy between the NE and YRD had a decrease of 2.27 years from 1990 to 2010 (Table 5.1). For another, in the NE, YRD and China, the average life expectancy of female was longer than male. At the end of 2010, the average life expectancy of male and female in the NE and YRD was longer than the national average, and the life expectancy of male and female in YRD was longer than the NE (Table 5.2).

Table 5.1 Average life expectancy of population, NE, YRD and China

	NE	YRD	China	NE - China	YRD - China	YRD - NE
1990	68.38	72.68	68.55	-0.17	4.13	4.30
2000	72.94	75.58	71.4	1.54	4.18	2.65
2010	76.18	78.21	74.83	1.35	3.38	2.03

Data source: NBSC (2015)

Table 5.2 Average life expectancy of population, male and female, NE, YRD and China (2010)

	NE	YRD	China	NE-China	YRD-China	YRD-NE
Average life expectancy	76.18	78.21	74.83	1.35	3.38	2.03
Male	73.92	76.13	72.38	1.54	3.75	2.21
Female	78.70	80.49	77.37	1.33	3.12	1.78

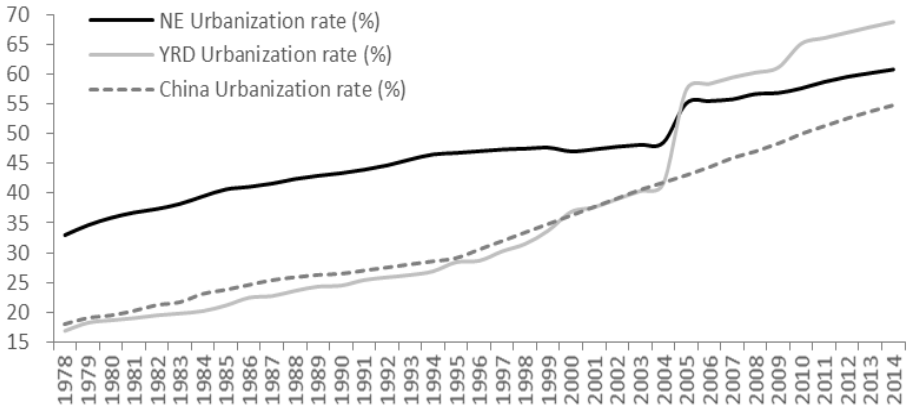
Data source: NBSC (2015)

5.1.6 Urbanization rate

Urbanization rate is the proportion of urban population in the total (urban and rural) population. This study analyses the urbanization rate of the NE and YRD with comparison to the national average to reflect the urban-rural structure of population from 1978 to 2014. The data for the NE and YRD are calculated from provincial statistical data with two main data sources: the provincial statistical yearbooks provide data from 1978 to 2004 and NBSC (2015) provides provincial data from 2005 to 2014.

The data source for China is NBSC (2015).

The urbanization rate of YRD remains higher than the NE and the national average since 2005, and the urbanization rate of the NE remains higher than the national average since 1978 (Figure 5.5).



Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.5 Urbanization rate, NE, YRD and China, 1978-2014

Particularly, the provincial data for urban and rural population before 2005 are divided by non-agriculture and agriculture population according to the record of household registration in the Hukou system as criteria for urban and rural population. In fact, since the opening and reform policy implemented in 1978, people with Hukou as agriculture population might actually work and live in cities, especially in the eastern coastal areas as YRD, but under the old statistical criteria they were still calculated as rural population, which might lead to a lower urbanization rate by calculation. Therefore, NBSC (2015) only published provincial statistical data for urban and rural population from 2005 to 2014 with the new statistical criteria. In this sense, the real urbanization rate of YRD from 1978 to 2004 should be higher than illustrated in Figure 5.5.

5.1.7 Ethnic groups and religions

This part briefly introduces the ethnic groups and religions in the NE and YRD, with Wikipedia as the main data source. The overwhelming majority of the population in the NE and YRD is Han Chinese. Besides, there are 55 ethnic minorities in YRD and 52 ethnic minorities in the NE[52].

As to the NE, after the establishment of the PRC in 1949, between the 1950s and the 1970s immigrations were organized by the Chinese central government to “develop the Great Northern Wilderness” in the NE. Consequently, most people in the NE trace their ancestries back to migrants, Northeastern Chinese were more culturally uniform compared to other regions of China. Ethnic Manchus form the second significant ethnic group in the NE, followed by the Mongols, Koreans, the Huis and 49 other ethnic minorities including Daurs, Sibos, Hezhens, Oroqens, Evenks and Kyrgyzs[53].

[52] Source: Wikipedia, Categories of National Population Census of the PRC: List of ethnic groups in 31 Provinces. https://zh.wikipedia.org/wiki/Category:%E4%B8%AD%E5%9B%BD%E4%BA%BA%E5%8F%A3%E6%99%AE%E6%9F%A5, accessed on 28 February 2016. (in Chinese)

[53] Source: Wikipedia, Northeast China. https://en.wikipedia.org/wiki/Northeast_China, accessed on 28 February 2016.

According to the 2007 Chinese Spiritual Life Survey[54], the predominant religion in the NE and YRD is Chinese folk religion[55], with 7.73% of the population in the NE as well as 16.67% and 23.02% of the population in Jiangsu and Zhejiang Province in YRD[56]. In addition to Chinese folk religion, other religions in the NE include Christianity (with 2.15% of the population in the NE according to the Chinese General Social Survey of 2009), Daoism, Confucianism, Buddhism, Islam, Shinto and Eastern Orthodox[57]; overall at least 5.50% of the population in YRD have other religions including Buddhism, Daoism, Catholicism, Christianity and Islam.

5.2 People's living conditions

This study analyses people's living conditions with concern on the following five main aspects: average wage (5.2.1), income per capita (5.2.2), resident consumption per capita (5.2.3), urban and rural consumption disparities and the average cost of living (5.2.4) and savings deposits (5.2.5).

5.2.1 Average wage of staff and workers

This study selects the indicator of average wage of staff and workers for the analysis of average wage in the two regions. Data for the NE and YRD are calculated from the provincial data. The main data sources are NBSC (2015) and provincial statistical yearbooks at various years, with availability of statistical data from 1978 to 2013.

The changes on the average wage of staff and workers in the NE, YRD and China are illustrated in Figure 5.6 with followings four characteristics:

First, the average wage of staff and workers keeps increasing in both regions and in China from 1978 to 2014.

Second, the average wage of staff and workers of the NE is higher than the national average from 1978 to 1983, but it remains lower than the national average since 1984.

Third, the average wage of staff and workers of YRD is lower than the national average from 1978 to 1985, but since 1986 it keeps higher than the national average except 1988.

Fourth, from 1984 to 2013, the average wage in YRD remains ahead of the NE, and the gap between them keeps widening: the average wage of the NE is equivalent to 97.45% of the average wage of YRD in 1985, 69.28% in 1995, 56.90% in 2005, 61.29% in 2009 and 64.26% in 2013. In 2013, the average wage in the NE is 44292 Yuan, which is 8069 Yuan lower than the national average (52388 Yuan) and 24632 Yuan lower than YRD (68924 Yuan). In a word, YRD has more competitiveness on average wage than the NE as well as the national average.

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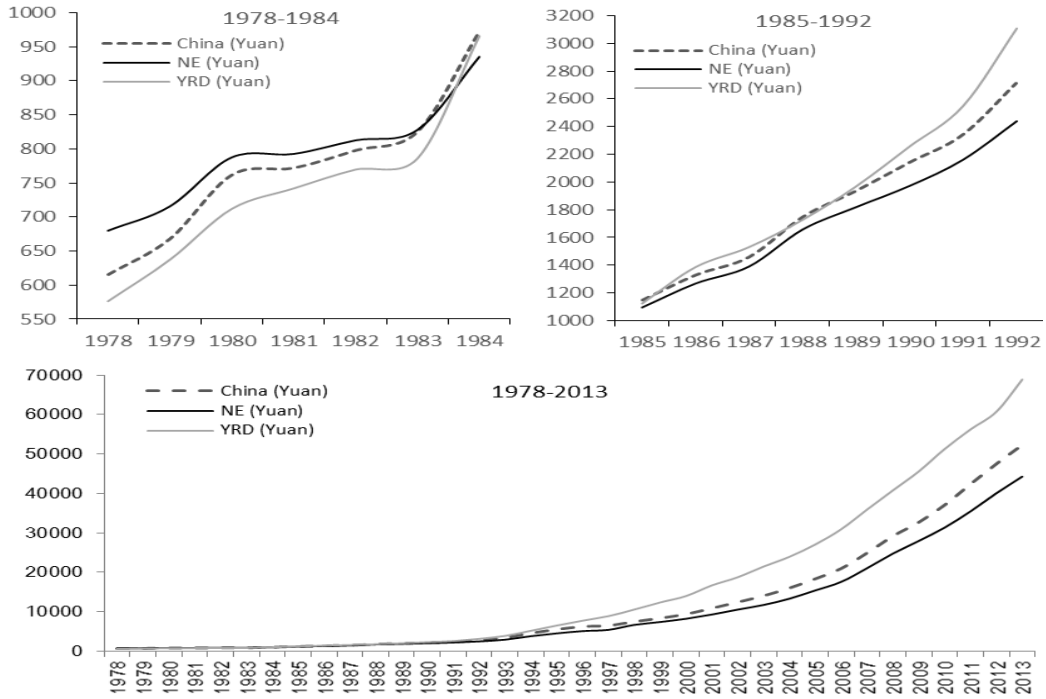
[54] Source: Spiritual Life Study of Chinese Residents. The Association of Religion Data Archives. http://www.thearda.com/Archive/Files/Descriptions/SPRTCHNA.asp, accessed on 28 February 2016.

[55] Source: Wikipedia, Chinese folk religion. https://en.wikipedia.org/wiki/Chinese_folk_religion, accessed on 28 February 2016.

[56] No data for Shanghai Municipality in this survey.

[57] Source: Wikipedia, Religion in Northeast China. https://en.wikipedia.org/wiki/Religion_in_Northeast_China, accessed on 28 February 2016.



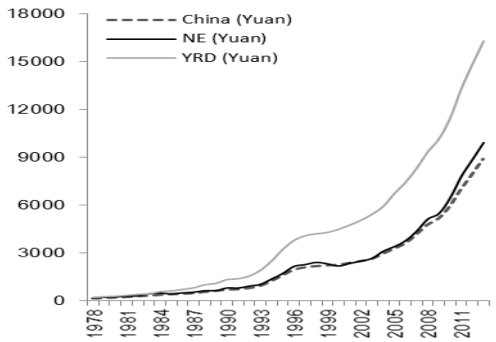
Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.6 Average wage of staff and workers, NE, YRD and China, 1978-2013

5.2.2 Annual income per capita

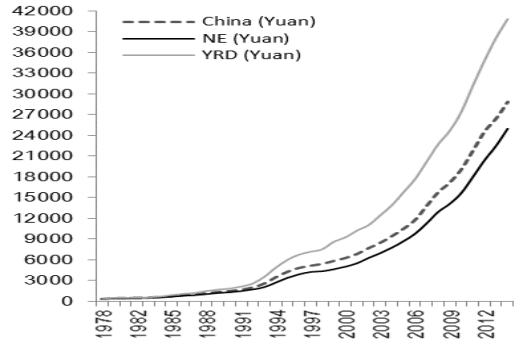
With focus on the analysis of income in the NE and YRD as well as in China, especially annual income per capita, this study selects two widely-used indicators in China: one is annual net income of rural households per capita, and the other is annual disposable income of urban households per capita. The main data sources are NBSC (2015) and provincial statistical yearbooks at various years. Due to the availability of statistical data, the analysis on annual net income of rural households per capita is from 1978 to 2013. Meanwhile, the analysis on annual disposable income of urban households per capita is from 1980 to 2014 and in 1978 due to not all provincial data available for the year of 1979 but only with statistical data for Shanghai Municipality and Heilongjiang Province.

The annual income per capita increase almost continually in the NE, YRD and China since 1978, and YRD keeps ahead of the NE and the national average since 1980 (Figure 5.7 and Figure 5.8).



Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.7 Annual net income of rural households per capita, NE, YRD and China, 1978-2013



Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.8 Annual disposable income of urban households per capita, NE, YRD and China, 1978-2014

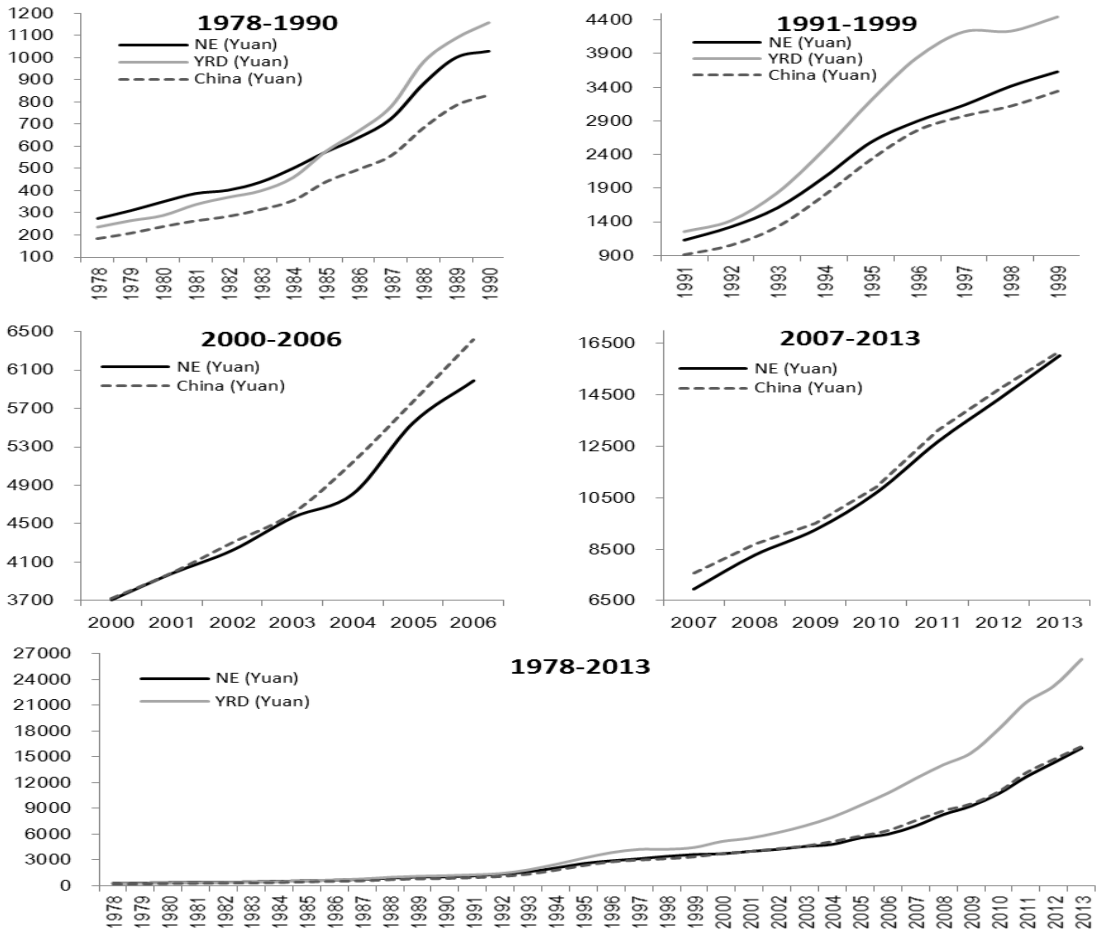
As to the NE, the annual net income of rural households per capita of the NE keeps close to the national average since 1978 (Figure 5.7), while the annual disposable income of urban households per capita in the NE remains lower than the national average since 1980 (Figure 5.8).

Relatively higher annual income in YRD is a positive aspect to attract working force move to this region, work and live there. Nevertheless, the consumption per capita and the average cost of living per capita are also important aspects to consider in addition to the annual income, which will be analysed in the following parts of 5.2.3 and 5.2.4.

5.2.3 Resident consumption per capita

This study analyses resident consumption per capita of the NE, YRD and China from 1978 to 2013. All the statistical data used here are at current prices. The data for the NE and YRD are calculated from provincial data. The data source of the national average as well as the provincial data from 1993 to 2013 is NBSC (2015), and other provincial data from 1978 to 1992 are from provincial statistical yearbooks at various years.

Compared to the national average, the resident consumption per capita of YRD keeps higher than the national average since 1978, while the NE keeps close to but remains lower than the national average since 2000 (Figure 5.9). Since 1985, the resident consumption per capita of YRD remains higher than the NE and the gap between them has been widening (Figure 5.9).



Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.9 Resident consumption per capita, NE, YRD and China, 1978-2013

In a word, compared to YRD, the relative lower resident consumption per capita of the NE is in accord with its relative lower income per capita analyzed above in 5.2.2. In addition to the resident consumption per capita analyzed in this part, the next part (5.2.4) will focus on the structure of resident consumption by analyzing the urban and rural consumption disparities and the average cost of living per capita in the year of 2014.

5.2.4 Urban and rural consumption disparities and the average cost of living

Besides the analysis above on resident consumption per capita in 5.2.3, this study also investigates two aspects in consumption in this part in order to reflect the structure of consumption, namely the urban and rural consumption disparities and the average cost of living. Due to the availability of statistical data, this part will only analyse for the year of 2014, and the data source is China Statistical Yearbook 2015.

As to the NE, in 2014, its urban household consumption per capita is below the national average but its rural household consumption per capita is above the national average, which indicates the relative lower consumption in the cities of the NE (Table 5.3). Actually, the lower urban consumption in the NE is in accord with its lower average wage of staff and workers (5.2.1), lower annual income per capita (5.2.2) and lower resident consumption per capita (5.2.3) analyzed previously in this chapter

As for YRD, both the urban and rural household consumption per capita in 2014 are above the national average (Table 5.3). Furthermore, in 2014, the rural household consumption per capita in YRD is equivalent to about half (49.98%) of its urban household consumption per capita, higher than the NE (41.79%) and the national average (34.36%), which reflects a relatively higher consumption standard as well as a relatively higher standard of living of the rural household in YRD compared to the NE and national average.

And what's more, this study also analyses the average cost of living per capita in the NE, YRD and China in 2014 to reflect the consumption structure related to the standard of living. In general, the average cost of living per capita in YRD in 2014 is much higher than the national average and the NE in all kinds of consumption for daily life, while the average cost of living in the NE is relatively lower than the national average, especially for the price of food, residence, household commodities and services, transport and communications (Table 5.3).

Table 5.3 Average cost of living per capita, NE, YRD and China (2014)

(Yuan)	NE	YRD	China
Urban and rural consumption disparities:			
Rural household consumption per capita	9573.24	17840.58	8744.00
Urban household consumption per capita	22905.48	35697.96	25449.00
Average cost of living per capita	14153.15	22459.66	14491.40
Food, tobacco and liquor	3943.14	6452.45	4493.90
Clothing	1350.79	1489.94	1099.30
Residence	2941.83	5646.29	3200.50
Household commodities and services	774.70	1175.62	889.70
Transport and communications	1744.95	3257.98	1869.30
Education, culture and recreation	1613.97	2378.03	1535.90
Health care and medical services	1372.74	1476.87	1044.80
Miscellaneous goods and services	411.04	582.51	358.00

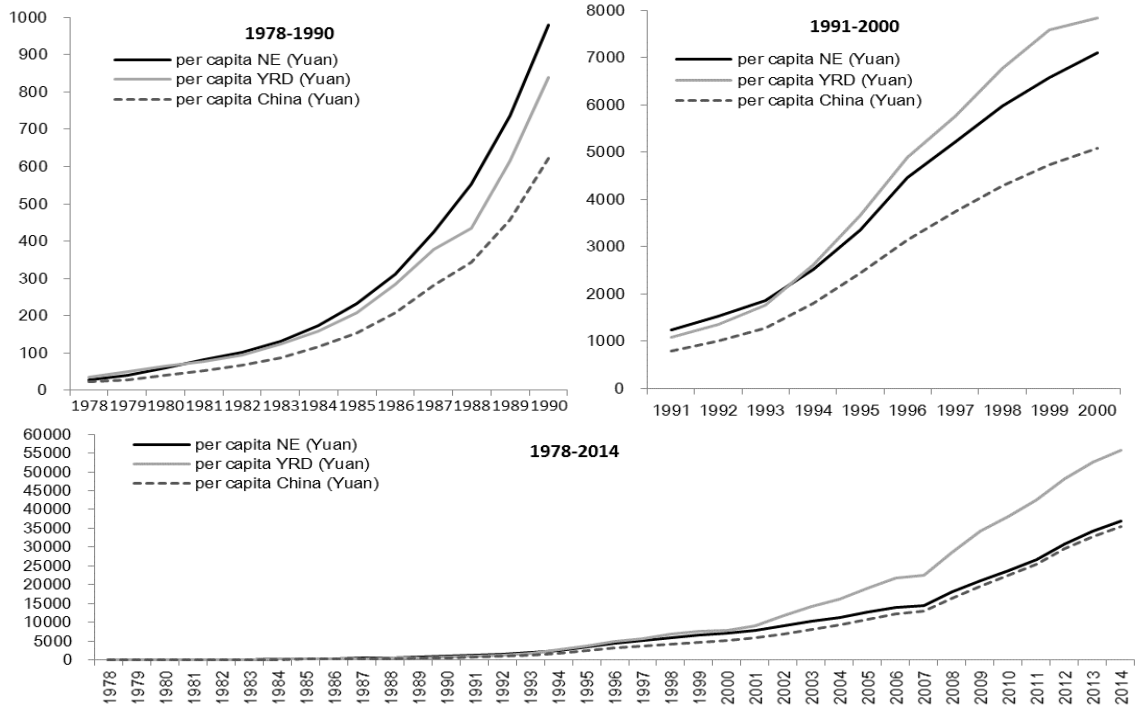
Data source: China Statistical Yearbook 2015, calculated from provincial data

5.2.5 Savings deposits of urban and rural residents per capita

According to NBSC (2015), RMB savings deposits refer to total savings deposits that urban and rural residents save at year-end in the banks and other financial institutions. This study analyze on savings deposits of urban and rural residents per capita (with balance at year-end) in the NE, YRD and China from 1978 to 2014, in order to reflect the standard of living besides average wage (5.2.1), income (5.2.2), consumption (5.2.3) and cost of living (5.2.4) along with the implementation of China's opening and reform policy since 1978.

The data source of the national data is NBSC (2015). Data for the NE and YRD from 1978 to 2013 are calculated from provincial data in provincial statistical yearbooks at various years, and data source for the year of 2014 is China Statistical Yearbook 2015.

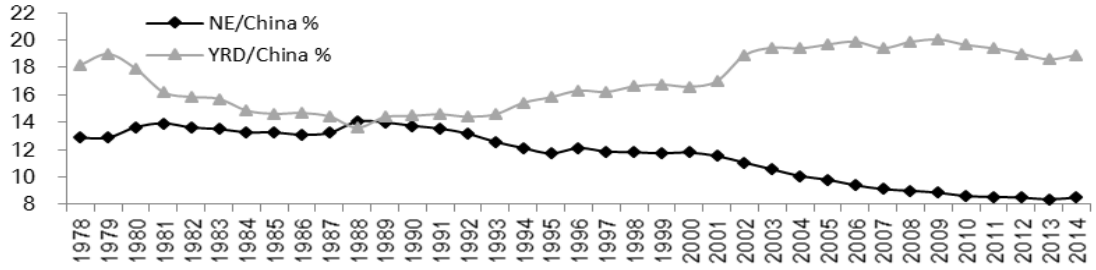
The savings deposits of urban and rural residents per capita sustain growth in the NE and YRD and keep ahead of the national average from 1978 to 2014, though the NE kept ahead of the YRD from 1981 to 1993 while YRD remains ahead of the NE since 1994 (Figure 5.10). In 2014, the savings deposits of urban and rural residents per capita of the NE is 37570.46 Yuan, just 5.90% more than the national average of 35476.99 Yuan; in contrast, deposits per capita of YRD is 57760.57 Yuan in 2014, which is 62.81% more than national average (Figure 5.10).



Data source: NBSC (2015); provincial statistical yearbooks at various years; China Statistical Yearbook 2015
Figure 5.10 Savings deposits of urban and rural residents per capita, NE, YRD and China, 1978-2014

In addition, the percentage of regional savings deposits to the national total changes differently in the NE and YRD. On the one hand, the percentage of the NE was relatively stable before 1988 (around 13% of the national total, for example, with 13.26% in 1985). However, it falls almost continuously since 1988, from 14.05% in 1988 to 11.72% in 1995, 9.80% in 2005, 8.85% in 2009, and further to 8.50% in 2014 (Figure 5.11). On the other hand, the percentage of YRD on savings deposits to the national total firstly

decreased from 1979 to 1988 and then almost ascends since 1988 despite of fluctuations: with 14.62% in 1985, 15.83% in 1995, 19.68% in 2005, 20.04% in 2009 and 18.92% in 2014 (Figure 5.11).



Data source: NBSC (2015); provincial statistical yearbooks at various years; China Statistical Yearbook 2015

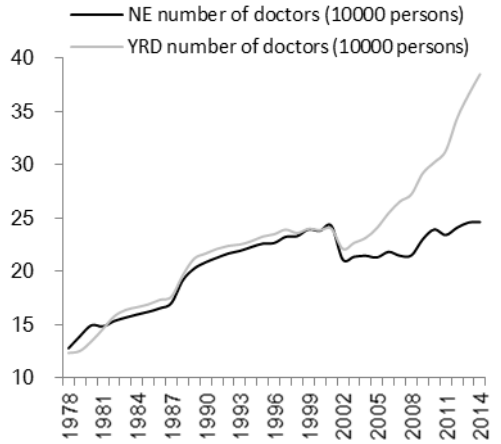
Figure 5.11 Percentage of savings deposits of urban and rural residents to the national total, NE and YRD, 1978-2014

5.3 Public health service

This study analyses four indicators on public health service of the NE and YRD from 1978 to 2014: total number of doctors[58] (5.3.1), number of doctors per 10000 persons (5.3.2), total number of beds of health care institutions[59] (5.3.3) and number of beds of health care institutions per 10000 persons (5.3.4). Data for the NE and YRD are calculated from provincial statistical data with China Statistical Yearbooks 1981-2015 as data sources.

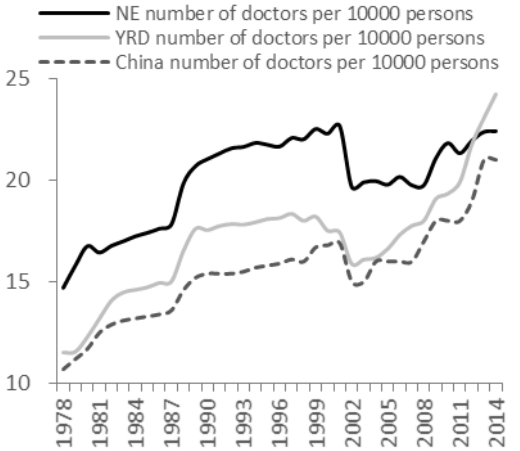
5.3.1 Total number of doctors

The total number of doctors has increased in the NE and YRD since 1978. There is not much difference between the two regions before 2002. However, since 2002, the total number of doctors in YRD has increased much faster than the NE (Figure 5.12).



Data source: China Statistical Yearbooks 1981-2015

Figure 5.12 Total number of doctors, NE and YRD, 1978-2014



Data source: China Statistical Yearbooks 1981-2015

Figure 5.13 Number of doctors per 10000 persons, NE, YRD and China, 1978-2014

[58] Since 2002, national statistical criteria has changed on public health service: doctors refer to licensed (assistant) doctors, and it reflects as a sharp decline on the statistical data in the year of 2002. Since 2002, the number of doctors refers to the number of licensed (assistant) doctors, and it is calculated as: number of licensed (assistant) doctors = number of licensed doctors + number of licensed assistant doctors (NBSC 2014).

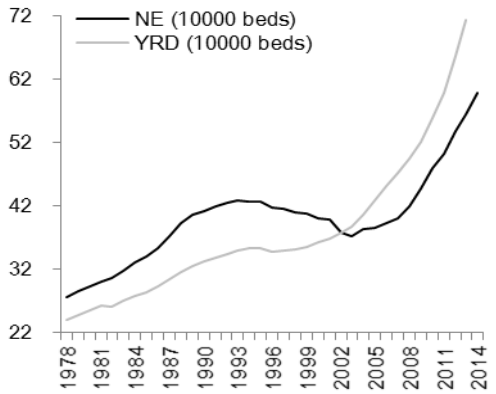
[59] "Health care institutions include hospitals, health care institutions at grass-root level, specialized public health institutions, and other medical and health care institutions" (NBSC 2014).

5.3.2 Number of doctors per 10000 persons

The disparity between the NE and YRD on the number of doctors per 10000 persons from 1978 to 2002 is relative stable. Nevertheless, since 2002, the number of YRD increases much faster than the NE. And what's more, in 2013, YRD surpasses the NE in the number of doctors per 10000 persons and the disparity between them exaggerates in the year of 2014 (Figure 5.13). In addition, the number of doctors per 10000 persons in the NE and YRD remains above the national average since 1978 (Figure 5.13).

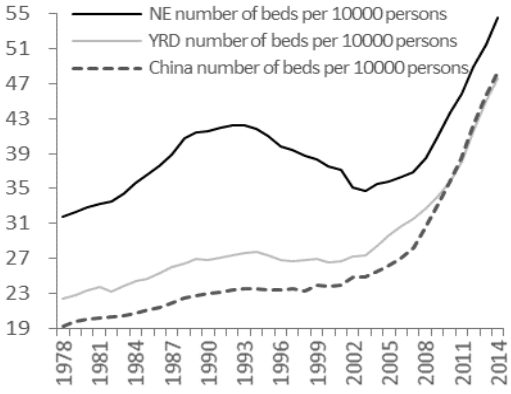
5.3.3 Total number of beds of health care institutions

The NE was ahead of YRD from 1978 to 2001 on the total number of beds of health care institutions. However, YRD takes the lead in 2002 and keeps ahead of the NE with a much faster increase since 2002 (Figure 5.14).



Data source: China Statistical Yearbooks 1981-2015

Figure 5.14 Total number of beds of health care institutions, NE and YRD, 1978-2014



Data source: China Statistical Yearbooks 1981-2015

Figure 5.15 Number of beds of health care institutions per 10000 persons, NE, YRD and China, 1978-2014

5.3.4 Number of beds of health care institutions per 10000 persons

As for the number of beds of health care institutions per 10000 persons, the NE remains ahead of YRD and the national average since 1978 (Figure 5.15). YRD was above the national average from 1978 to 2010, but has been below the national average since 2011, even if the disparity remains less than one bed per 10000 persons between them with the maximum disparity of 0.91 beds per 10000 persons in 2014 (Figure 5.15). In contrast, the NE is above the national average with a disparity of 6.01 beds per 10000 persons in 2014.

5.4 Education

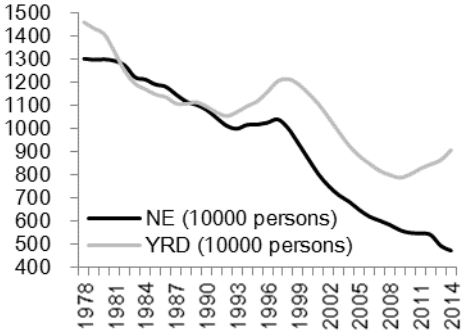
This study analyses the development of primary education (5.4.1), secondary education (5.4.2) and higher education (5.4.3) in the NE and YRD from 1978 to 2014 with comparison to the national average. The quantitative analysis is mainly based on official statistical data with NBSC (2015) as the main data source, and data for the NE and YRD are calculated from provincial statistical data.

5.4.1 Elementary education

The elementary education of the NE and YRD from 1978 to 2014 represent the following characteristics with four selected indicators.

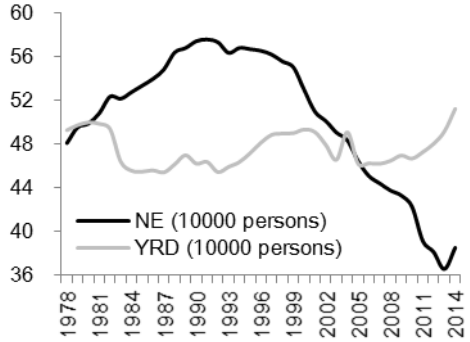
First, the total number of pupils of primary schools almost keeps decreasing in the NE from 1978 to 2014 except a slight increase during the 1990s (Figure 5.16) due to the increase in natural growth rate of population between 1985 and 1993 in the NE (see Figure 5.2 in 5.1.2), while YRD has experienced two period of increase in the 1990s and 2010s (Figure 5.16) in accordance with the changes on natural growth rate (Figure 5.2 in 5.1.2) and on annual population change beside natural growth (Figure 5.4 in 5.1.4).

Second, as for the total number of full-time teachers of primary schools, in Figure 5.17, compared to YRD with a relative stable total number of full-time teachers of primary schools since 1978, the NE has experienced a sharp increase from 1978 to 1991 and then an even sharper decrease from 1994 to 2013, which is basically consistent with the change of the total number of pupils illustrated in Figure 5.16.



Data source: NBSC (2015)

Figure 5.16 Total number of pupils of primary schools, NE and YRD, 1978-2014

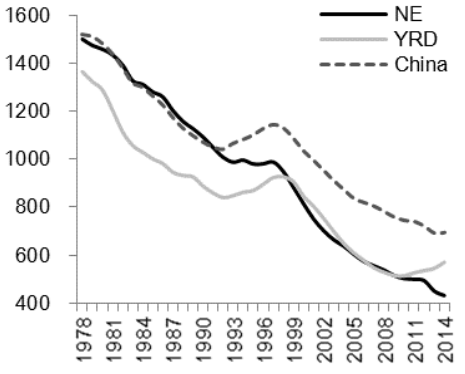


Data source: NBSC (2015)

Figure 5.17 Total number of full-time teachers of primary schools, NE and YRD, 1978-2014

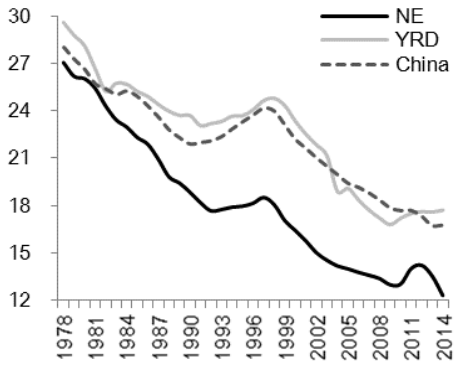
Third, as to the number of pupils of primary schools per 10000 persons, the changes in YRD generally keeps accordance with the national average but remains lower than the national average since 1978, while the NE has almost a continuous decrease since 1978 and remains below the national average since 1990s (Figure 5.18).

Fourth, the pupil-teacher ratio of primary schools demonstrates a trend of decrease from 1978 to 2014 in the NE and YRD in accord with Figure 5.16 and Figure 5.18, and the NE keeps below the national average while YRD keeps close to but often above the national average (Figure 5.19). Presently, YRD has been above the national average since 2012, which illustrates that on average one teacher at primary school in YRD teaches more pupils than the national average and the NE (Figure 5.19).



Data source: NBSC (2015)

Figure 5.18 Number of pupils of primary schools per 10000 persons, NE, YRD and China, 1978-2014



Data source: NBSC (2015)

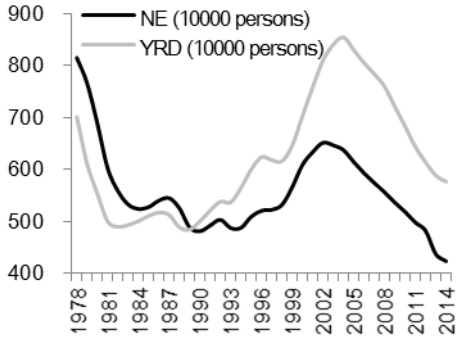
Figure 5.19 Pupil-teacher ratio of primary schools, NE, YRD and China, 1978-2014

5.4.2 Secondary education

The development of the secondary education in the NE and YRD represent the following four characteristics from 1978 to 2014.

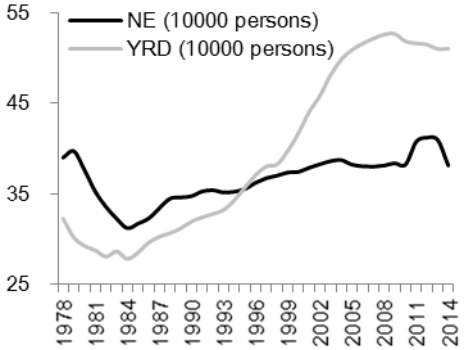
First, as for the total number of students of secondary schools, there were more students in the NE than YRD from 1978 to 1989, but YRD has taken the lead since 1990 (Figure 5.20).

Second, as to the total number of full-time teachers of secondary schools, the NE has more teachers than YRD from 1978 to 1994, but YRD keeps ahead of the NE since 1995 (Figure 5.21).



Data source: NBSC (2015)

Figure 5.20 Total number of students of secondary schools, NE and YRD, 1978-2014

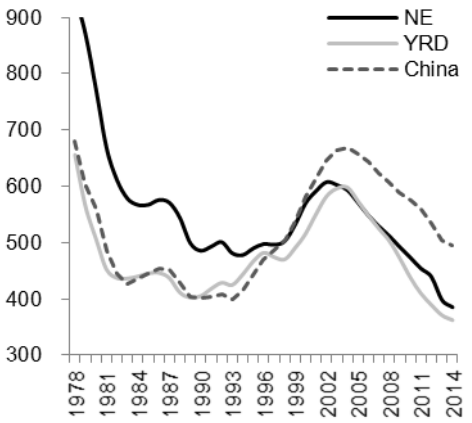


Data source: NBSC (2015)

Figure 5.21 Total number of full-time teachers of secondary schools, NE and YRD, 1978-2014

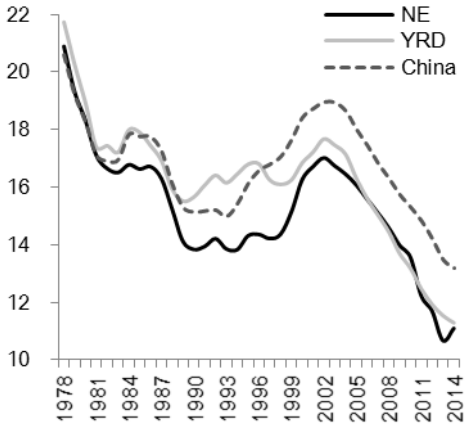
Third, as for the number of students of secondary schools per 10000 persons, the NE keeps ahead of YRD in most of the years from 1978 to 2014, except 2004 to 2006 (Figure 5.22). Moreover, compared to the national average, the NE and YRD remain below the national average respectively since 1998 and since 1997 (Figure 5.22).

Fourth, as to the student-teacher ratio of secondary schools, YRD remains higher than the NE in most of the years from 1978 to 2014 (Figure 5.23). Furthermore, the NE and YRD have lower student-teacher of secondary schools than the national average respectively since 1982 and since 1986 (Figure 5.23).



Data source: NBSC (2015)

Figure 5.22 Total number of students of secondary schools per 10000 persons, NE, YRD and China, 1978-2014



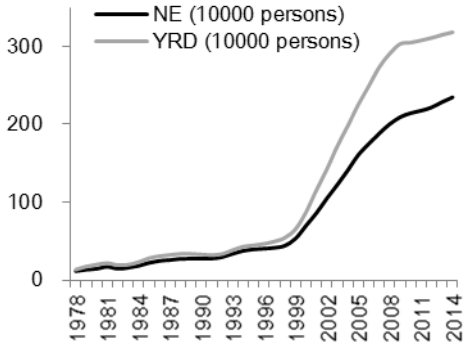
Data source: NBSC (2015)

Figure 5.23 Student-teacher ratio of secondary schools, NE, YRD and China, 1978-2014

5.4.3 Higher education

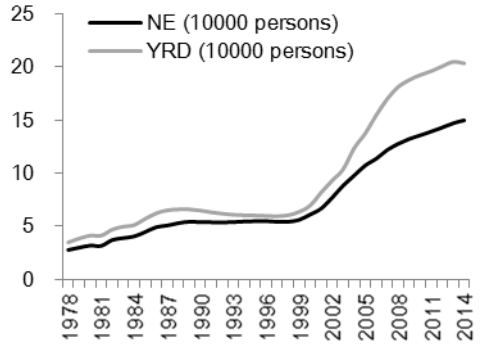
The NE and YRD have experienced development in higher education above the national average from 1978 to 2014.

On the one hand, the total number of students and full-time teachers of higher education almost keeps increasing in both regions since 1978, and YRD remains ahead of the NE (Figure 5.24 and Figure 5.25).



Data source: NBSC (2015)

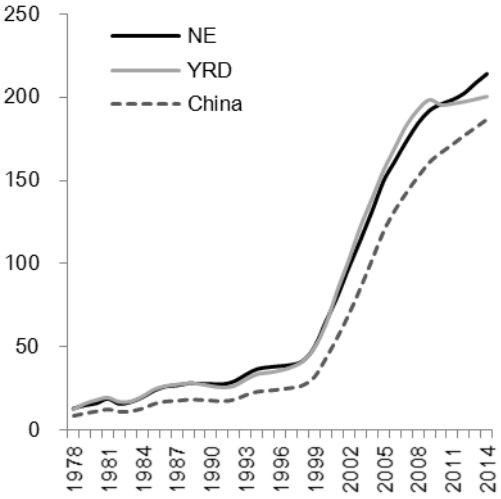
Figure 5.24 Total number of students of higher education, NE and YRD, 1978-2014



Data source: NBSC (2015)

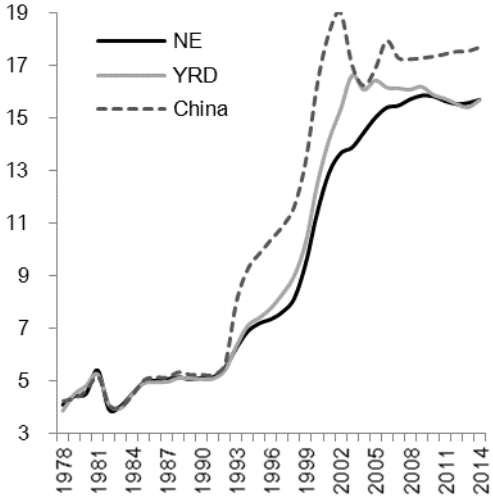
Figure 5.25 Total number of full-time teachers of higher education, NE and YRD, 1978-2014

On the other hand, the two regions are very close on number of students of higher education per 10000 persons and on student-teacher ratio of higher education from 1978 to 2014 (Figure 4.26 and Figure 4.27). For one thing, as to the number of students of higher education per 10000 persons, the NE and YRD has been above the national average since 1978, and the NE has been ahead of YRD since 2010 (Figure 5.26). In 2014, the number of students of higher education per 10000 persons in the NE and YRD are respectively 27.58 and 14.04 above the national average of 186.26. For another, the student-teacher ratio of higher education has increased approximately 3 times in the NE, YRD and China from 1978 to 2014. In 2014, the ratios of the NE and YRD are respectively 2 and 1.99 lower than the national average of 17.68 (Figure 5.27).



Data source: NBSC (2015)

Figure 5.26 Number of students of higher education per 10000 persons, NE, YRD and China, 1978-2014



Data source: NBSC (2015)

Figure 5.27 Student-teacher ratio of higher education, NE, YRD and China, 1978-2014

Accordingly, there are more higher education institutions (HEIs) in YRD than in the NE in 2014. Particularly, about one fifth (19.47%) of China's HEIs under central ministries and agencies are located in YRD, which demonstrates the competitiveness on higher education of YRD (Table 5.4).

Table 5.4 Number of regular higher education institutions (HEIs), NE, YRD and China (2014)

	NE	YRD	China	NE/China (%)	YRD/China (%)
Total	254	331	2529	10.04	13.09
HEIs offering degree programs	140	170	1202	11.65	14.14
HEIs under central ministries and agencies	10	22	113	8.85	19.47
Higher vocational colleges	114	161	1327	8.59	12.13

Data source: MOE (2015)

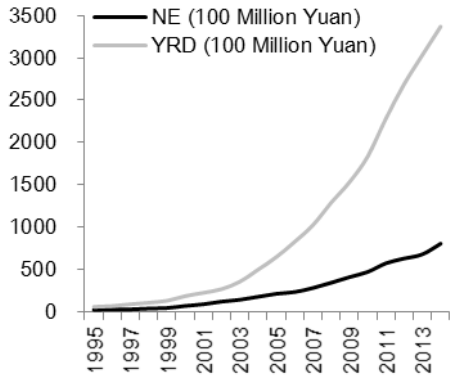
5.5 Science and technology: expenditures on R&D

This part analyses the total expenditures on R&D and the percentage of expenditures on R&D to GDP to reflect the development on science and technology in the NE and YRD. The expenditures on R&D in this study includes all kinds of fund sources such as governments, universities, research institutes, enterprises and other sources.

The quantitative analysis is based on official statistical data from 1995 to 2014 due to no statistical data on this indicator before 1995. The source of the national data is NBSC (2015). The data for the NE and YRD are calculated from provincial data, and the main data sources are respective provincial statistical yearbooks 1996-2015.

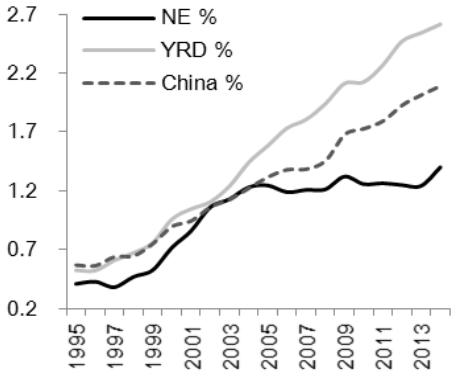
For one thing, the total expenditures on R&D keep increasing in the NE and YRD from 1995 to 2014, and YRD remains ahead of the NE with an ever-increasing gap (Figure 5.28).

For another, as to the percentage of expenditures on R&D to GDP, YRD keeps higher than the NE since 1995 and higher than the national average since 1998, while the NE remains lower than the national average since 1995, with an obviously increasing disparity between the NE and the national average since 2004 (Figure 5.29). In contrast, the percentage of YRD increased much faster than the national average from 1995 to 2013 (Figure 5.29).



Data source: NBSC (2015) and provincial statistical yearbooks 1996-2015

Figure 5.28 Total expenditures on R&D, NE and YRD, 1995-2014



Data source: NBSC (2015) and provincial statistical yearbooks 1996-2015

Figure 5.29 Percentage of expenditures on R&D to GDP, NE, YRD and China, 1995-2014

In a word, YRD remains ahead of the NE on R&D from 1995 to 2014, which demonstrates that YRD has laid more emphasis on the development of science and technology than the NE and the national average (Table 5.5).

Table 5.5 Expenditures on R&D and its percentage to GDP, NE, YRD and China

Year	Expenditures on R&D (100 Million Yuan)		Percentage of expenditures on R&D to GDP		
	NE	YRD	NE	YRD	China
1995	24.19	58.70	0.41%	0.52%	0.57%
2010	70.00	186.37	0.72%	0.96%	0.90%
2005	213.50	647.36	1.25%	1.58%	1.32%
2009	410.55	1530.81	1.32%	2.11%	1.68%
2014	804.92	3368.85	1.40%	2.62%	2.09%

Data source: calculated from provincial data in respective provincial statistical yearbooks 1996-2015

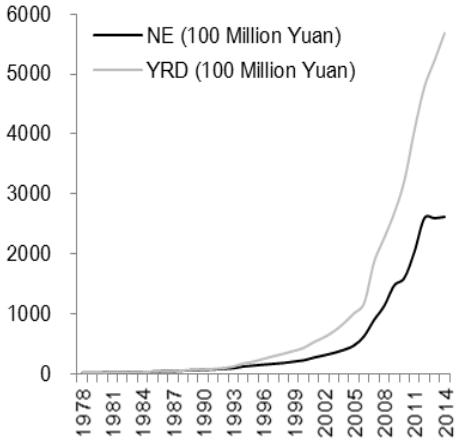
5.6 Governmental financial funds on social-cultural expenditures: expenditures on education, science, culture and public health

Expenditures on education, science, culture and public health as parts of government expenditures in China reflect the distribution of governmental financial funds by these functions to meet the needs for social-cultural development. This section mainly analyses the total expenditures on education, science, culture and public health of the NE and YRD as well as the percentage of expenditures on education, science, culture and public health to total government expenditures of the NE, YRD and China.

The quantitative analysis is based on provincial and national statistical data from 1978 to 2014. Data for the NE and YRD are calculated from provincial data with respective provincial statistical yearbooks at various years as data sources. The national data source is NBSC (2015).

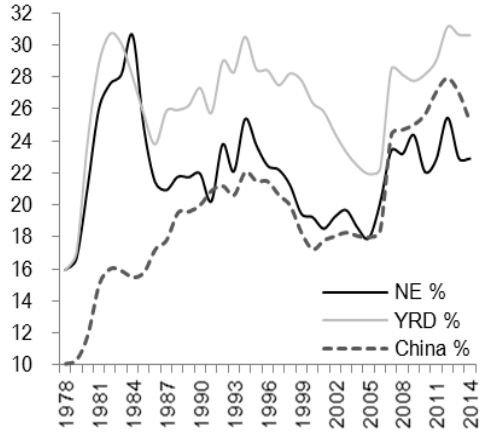
On the one hand, as for the total expenditures on education, science, culture and public health of the NE and YRD, both regions keep increasing since 1978 and YRD takes the lead of the NE since 1984, though the NE remained ahead of YRD from 1978 to 1983. Furthermore, since 2001, the expenditures on education, science, culture and public health of YRD remain far more beyond the NE with roughly a double expenditure of the latter (Figure 5.30).

On the other hand, as for the percentage of expenditures on education, science, culture and public health to total government expenditure of the NE, YRD and China, YRD takes lead of the NE since 1979 and remains ahead of the national average since 1978, while the NE remains below the national average since 2007 (Figure 5.31), which reflects the fact that compared to YRD and the national average, the NE has paid less emphasis on regional social-cultural development due to its unsustainable development pattern of regional economy mentioned previously in Chapter 4. As a consequence,, the NE has much less governmental financial funds for regional social-cultural development.



Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.30 Expenditures on education, science, culture and public health, NE and YRD, 1978-2014



Data source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 5.31 Percentage of expenditures on education, science, culture and public health to total government expenditure, NE, YRD and China, 1978-2014

5.7 Conclusion

YRD almost keeps ahead of the NE on average life expectancy (5.1.5), average wage of staff and workers (5.2.1), annual income per capita (5.2.2), saving deposits in urban and rural areas (5.2.5), resident consumption per capita (5.2.3), education (5.4), expenditures on R&D (5.5) and government social-cultural expenditures on education, science, culture and public health (5.6) from 1978 to 2014.

In addition, YRD as a region with various advantages in people's living conditions (5.2) related to the standard of living has demonstrated significant attractiveness to the immigrant population since 1991 (5.1.4), which may contribute to explain why YRD takes lead of the NE on the absolute number of doctors as well as beds of health care institutions but the NE has more doctors and beds per 10000 persons than YRD on public health service (5.3).

Furthermore, along with a higher population density (5.1.3) and urbanization rate (5.1.6) in YRD, the average cost of living per capita (5.2.4) in YRD is much higher than the national average and the NE in all kinds of consumption for daily life, while the average cost of living in the NE is relatively lower than the national average, especially the price of food, residence, household commodities and services, transport and communications (Table 5.3 in 5.2.4).

The quantitative path-assets analysis based on official statistical data in this chapter demonstrates that the region of YRD has more vitality than the NE on regional social-cultural development, and by the end of 2014 YRD exceeds the NE in the aspects mentioned above quite obviously. Actually, this also reflects the culture diversity in YRD, which in turn contributes to its regional economic development and enhances the attractiveness of YRD for the immigrant population.

There are many reasons why people move to YRD voluntarily in the past decades, for instance, higher average wage and income, higher standard of living, convenient

information change and sharing networks, leading position in China on creativity and innovation, outstanding service capacity of local governments, convenient regional transport system and more opportunities for good education especially for higher education with almost one fifth (19.47%) of China's HEIs under central ministries and agencies (Table 5.4 in 5.4.3).

In a word, YRD takes lead on regional social-cultural development ahead of the NE, at least in most of the years from 1978 to 2014.

By way of contrast, after the establishment of the PRC in 1949, the historical large-scale migration into the NE in Maoist China (1949-1976) were almost not voluntary but forced, planned and State-induced migration between the 1950s and the 1970s. Consequently, along with China's economic reform process since 1978, many people have moved out from the NE, which has been confirmed by the lower natural growth rate and TFR in the NE in a certain degree (5.1.2).

More importantly, the lower natural growth rate and TFR might become a challenge to regional sustainable development in the NE, particularly with consideration on the population change besides natural growth (5.1.4) together. Since 2009, the NE has become a region with continuous emigration, which has brought certain social problems such as shortage of skilled workers and professionals for regional development due to emigration out of the NE.

In fact, the historical State-induced migration into the NE, on the one hand, turned the past wild marshy areas known as "Great Northern Wilderness" into the present "Great Northern Granary"; on the other hand, it gave rise to significant decrease in original wetlands whilst increase in natural hazards along with the land reclamation and the establishment of thousands of farms in this area since the 1950s, which will be discussed further in Chapter 6 with focus on the environmental dimension of the NE and YRD.

6 Path-Assets Analysis III: Environmental Dimension

In light of the existence of path dependence and lock-in in the process of regional development, a historical change in human-environment relationship might have long-lasting effects on the environmental dimension. This chapter interrelates a historical change in human-environment relationship in Maoist China and its influence on environmental degradation in the NE, YRD and China since 1978. Within this intention, this chapter introduces the historical context of human-environment relationship in Maoist China (1949-1976) and its long-lasting effects on environmental degradation and pollution in China (6.1) besides providing general information on the environment of the NE (6.2) and YRD (6.3) on the following four aspects: geographical location and climate, biome and ecosystem, soil and agricultural conditions as well as resource use. Furthermore, this chapter conducts quantitative environmental path-assets analysis of the NE and YRD from 1978 to 2014 based on official statistical data (6.4), and comes to the conclusion at the end of this chapter (6.5).

6.1 Historical context: the change in human-environment relationship in Maoist China (1949-1976) and its long-lasting effects on environmental degradation and pollution in China

As a historical context to the environmental path-assets analysis in the NE and YRD, this part introduces the change of human-environment relationship in Maoist China (6.1.1), the state of environmental degradation and pollution in China (6.1.2) and the economic and social costs of environmental degradation and pollution in China (6.1.3).

6.1.1 The change in human-environment relationship in Maoist China (1949-1976)

Serious environmental degradations have taken place in China due to an important shift in human-environment relations in Maoist China (1949-1976). During the Mao era, the traditional Chinese ideal of “harmony between heaven and humans” was abrogated in favour of Mao’s insistence that “Man Must Conquer Nature” (Shapiro 2001: 67). Some of the typical slogans of this era included: “The foolish old man removes the mountain; Create farmland by encircling the lake; Man must conquer heaven; ... Cultivate on the top of the mountain, plant rice at the center of the lake; Actively smelt steel and iron; How much courage you have, how much yield it has; … To struggle against the heaven is endless joy, to struggle against the earth is endless joy, to struggle for the people is endless joy” (Bao 2006: 37). Following these slogans, human activities “violated the nature and resulted in serious environmental pollution and ecological damage” (Bao 2006: 37). Since then, China has experienced serious environmental degradation with long-lasting impact of environmental damage.

6.1.2 The state of environmental degradation and pollution in China

In the past three decades, rapid economic growth, industrialization and urbanization in China have made continuous pressure on the environment. Although new environmental technologies, cleaner products, lower emission per unit of product as well as the closing down of some heavily polluting factories have increased efficiency in

resource use, environmental degradation and pollution has grown even faster (Mol and Carter 2006). In China, about 75% of lakes are polluted (Liu and Diamond 2005: 1182), about 40% of land area suffers from acid rain (Wu *et al* 2006b: 70), 19% of land area suffered from soil erosion (Liu and Diamond 2005: 1181) and 79% of China's dryland area or 27.5% of China's total land area suffers from desertification (Jiang 2010: 14).

Human actions have made some natural disasters more frequent, especially dust storms, landslides, droughts and floods (Liu and Diamond 2005: 1183). China suffered from various environmental pollution accidents and disasters since the 1990s including the 1998 floods (Liu and Diamond 2005: 1179), the 2005 Jilin Chemical Plant explosions (UNEP 2005), the 2007 algal blooms due to polluting factories around lakes and air pollution of $PM_{2.5}$ (Hsu 2012).

Environmental disasters as well catastrophes can sensitize society and induce decision-makers to undertake climate actions for otherwise difficult political decisions (Richerzhagen and Scholz 2007: 6). Increasing environmental pollution accidents (China Daily 2012) as well as environmental catastrophes in recent years let the Chinese government realize that short-term considerations and acceptance of environmental degradation for economic reasons is not sustainable and cannot maintain China's growth in the long run (SEI and UNDP China 2002). Since the 1998 floods China has paid greater attention to environmental policy and strengthened environmental institutions as well (Richerzhagen and Scholz 2007: 9).

6.1.3 Economic and social costs of environmental degradation and pollution in China

Environmental degradation in China has drawn skyrocketing economic and social costs (Economy 2004; Liu and Diamond 2005; World Bank and SEPA 2007). Air and water pollution costs conservatively roughly 8% of GDP (Johnson *et al* 1997). Smil (1996: 56) estimated economic losses due to environmental degradation at 10% to 15% of China's annual GDP, Economy (2004: 88) estimated between 8% to 12% of China's annual GDP, Liu and Diamond (2005: 1183) estimated the losses from pollution and ecological damage between 7% to 20% of annual GDP, and Shanghai Daily (2006) reported the total cost of environmental damage was 10% of China's GDP. However, the real numbers are much higher once the damage from large-scale disasters such as the 1998 Yangtze River floods or the 2001 drought is included (Economy 2004: 295, Note 158).

> "Sand-storm damage costs about $540 million per year, and losses of crops and forests due to acid rain amount to about $730 million per year. More serious is the $6 billion cost of the 'green wall' of trees being built to shield Beijing against sand and dust, the annual direct losses due to desertification ($7 billion), and the $7 billion per year in losses created by several major alien species other than alligator weed. Even bigger numbers are the one-off cost of the 1996 floods ($27 billion, but still cheaper than the 1998 floods) and the annual losses due to water and air pollution ($54 billion). " (Liu and Diamond 2005: 1183)

In addition, climate change has affected human health directly and indirectly in China, including mortality from extreme weather events, changes in air and water quality as well as changes in the ecology of infectious diseases (Kan *et al* 2012).

According to Tang *et al* (2016), the average agricultural pollution costs from emissions of chemical oxygen demand (COD), total nitrogen (TN) and total phosphorus (TP) are estimated at 6.09% of the annual gross output value of the agricultural sector in China from 2001 to 2010, and at 4.17% in the NE as well as at 2.39% in YRD[60]. Along with the use of pesticides to increase agricultural yields from 1991 to 2010, high levels of pesticide residues became an urgent food safety concern in China (Hamburger 2002), and high levels of DDT in human breast milk were found in several large Chinese cities in China (Wong *et al* 2005), but there is still a knowledge gap for understanding the status of pesticide contamination and related risk in China (Grung *et al* 2015).

The levels of air pollution in China are very high in general and draws serious health risk. Years of life lost were significantly elevated corresponding to an increase in current ambient concentrations of PM_{10}, NO_2 and SO_2 (Lu *et al* 2015). About 289000 deaths per year are attributed to air pollution: an estimated 178000 deaths in major cities each year due to air pollution as well as 111000 deaths each year in rural areas due to indoor air pollution (Johnson *et al* 1997: 19).

Water pollution is very serious in China, with only less than half (about 46%) of the 178000 km of key rivers and lakes monitored by the MEP up to standard on quality (China Daily 2012). Specific localized disease caused by environmental pollution is increasing and evident throughout China (Economy 2004: 84). In the areas relying on wastewater for irrigation, cancer rates and deaths as well as birth defects have increased significantly since the 1970s (Economy 2004), and there were twice as many cancer patients in the sewage-irrigated area (Wu *et al* 1999). The incidence of intestinal infections and enlargement of the liver in Shenyang and Fushun in the NE was 49% and 36% higher, respectively in the irrigated areas than in the control area (Economy 2004). Exposure to organic and inorganic chemicals in drinking water may significantly contribute to chronic disease. In July 2000, a survey in Zhejiang Province in YRD published by the Chinese Preventive Medicine Journal found 5 to 8 times more morbidity of intestine cancer caused by microcystin toxins in water than among people who have access to cleaner drinking water (Zhou *et al* 2000). In addition, high concentrations of heavy metals elements such as Cd, Cu, Pb and Zn in soils originated from historical industrial activities may pose public health risk (Li *et al* 2013; Xiao *et al* 2015).

6.2 The environment of the NE

Based on the historical context mentioned above in 6.1, this part mainly introduces the environment of the NE in the following four aspects: geographical location and climate (6.2.1), biome and ecosystem (6.2.2), soil and agricultural conditions (6.2.3) as well as resource use (6.2.4).

6.2.1 Geographical location and climate

The NE (E118°53′ - E135°05′, N38°43′ - N53°33′) as the region with the highest latitude

[60] The data for the NE and YRD are calculated from the provincial data of Table 4 in Tang *et al* (2016): data of the NE is an average of the three provinces of Liaoning, Jilin and Heilongjiang, while data of YRD is only an average of Jiangsu Province and Zhejiang Province (no data for Shanghai).

in China, belongs to temperate continental monsoon climate, with warm summer continental (or hemi-boreal) climates in the plain areas and south as well as continental subarctic (or boreal) climates in north (northern part of Heilongjiang Province, e.g. Mohe County). The overall climate of the NE is featured by a warm, short and rainy summer while a cold, long and dry winter.

The heart of the NE is the Northeast China Plain (Figure 6.1) with an area of 0.35 million km^2 as China's largest plain, accounting for 30.43% of the total plain area of the country and 43.30% of the total area of the NE. Songhua River, Nen River and Liao River run through its vast and fertile land (Figure 6.1). The plain areas of the NE is featured with distinct four seasons with frequent spring hypothermia and autumn frosts, whilst the weather in the mountainous areas can be very erratic.

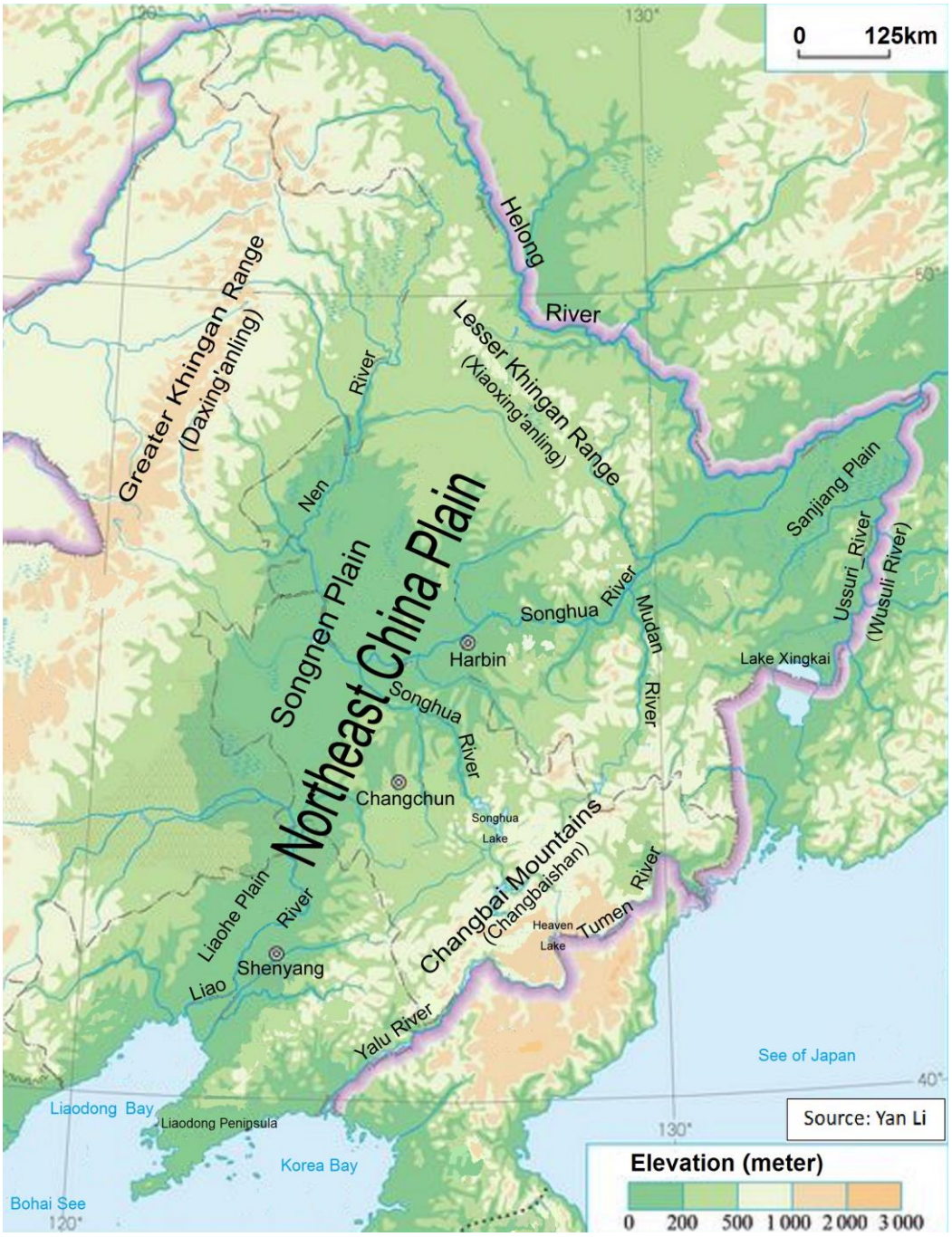


Figure 6.1 Northeast China Plain

Surrounded by East Siberia in the north with Verkhoyansk (located at 67°33′N 133°23′E) and Oymyakon (located at 63°15′N 143°9′E) as the Poles of Cold with lowest recorded air temperatures in the northern hemisphere and by Mongolian Plateau with an average elevation above 1000m in the west, influenced by the Siberian High[61], the average winter temperature of the NE is lower than other land of the earth at same latitudes with a disparity of more than 10°C[62]. Winters in the NE are long and cold with frequent snow, much frost and wind chill, and the winter in the north could be longer than half a year. Mohe County in the north of the NE keeps the record of the minimum temperature of China in winter with -52.3°C (on 13 February 1969), and its mean temperature in January is -30.5°C with the minimum temperature often lower than -40°C.

The annual precipitation of the NE averages mainly between 350mm and 750mm, though in some places with higher latitude in Changbai Mountain the annual precipitation could exceed 1400mm. Summer rainfall is almost everywhere sufficient for cultivation but tends to be unreliable; in some years drought could be a problem.

The NE is a sensitive region of climate change (Zhao *et al* 2007). In the context of global and regional warming, from 1961 to 2010, the annual mean temperature in the NE increased approximately at the rate of 0.35°C per decade, higher than the worldwide and national average rate, with the most significant increase in the northern Xiaoxing'anling (the Lesser Khingan Mountains) at 0.61-0.64 °C per decade (Wang *et al* 2013). The annual precipitation showed a weak decreasing trend, while the number of precipitation days showed a significant downward trend, with a rate of 2.4 d per decade (Zhao *et al* 2013). In addition, under climate change conditions, climate disasters has arisen in the NE. For instance, there have been more frequent floods in the NE since 1990s due to climate change[63].

6.2.2 Biome and ecosystem

According to the biome classification of China based on plant functional types by Ni (2001), there are four types of biomes in the NE: Boreal deciduous coniferous forest/woodland, Boreal mixed forest/woodland, Temperate mixed forest and Moist savannas. Influenced by climate change, on the one hand, the growing season of coniferous forests in the NE has been increasing at an average rate of 3.9 d per decade (Guo *et al* 2010); on the other hand, the forest edge of the cool temperate zone in the southern Daxing'anling (the Greater Khingan Mountains) has retreated 140 km northward from 1902 to 2002 (He *et al* 2009). Nevertheless, dense forests such as larch, birch, aspen and pine cover the ranges and mountains in the NE, with shrubs covering

[61] The Siberian High is the strongest semi-permanent high in the northern hemisphere responsible for both the lowest recorded temperature in the Northern Hemisphere and the highest pressure. The Siberian High is responsible both for severe winter cold and attendant dry conditions with little snow and few or no glaciers across Siberia, Mongolia and China. During the summer, the Siberian High is largely replaced by the Asiatic low. (Source: Wikipedia, https://en.wikipedia.org/wiki/Siberian_High, accessed on 8 October 2015)

[62] Source: Baidu Zhidao. The characteristics of climate in Northeast China. http://zhidao.baidu.com/question/116972594.html?loc_ans=369947893, accessed on 8 October 2015. (in Chinese)

[63] Source: WWF. Climate change impacts in China. http://wwf.panda.org/about_our_earth/aboutcc/problems/rising_temperatures/hotspot_map/china.cfm, accessed on 28 February 2016.

at the highest elevations. The rich and diverse wildlife include deer, elk, marten, hare and many other fur-bearing animals.

There are five UNESCO Biosphere Reserves in the NE: Changbaishan (Changbai Mountains), Fenglin, Wudalianchi, Lake Xingkai and Shedao Liaotieshan[64]. Among them, the Changbai Mountains as the source of the Songhua, Tumen and Yalu Rivers are regarded as a rare gene bank of species and natural museum in the world with the most typical natural composite body in the Eurasia Continent. Forests in the Changbai Mountains are the richest in the NE[65], and some of the late successional forests are of special significance because they remain quite undisturbed. Changbaishan Nature Reserve[66] was established in 1960 and involved in the UNESCO's Man and Biosphere program in 1980 as part of the world's biosphere reserves. The Reserve bears a great variety of wild species with 2806 flora species, 1558 fauna species and a fairly intact comprehensive ecosystem with primeval forests. According to website of the Changbaishan National Nature Reserve, the total value of biodiversity in the Changbaishan Nature Reserve is 7.82 billion Yuan, among which, the annual ecological benefits of 6.34 billion Yuan, the assessable annual social benefits of 1.05 billion Yuan and the gross annual economic benefits of 0.42 billion Yuan[67]. In addition to logging and hunting as two of the most pervasive threats to biodiversity in the NE, tourism development is another activity of concern to conservation in the Changbai Mountains, which implies that protected areas need to have a carefully planned system of buffer zone management (MacKinnon 1996).

Due to historical land reclamation in wetlands in the NE, original wetland ecosystem has been destroyed by intensive farming, and many of the wetlands with subject to flooding. Recently, the ecological restoration and conservation of the landscape, biodiversity and ecosystem of wetlands in the NE has served as national demonstration on the protection of wetland ecosystem. For example, Sanjiang Plain[68] (see Figure 6.1 in 6.2.1) in Heilongjiang Province as one of the production base for commodity grain of the NE and China since the 1950s, was originally wild marshy areas known as the "Great Northern Wilderness" with relatively fewer population in China. Nevertheless, it turns out to be the "Great Northern Granary" at present, which feeds about one sixth of China's

[64] Source: Wikipedia. List of 32 UNESCO Biosphere Reserves in China. https://zh.wikipedia.org/wiki/%E4%B8%AD%E5%9B%BD%E4%B8%96%E7%95%8C%E7%94%9F%E7%89%A9%E5%9C%88%E4%BF%9D%E6%8A%A4%E5%8C%BA, accessed on 28 February 2016. (in Chinese)

[65] Source: WWF. http://www.worldwildlife.org/ecoregions/pa0414, accessed on 28 February 2016.

[66] Or Changbai Mountains Nature Reserve is located on the eastern side of Jilin province, bordering North Korea. Approved by the State Council in 1986, it became a State-level reserve. In 2007, it was named a national 5A-Class Tourist Scenic Area (the highest level) by China's National Tourism Administration. (Source: http://124.205.185.3/publicfiles/business/htmlfiles/cbsbhq/bhqdsj/index.html, accessed on 12 October 2015 (in Chinese))

[67] Source: Overview of the Changbaishan National Nature Reserve. http://cbsnr.forestry.gov.cn/business/htmlfiles/cbsbhq/jqgk/index.html, accessed on 28 February 2016. (in Chinese)

[68] The Northeast Plain lies between the Greater and Lesser Khingan and Changbai Mountains and could be divided into three alluvial plains: the Songnen Plain in the middle-west formed by alluvium from the Songhua River and the Nen River, the Liaohe Plain in the south formed by alluvium from the Liao River and the Sanjiang Plain in the northeast formed by alluvium from the Heilong River, the Songhua River and the Wusuli River. (Source: Wikipedia, Northeast China Plain. https://en.wikipedia.org/wiki/Northeast_China_Plain, accessed on 28 February 2016)

population and composes to one fourth of China's commodity grain with only about one tenth of China's cultivated land, but its original wetlands has decreased significantly while natural hazards increased along with the land reclamation and the establishment of thousands of farms since the 1950s (Xinhua 2014). Another example is the Liaohekou National Nature Reserve at the mouth of the Liao River in Liaoning Province to protect endangered red-crowned cranes and Saunders gulls as well as the coastal wetland ecosystem[69].

6.2.3 Soil and agricultural conditions

The NE is the region with widest black soil series in China, especially black soil (in the centre, east and north) and Chernozem (in the west), and both of them are fertile black-coloured soil with a high percentage of humus and could produce a high agricultural yield. Other soil types in the NE include medow soil (in the south and west), sandy soil (in the west), saline soil and bog soil (in coastal area). There are large areas under permafrost in the mountains, especially in the northern part of the NE. In addition, soil erosion is a problem of sloping cultivated fields in the NE.

The vast plain area of the NE is suitable for mechanized farming, and huge areas are planted with commercial crops such as wheat, corn, soy beans, rice and sugar beets. The Sanjiang Plain in Heilongjiang Province is the largest rice production base in China. Particularly, the NE serves as a national strategic base for grain production and national grain safety in China (Ma and Niu 2009) with many studies on its regional grain production (e.g. Cheng and Zhang 2005a,b; Cheng 2009; Liu *et al* 2014). Some scholars believe that in order to improve grain production capacity and ensure national grain security, it is important for the NE to improve grain yield per unit area by accelerating construction of mechanized farming (Deng *et al* 2004; Cheng 2009). However, due to intensive farming in the NE, very little traces of the original forest remain in the plain area, though patches of forest can still be seen in some places where has been protected for religious reasons or the land is steep and inaccessible[70].

The NE has a relatively higher forest coverage rate in China, especially in the mountainous areas, which contributes to the NE as one of China's national base for agriculture and forestry. Nevertheless, lightning fires in Daxing'anling have significantly increased since 1987 as a consequence of climate change, with August as the month of most frequent lightning fires (Zhang and Hu 2008). Moreover, the NE is one of three regions of China that support substantial timber reserves, and "many of the forest stands have been subject to intensive logging resulting in replacement of late-successional forest by secondary growth and incursion by networks of logging roads that encourage further anthropogenic disturbance"[71]. In fact, according to Zhao *et al* (2009), even if the carbon sink capacity of the forest ecosystems in the NE has been

[69] Source: Basic information on Liaohekou National Nature Reserve. http://zrbhq.panjin.gov.cn/view.php?id=813&lm=2&layer=000001, accessed on 28 February 2016. (in Chinese)

[70] Source: Northeast China Plain deciduous forests, the Encyclopedia of Earth. http://www.eoearth.org/view/article/51cbee867896bb431f6987a8/, accessed on 28 February 2016.

[71] Source: WWF. http://www.worldwildlife.org/ecoregions/pa0426, accessed on 28 February 2016.

weakened since 2003, the total carbon absorption will still increase and the forest ecosystems in the NE are likely to remain a significant carbon sink and play a positive role in the mitigation of climate change.

6.2.4 Resource use

Resources can be either renewable resources (sunlight, air, wind, etc.) or non-renewable resources (earth minerals and metal ores, fossil fuels including coal, petroleum and natural gas, groundwater in certain aquifers, etc.)[72].

The NE as a region with abundant non-renewable resources in China is rich in mineral resources with relatively complete main metallic mineral deposits (e.g. iron, manganese, copper, molybdenum, lead, zinc, gold and rare elements) and non-metallic minerals (e.g. coal, oil, oil shale, graphite, magnesite, dolomite, talc and asbestos)[73]. Among them, the An'shan-Benxi Iron Ore as one of China's largest proven mining areas covers about one fourth of the country's total reserve[74]. In addition, there are several large oilfields in the NE, including Daqing Oilfield (China's largest oilfield), Liaohe Oilfield (China's fourth largest oilfield) and Jilin Oilfield. Besides, the NE has the largest oil shale reserves in China. According to China Statistical Yearbook 2015, 23.09% of China's ensured petroleum reserves in 2014 are located in the NE[75].

However, depletion of localized non-renewable resources in the NE has served as one of the bases for regional and national economic development since the 1950s. For example, there were 3292 mining companies, 4376 mining rights, 1.58 billion Yuan compensation for mineral resources and 10 billion Yuan investment in 33 key mining industrial projects with 155.1 billion Yuan main business income in Heilongjiang Province of the NE in 2013 (MLR 2015). Nevertheless, the increasing depletion of localized non-renewable mineral resources still fail to meet the requirements of economic development.

As to renewable resource use, the use of surface water and wind resources are the main renewable resource use in the NE. The annual total surface runoff of the NE is approximately 150 billion m^3 despite of disparities in spatial distribution: with the east more than the west while the north more than the south. In the plain areas, especially Songnen Plain and Sanjiang Plain, there are abundant wind resources in the spring.

In addition, the landscape of coastal areas as well as the 2920 km (mainland and island) coastal line[76] in the NE has changed a lot due to industrial construction and coastal

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[72] Source: Wikipedia. https://en.wikipedia.org/wiki/Non-renewable_resource, accessed on 12 October 2015.

[73] Source: Baidu Baike. Natural resources in the Northeast. http://baike.baidu.com/view/2748260.htm?fromtitle=%E4%B8%9C%E5%8C%97%E5%9C%B0%E5%8C%BA&fromid=7596883&type=search#4_2, accessed on 12 October 2015. (in Chinese)

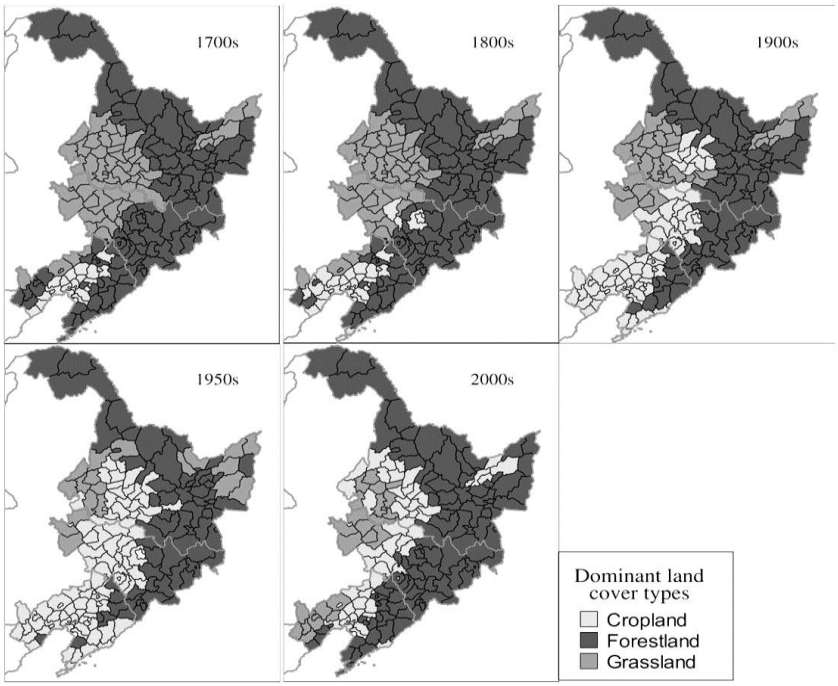
[74] Source: Chinabaike.com. A brief introduction to mineral resources in the Northeast. http://www.chinabaike.com/z/keji/ck/544266.html, accessed on 12 October 2015. (in Chinese)

[75] Data source: Table 8-5 Ensured Reserves of Major Energy and Ferrous Metals by Region (2014). China Statistical Yearbook 2015.

[76] Source: Natural Profile of Liaoning Province. http://www.ln.gov.cn/zjln/zrgm/, accessed on 12 October 2015. (in Chinese)

erosion in the past decades. As a result, the length of mainland coastal line decreased from 2170km in 1970 to 1906.33km in 2000, but increased to 2168.52km in 2012 due to the construction of several coastal industrial zones in Liaoning Province (Xu *et al* 2013). In some coastal cities, local governments' blind decisions on reclamation for construction projects have made substantial damage to the ecology of coastal wetlands and estuary areas[77].

The NE as one of the last remaining relatively less-exploited areas in China was explored much later than eastern China (such as YRD). Only during the last century has this region been fully explored and settled, and its land use and vegetation cover have changed more markedly than those in most parts of China (Ye and Fang 2009) (Figure 6.2). Greatly expanded cultivated land has helped to reduce China's food shortage problem. The NE is one of China's grain production base with a surplus grain output of more than 40% of the national output (Yin *et al* 2006).



Source: Ye and Fang (2011) p.416, Figure 8

Figure 6.2 Spatial pattern of land cover type changes in the NE during the past 300 years

According to Ye and Fang (2009; 2011), agricultural cultivation was the direct cause of land use and landscape change in the NE over the past 300 years, and land cover change in the NE during this period resulted from the continual disruption of the pristine natural landscape by external factors, mainly human migrations and resource exploitation. "The pristine forest and grassland were not only replaced by cropland and buildings but were also degraded through deforestation and overgrazing, especially in the early half of the twentieth century" (Ye and Fang 2011: 416). From 1930s to 1950s, land use in the NE was shaped by "a combination of deforestation, farmland abandonment, mining, urbanization, and war (including the Chinese-Japanese war and the Chinese Civil War)" (Ye and Fang 2011: 409), while in the latter part of the twentieth

[77] Source: Website of Liaoning Provincial Committee of Chinese People Consultative Conference. http://www.lnzx.gov.cn/lnszx/Newspapers/wyzx/2010-12-20/Article_19785.shtml, accessed on 12 October 2015. (in Chinese)

century, the introduction of new technologies allowed a rapid increase in agricultural development in the NE (Figure 6.2), and the growth of urban areas continued to affect land use patterns there: the total urban area for the 1930s, 1980s, 1990s and 2000s was 2536 km^2, 23380 km^2, 24829km^2 and 23560 km^2, respectively 0.32%, 3%, 3.2% and 3% of the total land area of the NE (Ye and Fang 2011: 414).

6.3 The environment of YRD

In accord with 6.2, this part mainly introduces the environment of YRD in the following four aspects: geographical location and climate (6.3.1), biome and ecosystem (6.3.2), soil and agricultural conditions (6.3.3) as well as resource use (6.3.4).

6.3.1 Geographical location and climate

The region of YRD (E116°18′ - E123°27′, N27°12′ - N35°20′) is located in the middle of China's eastern coastal areas on the west coast of Pacific Ocean. Most of YRD has a humid subtropical climate with four distinct seasons, with beginning to transition into a humid continental climate in the far north.

Overall, the climate of YRD features with hot and humid summers, cool and dry winters as well as warm spring and fall. The average annual temperature of YRD is around 13°C to 19°C, with average July temperature around 26°C to 30°C. The average January temperature ranges around -1°C to 4°C in the northern part and around 2°C to 8°C in the southern part. In summer, the warm and damp air moves in from the Pacific and forms the heat in YRD.

The annual average precipitation of YRD ranges from about 800-1000 mm in the north and about 1200-1900 mm in the south, concentrated mostly in summer during the southeast monsoon. Rain falls frequently during the Meiyu season or the East Asian rainy season[78] for nearly two months in late spring and early summer. Although the main rainy season is summer, there is some rain throughout the year.

YRD is not only threatened by flood (particularly the Yangtze River Flood) in the late spring and early summer during the Meiyu season, but also susceptible to typhoons forming in the Pacific with rainstorms occur in late summer and early autumn. In addition, there has been a 7-fold increase in frequency of floods in Yangtze River since 1950s and an increasing frequency of extreme rains with more intense summer rains in YRD since 1997 due to climate change[79]. Consequently, many cities in YRD have to face an increased threat from flooding.

According to Gu *et al* (2011), climate change has been shaping the Delta and its socioeconomic development, while the urbanization process has contributed to climate

[78] "The East Asian rainy season, commonly called the plum rain (Meiyu), is caused by precipitation along a persistent stationary front known as the Meiyu front for nearly two months during the late spring and early summer between eastern Russia, China, Taiwan, Korea, and Japan. The wet season ends during the summer when the subtropical ridge becomes strong enough to push this front north of the region." (Source: Wikipedia. https://en.wikipedia.org/wiki/East_Asian_rainy_season, accessed on 8 October 2015.)

[79] Source: WWF. Climate change impacts in China. http://wwf.panda.org/about_our_earth/aboutcc/problems/rising_temperatures/hotspot_map/china.cfm, accessed on 28 February 2016.

change in the light of YRD's built environment unadaptable to future climate change. "In the past century, the temperature rose 0.78°C in YRD, slightly higher than the average global warming rate" (Gu *et al* 2011: 550). "In the 1990s, climate change has become even faster in YRD; the annual average temperature of the cities in YRD was 0.96°C higher than the previous 4 decades", and the average temperature in Shanghai even rose 0.73°C every 10 years (Gu *et al* 2011: 550).

Moreover, YRD is one of the most sensitive areas of the sea-level changes in the world. During the past century, China's sea-level rose by 1.4 mm per year on average, 14 cm in total, but the see level rose more than 20 cm along the coast of YRD (Gu *et al* 2011: 550). In consideration of global sea-level rise and ground subsidence in YRD, it is predicted that by 2030 the sea-level would rise 36-38 cm per year around Shanghai and 32-34 cm per year in coastal areas in Jiangsu Province; between 2030 and 2050, the sea-level would continue to rise 21-23 cm (Ren 1993; Sun *et al* 1997; Liu and Ye 2005).

6.3.2 Biome and ecosystem

According to the biome classification of China based on plant functional types by Ni (2001), YRD is featured with Warm-temperate broad-leaved evergreen and mixed forest.

In YRD, Zhejiang Province is rich in bio-diversity with a wide variety of wildlife and tree species, among which 123 are national key protected wild animals and 51 are rare and endangered plants of China[80]. Jiangsu Province is rich in plant resources, with more than 850 species of plants in 2013, among which more than 600 are wild plants[81]. There are three UNESCO Biosphere Reserves in YRD: Yancheng Coastal Birds Biosphere Reserve, Tianmu Mountain Biosphere Reserve and Nanji Archipelago Biosphere Reserve[82]. Among them, the Yancheng Coastal Birds Biosphere Reserve is the first nature reserve in the world for the protection of wild elk with special landscape and ecology of wetlands[83].

More importantly, besides the UNESCO Biosphere Reserves, there are three Globally Important Agricultural Heritage Systems (GIAHS) [84] designated harmonious ecosystems in YRD: the Kuaijishan Ancient Chinese Torreya (2013), the Rice-Fish

[80] Source: Statistical Bureau of Zhejiang Province. http://www.zj.stats.gov.cn/zjsq/zygk/, accessed on 12 October 2015. (in Chinese)

[81] Source: People's Government of Jiangsu Province. http://www.jiangsu.gov.cn/zgjszjjs_4758/jsgl/zrzy/201409/t20140912_339976.html, accessed on 12 October 2015. (in Chinese)

[82] Source: Wikipedia. Members of the UNESCO Biosphere Reserves in China. https://en.wikipedia.org/wiki/Biosphere_Reserves_of_China, accessed on 8 February 2016.

[83] Source: http://www.chinamlw.org/, accessed on 12 October 2015. (in Chinese)

[84] Globally Important Agricultural Heritage Systems (GIAHS) are defined as "remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the co-adaptation of a community with its environment and its needs and aspirations for sustainable development". (Source: http://www.fao.org/giahs/giahs/en/, accessed on 8 February 2016) GIAHS was initiated in 2002 by the Food and Agricultural Organization of the United Nations (FAO) to help conserve and support world's agro-cultural heritage systems. To date, there are 8 GIAHS in China, 19 in Asia and 27 worldwide. (Source: http://english.agri.gov.cn/news/dqnf/201404/t20140423_21714.htm, accessed on 8 February 2016.)

Culture System (2005) and the Xinghua Duotian Agrosystem (2014)[85]. All of them have a history over thousand years and represent remarkable harmonious human-environment relationship of sustainable development.

The plain area of YRD is part of China's third largest plain — Middle and Lower Yangtze River Plain after Northeast China Plain and North China Plain, with Lake Tai and Hongze Lake as the third and fourth largest freshwater lakes of China. In the plain areas in YRD, harmonious ecosystems based on remarkable water-land utilization have been created by local residents in history for agriculture while protecting biodiversity, such as the Rice-Fish Culture System (2005) and the Xinghua Duotian Agrosystem (2014) as GIAHS mentioned above. For one thing, the ingenious agricultural rice-fish mutuality is based on ecological symbiosis: on the one hand, fish provides fertilizer to rice, regulates micro-climatic conditions, softens soil, disturbs water and eats larvae and weeds in the flooded fields; on the other hand, rice provides shade and food for fish[86]. For another, Xinghua Duotian Agrosystem is a typical example of wetland agro-system, known for its indigenous management of low-lying land in water bodies and the splendid landscape created by miles of "duotian" (elevated pieces of field) above water which is rarely seen in the world (MOA 2013).

In southern mountainous areas of YRD, another harmonious ecosystem has been created and developed by the Kuaijishan Ancient Chinese Torreya Community in Shaoxing, which prevents soil erosion while providing diverse 'high value' economic products such as nuts, medicine, oil and ornaments from the trees, which reflects a highly sustainable mode of human survival through the careful transformation, sustainable management and utilization of natural resources[87].

However, ecosystems in YRD has paid a great price for rapid industrialization and urbanization with loss of biodiversity, land degradation and serious ecological damage. YRD is increasingly affected by extreme weather and its ecosystems are under threat (BBC 2009), and YRD has become China's new eco-environmental vulnerable zone (Gu *et al* 2011).

6.3.3 Soil and agricultural conditions

The plain area of YRD is mainly covered with paddy soil formed by perennial cultivation of rice in the past thousands of years, which is part of the South China Rice Zone famous for rice production. Actually, the paddy soil in YRD is the best-quality paddy soil in the South China Rice Zone, and it is almost the best-quality cultivated land in China in addition to newly-cultivated black soil in the NE, with even better maintenance of soil fertility than black soil due to soil degradation of the latter by cumulative cultivation since the 1950s. Other soil types in YRD are with less soil fertility including loess and laterite

[85] Source: GIAHS. http://www.fao.org/giahs/giahs-sites/asia-and-the-pacific/en/, accessed on 8 February 2016.

[86] Source: GIAHS. The Rice-Fish Culture Systems in China. http://www.fao.org/docrep/016/ap203e/ap203e.pdf, accessed on 8 February 2016.

[87] Source: GIAHS. Kuaijishan Ancient Chinese Torreya, China. http://www.fao.org/giahs/giahs-sites/south-east-asia/kuaijishan-ancient-chinese-torreya-china/detailed-information/en/, accessed on 8 February 2016.

in southern mountainous areas and solonchak in coastal areas.

YRD is among China's comprehensive high-yield agricultural areas with many famous agricultural products such as rice, tea, silk, aquatic products, citrus and bamboo products. Moreover, local residents of YRD has formed unique agricultural tradition with harmonious ecosystems as GIAHS (see 6.3.2).

The main challenges for agriculture in YRD are continuously decreasing cultivated land and pollution. On the one hand, the percentage of cultivated land in YRD has been continuously decreasing along with the rapid increase of construction land since the 1990s, and many farm land has been changed into construction land or industrial park due to urbanization and industrialization since 1978. On the other hand, water pollution, acid rain (annual rain pH<5.6), soil pollution (both heavy metal and organic pollution) and solid waste accumulation during industrialization and urbanization have become prominent challenges for agriculture in YRD (Gu *et al* 2011).

6.3.4 Resource use

YRD is in general not rich in natural mineral resources (compared to the NE), and the main mineral resources of the region are non-metallic minerals. The Donghai County of Lianyungang City in Jiangsu Province is known as "China's Crystal Capital".

YRD is rich in island and coastline resources. Along the eastern rugged coastline, there are more than 3000 islands with an area larger than 500 m^2 as well as many bays (e.g Hangzhou Bay). Am them, Chongming Island and Zhoushan Island are the third and fourth largest islands of China after Taiwan and Hainan. There are 7930.64 km coastline (mainland and island) in YRD, which accounts for 24.78% of the national total. Particularly, the length of deep-water coastline suitable for berths above 10000 tons in Zhejiang Province is 290.4 km, which accounts for one third of the country. Among them, there are 105.8 km of deep-water coastline suitable for berths above 100000 tons.

In addition, YRD takes lead on renewable energy use in China especially on wind power. There are abundant wind resources in YRD, especially in the eastern coastal areas between Nantong and Lianyungang in Jiangsu Province, with an annual average wind speed above 5 m/s, annual effective wind power hours above 6000 h and an annual average wind power density up to 200 W/m^2. In 2015, the offshore wind power installed capacity in Jiangsu Province reached 4.7 million kW and ranked the first in China[88].

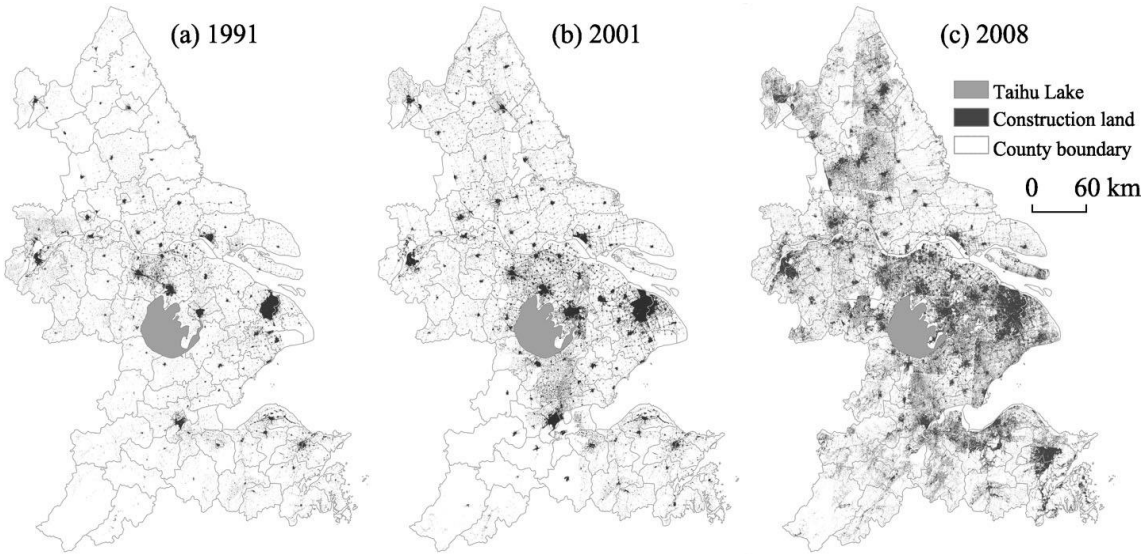
Although there are many lakes, rivers and canals in YRD, many of them are heavily polluted due to wastewater discharge and leads to quality-induced water shortage as a consequence. According to Gu *et al* (2011: 549-550), the YRD section of the Beijing-Hangzhou Grand Canal, Lake Tai, the downstream section of the Yangtze River and the Qiantang River all suffer from various degrees of pollution, and Lake Tai does the most. In addition, suffered from atmospheric pollution especially SO_2 pollution, almost the whole YRD is threatened by acid rain with the annual rain pH<5.6, and acid rain has happened in 14 of the 16 central cities (Gu *et al* 2011: 550). As a result, YRD becomes an area with the highest industrial and domestic waste emission intensity in

[88] Source: http://science.china.com.cn/2016-02/29/content_8600458.htm, accessed on 2 March 2016. (in Chinese)

China: the industrial wastewater and exhaust emissions account for about 9.5% and 5.3% of the nation respectively (Gu *et al* 2011: 550).

Along with the process of regional industrialization and urbanization, construction land has increased rapidly in YRD since 1991 and the proportion of construction land is much higher than the national average (Wang *et al* 2015: 856). According to China Statistical Yearbook 2015[89], in 2013, 17.83% of the total area of YRD were occupied by construction land, much higher than the NE (5.28%) and the national average (3.90%). In other words, more than one tenth (10.06%) of China's construction land was located in YRD in 2013, while the area of YRD is only equivalent to 2.20% of the national total.

According to Wang *et al* (2015), among all the cities in YRD, Shanghai took the greatest percentage on construction land; spatially, areas where government departments located became the growth centre of construction land; prefecture-level cities were the fastest growth region and the changing trend showed circle layered characteristics and significant increase with Shanghai and Suzhou as the core (Wang *et al* 2015: 856-857) (Figure 6.3).

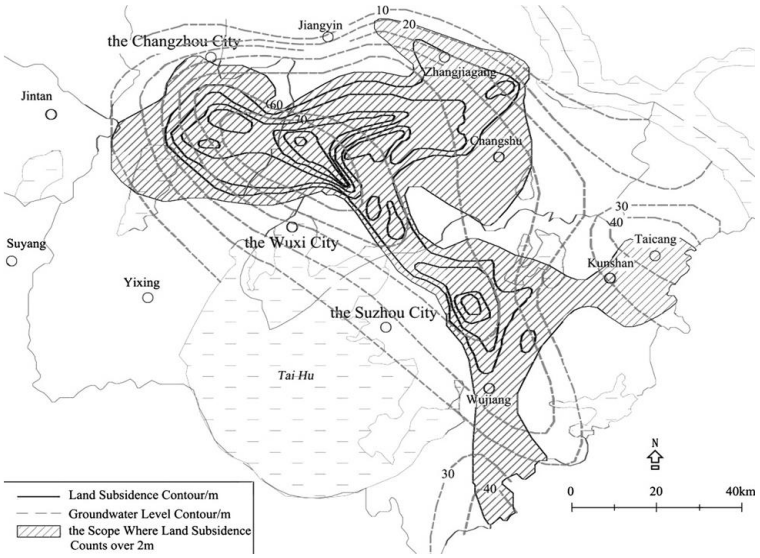


Source: Wang *et al* (2015) p.857, Figure 2

Figure 6.3 Construction land of YRD: 1991, 2001 and 2008

And what's more, many cities in YRD suffered from land subsidence due to over-extraction of groundwater and water pollution, such as Suzhou-Wuxi-Changzhou (Figure 6.4) and Hangzhou-Jiaxing-Huzhou in the southern plain area and Shanghai. Due to ground subsidence, in Shanghai, its sandy soil has required its skyscrapers to be built with deep concrete piles to stop them from sinking into the soft ground of the central area.

[89] Data source: Table 8-24 Land Use by Region (2013). China Statistical Yearbook 2015.



Source: Liu and Ye (2005)

Figure 6.4 Land subsidence in Suzhou, Wuxi and Changzhou in YRD

6.4 Quantitative environmental path-assets analysis of the NE and YRD

Based on the general facts of the environment of the NE (6.2) and YRD (6.3) as well as the availability of statistical data, this part mainly conducts quantitative environmental path-assets analysis of the NE and YRD in the following seven aspects: forest (6.4.1), natural reserves (6.4.2), energy consumption (6.4.3), air quality (6.4.4), water quality (6.4.5), environmental accidents (6.4.6) and investment in pollution treatment (6.4.7). The main data sources are official statistical data published in NBSC (2015) as well as national and provincial statistical yearbooks at various years.

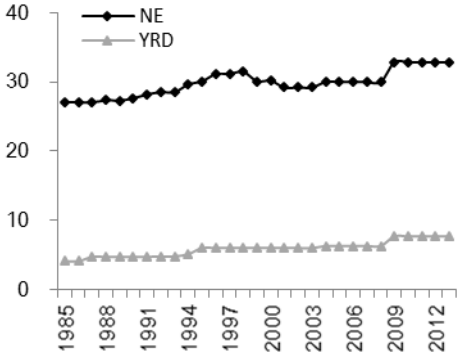
6.4.1 Forest

China is one of the world's most forest-deficient countries, with only 0.1 ha of forest per person, compared with a world average of 0.6 ha, and deforestation is a major cause of soil erosion and flooding in China (Liu and Diamond 2005: 1182). In line with the progress of rapid urbanization and industrialization in China since 1978, demands for the environmental functions of the forest have been increasing for national and regional development such as air purification, headwater conservation for the alleviation of water shortages and floods by stabilizing stream flow, prevention of noise, conservation of biodiversity and prevention of disasters in mountain areas such as landslides or erosion.

This study mainly analyses forest area and forest coverage rate[90] of the NE and YRD from 1985 to 2013 due to the availability of statistical data. Data for the NE and YRD are calculated from provincial statistical data. The main data sources are NBSC (2015) with national and provincial statistical data from 2004 to 2013 and provincial statistical yearbooks (1986-2004) with provincial statistical data from 1985 to 2003.

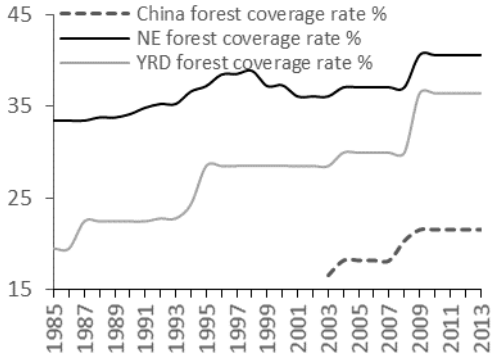
[90] Forest area refers to "the area of trees and bamboo grow with a canopy density above 0.2 degree, the area of shrubby tree according to regulations of the government, the area of forest land inside farm land and the area of trees planted by the side of villages, farm houses and along roads and rivers" (NBSC 2015). Forest coverage rate is the ratio of forest area to the total land area, which reflects the status of abundance of forest resource and eco-system balance.

The forest area and forest coverage rate increased in the NE and YRD from 1985 to 2013, and the NE took lead of YRD (Figure 6.5 and Figure 6.6). The forest coverage rate of the NE and YRD remains above the national average from 2003 to 2013 (Figure 6.6). The leading position of the NE on the forest lies in that the NE is China's main forest-harvesting base with abundant forest resources in the mountainous areas in the region, and the total volume there accounts for about one third of the country.



Source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 6.5 Forest area (10^4 km^2), NE and YRD, 1985-2013



Source: NBSC (2015) and provincial statistical yearbooks at various years

Figure 6.6 Forest coverage rate, NE, YRD and China, 1985-2013

6.4.2 Natural reserves

This study mainly analyses the area of natural reserves[91] of the NE and YRD from 2000 to 2013 with reference to the year of 1995, since before 2000 the only national and provincial statistical data available are for the year of 1995. The data sources are NBSC (2015) with national and provincial data from 2004 to 2013 and national and provincial statistical yearbooks from 1996 to 2004 with data before 2004.

On the one hand, the total area of nature reserves in the NE as well as its percentage to regional land area is more than YRD. Moreover, the area of nature reserves in the NE keeps increasing and it increased almost 3 times from 1995 to 2013, with 14.9% to the regional land area in 2013 (Table 6.1).

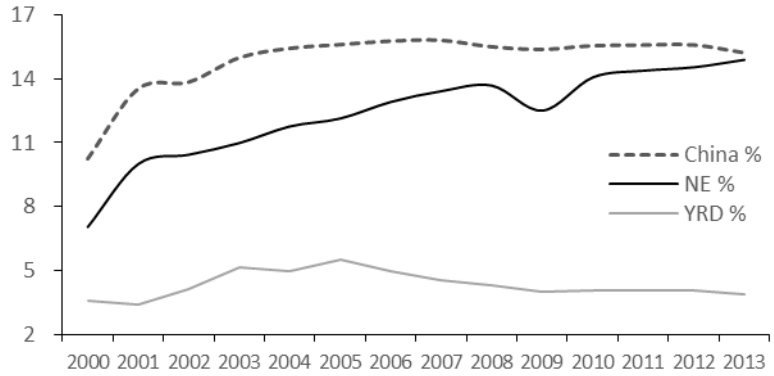
Table 6.1 Area of nature reserves and its percentage to the total regional land area, 1995, 2000-2008

	NE		YRD	
	Area of nature reserves (km^2)	Percentage of nature reserves area to total land area (%)	Area of nature reserves (km^2)	Percentage of nature reserves area to total land area (%)
1995	39760	5.0	5038	2.4
2000	56969	7.0	7609	3.6
2005	98130	12.1	11670	5.5
2009	101120	12.5	8500	4.0
2013	120410	14.9	8230	3.9

Data source: NBSC (2015); China and respective provincial statistical yearbooks 1996-2004

[91] According to NBSC (2015), natural reserves "refer to number of certain areas of land, or waters that have been set aside and put under special protection and management in order to protect natural environment and natural resources, and promote the sustainable development of national economy. They are subject to formal approval from governments of various levels. According to the protected targets, natural reserves can be divided into three categories: reserves of natural ecological system, natural reserves of wildlife species, and natural heritage of historical significance. Scenic spots and cultural preservation zones are not included."

On the other hand, the NE and YRD were below the national average on the percentage of nature reserves area to total land area from 2000 to 2013, and YRD was far less than the NE and national average (Figure 6.7). The main reason might be that quick industrialization as well as urbanization in the region of YRD intentionally or unintentionally occupied part of the nature reserves to meet the needs for regional economic growth.



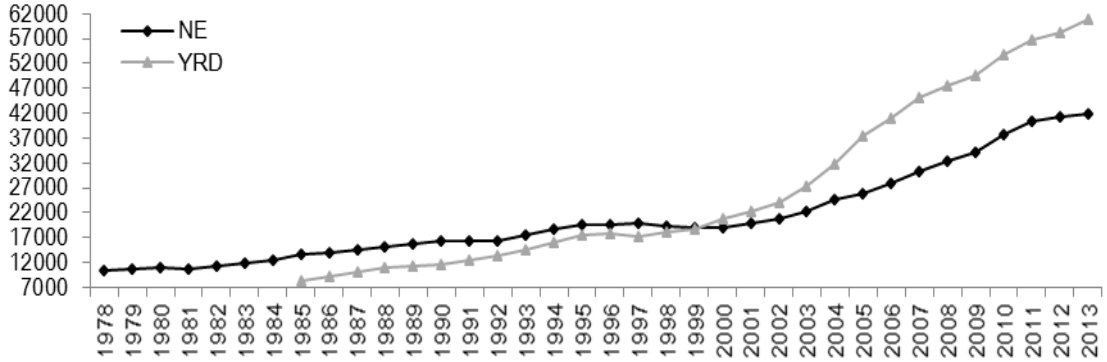
Source: NBSC (2015); China and respective provincial statistical yearbooks 1996-2004

Figure 6.7 Percentage of the nature reserves area to total land area, NE, YRD and China, 2000-2013

6.4.3 Energy consumption

This study analyses two indicators for energy consumption in the NE and YRD: the total amount of energy consumption and energy consumption per unit of GRP. The main data sources are respective provincial statistical yearbooks at various years with provincial data from 1978 to 2013, and the data for the NE and YRD are calculated from provincial data. Owing to the fact that there is no statistical data for Jiangsu Province and Zhejiang Province before 1985, the analysis of YRD is only possible from 1985 to 2013. In addition, the source of national data is NBSC (2015) with statistical data from 1978 to 2014.

For one thing, the total amount of energy consumption by Standard Coal Equivalent (SCE)[92] increased in both regions since 1978, and YRD with a faster annual increasing rate on the total amount of energy consumption consumes more energy than the NE since 2000 (Figure 6.8).

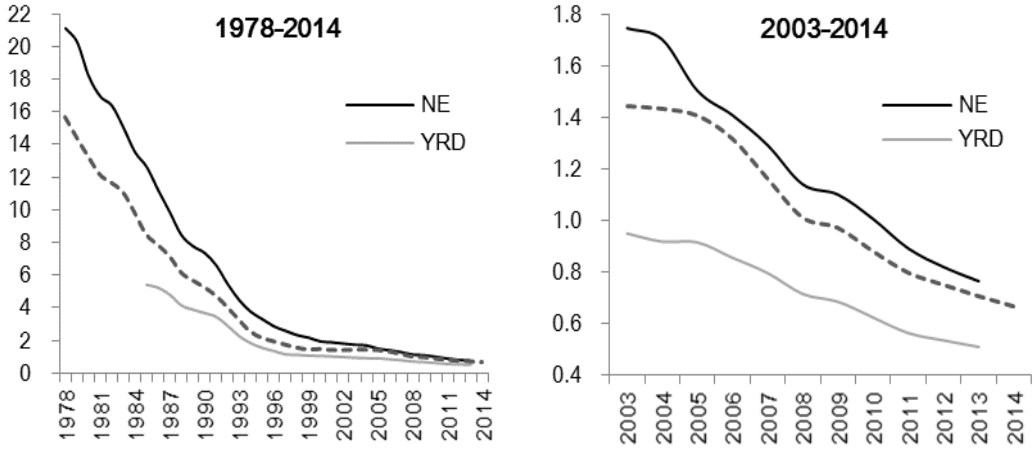


Data source: provincial statistical yearbooks at various years

Figure 6.8 Total energy consumption (10000 tons of SCE), NE and YRD, 1978-2013

[92] Standard Coal Equivalent (SCE), a measurement of energy given as the mass of coal. 1 kW is equivalent to 0.1229 kg SCE.

For another, the energy consumption per unit of GRP has been decreasing in both regions and in China since 1978. The NE remains higher than the national average while YRD remains lower than the national average, which implies that the NE consumes more energy for economic growth per unit, while YRD takes lead on energy saving compared to the national average and the NE (Figure 6.9).



Data source: provincial statistical yearbooks at various years; NBSC (2015)

Figure 6.9 Energy consumption per unit of GDP (SCE/10000 Yuan), NE, YRD and China, 1978-2014

In a word, as for energy consumption, notwithstanding a steady increase in the total amount of energy consumption in accord with the regional economic performance, YRD consumed less energy than the NE and the national average per unit of GDP from 1985 to 2013, whilst the energy consumption per unit of GDP of the NE remains higher than the national average since 1978, which reflects the disparity between the two regions on industrial structure and performance.

6.4.4 Air quality (main cities)

In China, air quality is evaluated and published by daily air quality index (AQI) with status and grades of air quality (Table 6.2). According to the National Ambient Air Quality Standards of China (SEPA 1996, 2000), the air quality of cities should meet the Grade II standard considering of health and safety of citizens. Unfortunately, the NE and YRD are among the two large pollution areas in China in light of the annual average of daily AQI (Ren *et al* 2004).

Table 6.2 AQI, status and grades of air quality in China

AQI	Status	Grades
0-50	Very good	I
51-100	Good	II
101-150	Mild polluted	III
151-200	Moderate polluted	IV
201-300	Heavily polluted	V
>300	Severely polluted	VI

Source: MEP (2015)

According to State Council (2010), YRD is one of the three key regions (with Jingjinji and Pearl River Delta) in China for starting the joint prevention and control work of regional atmospheric pollution and central Liaoning of the NE is among the regions which should actively promote the joint prevention and control work of regional

atmospheric pollution, with the goal of making air quality of every city in the region meet or be better than the Grade II National Ambient Air Quality Standard by 2015. Presently, there are 29 cities in the NE and YRD (12 cities in the NE and 17 cities in YRD) for air quality monitoring (MEP 2015), and this study analyses the AQI of the 12 cities in the NE (Table 6.3) and 17 cities in YRD (Table 6.4) from 2000 to 2013 with MEP (2015) as the main data source.

In the NE, there are two cities which are in more than 20% of the valid monitoring days of the year with AQI worse than Grade II, four cities with percentage between10% and 20% and six cities with percentage less than 10% (Table 6.3).

In YRD, there are two cities with percentage more than 20%, thirteen cities between 10% and 20% with AQI worse than Grade II and two cities with percentage less than 10% (Table 6.4).

In 2013, most of the cities in the NE and YRD suffered from air pollution, which implies the air quality deteriorates in both regions. In fact, factories of pharmaceutical or chemical companies in the manufacturing sector are potential threats to local air quality and local residents' health[93]. In addition, haze happened more frequently in YRD in the past decade due to industrial pollution and became a respiratory health threat to local residents. For instance, in 2009, haze occurred in Shanghai for 134 days, in Suzhou for 169 days and in Nanjing even for 211 days[94].

[93] For example, according to a report of the State broadcaster – China Central Television (CCTV) on 5 June 2011, the General Pharmaceutical Factory of Harbin Pharmaceutical Group Co Ltd, one of the biggest producers of penicillin and other antibiotics in China, based in Harbin, capital of Heilongjiang province in the NE, has not done enough since 2004 to eliminate the causes of its pollutant discharges during production. The smell is so bad that residents living nearby have taken to wearing masks and closing the windows of their homes. Independent tests have found that the amount of hydrogen sulfide in the air near the factory is 1550 times higher than the limit allowed by national regulations and the amount of ammonia gas is about 20 times higher (China Daily 2011).

[94] Source: http://policy.caing.com/2011-03-02/100231026.html, accessed on 28 August 2015. (in Chinese)

Table 6.3 Percentage of number of the days with AQI worse than Grade II to number of valid monitoring days of the year of the main cities in the NE, 2000-2013

	Shenyang	Dalian	Anshan	Fushun	Benxi	Jinzhou	Changchun	Jilin	Harbin	Qiqihar	Daqing	Mudanjiang
2000	25.36%	0.95%					10.00%		20.67%			
2001	56.40%	4.36%					11.72%		23.71%			
2002	44.38%	4.66%					6.58%		22.19%			
2003	18.36%	4.38%					6.30%		18.63%			
2004	17.76%	4.64%	27.49%	22.27%			5.74%		18.58%	11.85%		18.48%
2005	13.15%	5.21%	22.74%	22.47%			6.85%		17.53%	5.48%		15.89%
2006	12.05%	7.40%	20.27%	19.18%			6.85%		15.62%	10.68%		14.25%
2007	11.51%	7.40%	19.73%	16.16%			6.85%		15.62%	4.93%		12.88%
2008	11.75%	3.55%	16.12%	7.65%			6.56%		15.85%	4.37%		8.74%
2009	9.89%	1.65%	19.78%	9.34%			6.87%		14.84%	5.22%		7.14%
2010	9.89%	1.10%	11.81%	9.07%			6.59%		14.29%	5.77%		5.49%
2011	9.07%	3.02%	11.26%	9.34%	2.79%	4.02%	5.49%	3.72%	13.19%	5.22%	3.10%	5.77%
2012	9.86%	3.84%	4.38%	6.03%	3.56%	3.01%	7.40%	7.12%	12.88%	2.19%	2.19%	1.92%
2013	85.71%	28.57%	8.65%	10.66%	3.75%	5.48%	64.29%	13.83%	78.57%	5.48%	5.76%	10.09%
average	23.94%	5.77%	16.22%	13.22%	3.37%	4.17%	11.29%	8.22%	21.58%	6.12%	3.68%	10.07%

Data source: MEP (2015)

Table 6.4 Percentage of number of the days with AQI worse than Grade II to number of valid monitoring days of the year of the main cities in YRD, 2000-2013

	Shanghai	Nanjing	Wuxi	Xuzhou	Changzhou	Suzhou	Nantong	Lianyungang	Yangzhou	Zhenjiang	Hangzhou	Ningbo	Wenzhou	Jiaxing	Huzhou	Shaoxing	Taizhou
2000	10.48%	25.24%				1.90%	8.57%				7.14%						
2001	15.26%	32.70%				9.54%	18.26%	16.59%			24.25%	2.86%	3.00%				
2002	23.01%	41.37%				31.51%	25.21%	27.67%			27.95%	4.11%	2.47%				
2003	10.96%	18.63%				21.37%	11.51%	15.89%			19.73%	7.95%	1.10%				
2004	15.85%	19.40%				16.39%	11.75%	11.75%	18.48%	27.01%	20.22%	8.20%	3.01%		10.43%	1.42%	
2005	11.78%	16.71%				12.33%	11.78%	10.96%	13.15%	11.78%	17.53%	9.59%	2.19%		9.86%	9.32%	
2006	11.23%	16.44%				11.23%	12.05%	11.23%	12.88%	15.07%	18.08%	10.14%	2.74%		10.41%	10.41%	
2007	10.14%	14.52%				10.68%	11.51%	9.86%	11.23%	9.04%	15.62%	9.86%	1.10%		9.04%	13.15%	
2008	10.38%	11.75%				11.20%	12.02%	8.47%	12.02%	9.29%	17.49%	10.93%	3.55%		9.29%	14.21%	
2009	8.52%	13.74%				9.89%	7.14%	8.24%	7.14%	10.99%	10.44%	10.16%	3.30%		7.97%	15.11%	
2010	7.97%	17.03%				9.89%	9.62%	8.24%	12.36%	9.07%	13.74%	13.46%	7.14%		9.89%	11.81%	
2011	7.69%	13.19%	4.95%	9.29%	8.05%	8.24%	7.14%	9.07%	11.26%	7.14%	8.79%	11.54%	7.97%	8.05%	13.46%	11.54%	2.48%
2012	6.30%	13.42%	5.75%	9.86%	7.95%	7.40%	9.04%	12.33%	12.05%	11.78%	8.22%	6.03%	6.03%	5.21%	11.51%	13.15%	1.37%
2013	0.00%	71.43%	28.57%	57.14%	21.43%	35.71%	21.43%	35.71%	7.14%	7.14%	42.86%	28.57%	7.14%	21.43%	42.86%	57.14%	19.05%
average	10.68%	23.26%	13.09%	25.43%	12.48%	14.09%	12.65%	14.31%	11.77%	11.83%	18.00%	10.26%	3.90%	11.56%	13.47%	15.73%	7.63%

Data source: MEP (2015)

6.4.5 Water quality (key monitored sections of rivers and lakes)

According to SEPA (2002), the surface water quality is divided into five grades in China: Grade I with the best quality and Grade V with the worst quality; V+ means the water quality is even worse than Grade V (Table 6.5).

Table 6.5 Surface water quality standard of China

Grade	Function	Quality
I	source of the water body and national nature reserve	drinking water quality
II	Class one water source protection area for centralized drinking water supply, natural habitat for rare fish species and spawning grounds for fish and shrimps	
III	Class two water source protection area for centralized drinking water supply, sanctuaries for common species of fish, and swimming zones	
IV	mainly applicable to water bodies used for general industrial water supply and recreational waters in which there is no direct human contact with the water (non physical)	polluted
V	mainly applicable to water bodies used for agricultural water supply and for general landscape requirements	polluted
V+	essentially useless	highly polluted

Source: SEPA (2002)

There are 47 key monitored sections in the NE and YRD[95]. This study mainly analyses the water quality in two selected sections from 2004 to 2014 as examples: the section of Liaohe Park in Yingkou City (Liao River, NE) and the section of Qingpu Jishuigang in Shanghai City (Lake Tai, YRD). The data source is MEP (2015) with automatic water quality weekly monitoring data of the key sections.

The section of Liaohe Park in Yingkou City of the Liao River in the NE is observed with Grade IV as the worst records in 2013 and 2014, compared to many weeks pro year with records of worse than Grade V (V+) and Grade V from 2004 to 2012. Grade III first appeared at this section in 2012 with a record of 9 weeks, but then the records of Grade III declined from 16 weeks in 2013 to 10 weeks in 2014 (Table 6.6).

[95] By the end of August 2015, there were 31 key monitored sections in the NE (21 sections in Songhua River, 8 sections in Liao River as well as 2 sections in Xingkai Lake) and 16 key monitored sections in YRD (7 sections in Lake Tai, 6 sections in Huai River, 2 sections in Yangtze River as well as 1 section in Qiantang River) (MEP 2015).

Table 6.6 Water quality grades of the monitored section in Liao River at Liaohe Park, Yingkou, 2004-2014

week	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	V+	V+	V+	V+	V+	V	V+	V	★	IV	IV
2	V+	V+	V+	V+	V+	V		V	★	IV	IV
3		V+	V+	V+	V+	V+		V	★	IV	IV
4	V+	V+	V+	V+	V+	V+		V	★	★	IV
5	V+	V+	V+	V+	V+	V+		V	★	★	IV
6	V+	V+	V+	V+		V+	★	V+	★	★	IV
7	V+		V+	V+	V+	V+	★	V+	★	★	IV
8	V+	V+	V+	V+	V+	V+	★	V+	★	★	IV
9	V+	V+	V+	V+	V+	V+	★	V+	★	★	IV
10	V+	V+	V+	V+	V+	V+	★	V+	★	★	IV
11	V+	V+	V+	V+	V	V+	★	V+	★	★	IV
12	V+	V+	V+	V+	V	V+	★	V+	★	★	IV
13	V+	V+	V+	V+	V+	V+	V+	V+	★	★	IV
14	V+	V+	V+	V+	V+	V+	V+	V+	★	★	IV
15	V+	V+	V+	V+	V+	V+	V+	IV	★	★	IV
16	V+	V+	V	V+	V+	V+	V+	IV	★	★	IV
17	V	V+	V+	V+	V+	V+	V+	V	★	★	IV
18	V+	V+		V+	V	V+	V+	V+	★	★	IV
19	V+	V+	V+	V+	IV	V+	V+	V+	V+	IV	IV
20	V+	V+	V+	V+	V+	V+	V+	V+	IV	IV	III
21	V+	V+	V+	V	V	V	V+	V	IV	III	IV
22	V+	V+	V+	V	V	V	V	V	IV	III	IV
23	V+	V+	V	IV	V	V	IV	IV	IV	III	IV
24	V+	V+	IV	IV	V	V+	IV	V	III	III	IV
25	V	V+	V	V	V+	V	V	IV	III	III	III
26	V	V+	IV	V+	V+	V	V	IV	IV	III	IV
27	V+	V+	V+	V+	V+	V	V	IV	III	IV	IV
28		V+	V+	V+	V+	V	V+	IV	III	III	IV
29		V+	V+	V+	V+	V	V+	IV	IV	III	IV
30		V	V+	V+	V+	V	V	IV	IV	IV	IV
31	V+	V+	V+	V+	V+	V+	V	IV	III	III	IV
32	V+	V+	V+	V+	V+	V	V	IV	IV	III	III
33	V	V+	V+	V+	V+	V	V	IV	IV	III	IV
34	V	V+	V	V+	V+	V	V	IV	IV	III	IV
35	V	V	IV	V+	V	V	V+	V+	III	III	III
36	V	IV	V+	V+	IV	IV	V+	IV	III	III	III
37	V	V	V+	V	IV	V	V+	V	III	III	III
38	V+	IV	V+	V	IV	IV	V	V	IV	III	III
39		V+	V+	V+	IV	IV	V	V+	III	IV	IV
40	V+	V+	V+	V+	IV	IV	V+	V	IV	IV	III
41	V+	V+	V+	V+	IV	IV	V+	V	IV	IV	IV
42	V+	IV	V+	V	IV	IV	V	V+	IV	IV	IV
43	V+	IV	V	V	IV	V	IV	V+	IV	IV	IV
44	V+	IV	IV	V+	V+	V+	V	V+	V	IV	IV
45	V+	IV	V	V+	V+	IV	V	V+	V+	IV	IV
46	V	V	V+	V+	V+	V+		V+	V+	IV	IV
47	V+	V	V+	V+	V+	V+	IV	V	V+	IV	IV
48	V+	V+	V+	V+	V+	V+	IV	V	V+	IV	III
49	V+	V+	V+	V+	V	V+	V+	V	V+	IV	IV
50	V+	V+	V+	IV	V	V+	V+	V+	V	IV	IV
51	V+	V+	V+	V	V	V+	V+	V+	V+	IV	IV
52	V+	V+	V+	V	IV		V+	V+	IV	IV	III

blank: no monitering data
★: no flow of the river section
V+: worse than Grade V

Data source: MEP (2015)

The water quality of the section of Qingpu Jishuigang in Shanghai of Lake Tai in YRD was improved from 2004 to 2014, and this section was observed with Grade V as the worst records in 2013 and 2014, compared to many weeks pro year with records of worse than Grade V (V+) from 2004 to 2012 (Table 6.7).

Table 6.7 Water quality grades of the monitored section in Qingpu Jishuigang, Shanghai, YRD, 2004-2014

week	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	V+	V+	V+	V+	V+	V+	V+	V+	V	IV	IV
2	V+	V+	V+	V+	V+	V+	V+	V+	V+	III	IV
3	V+	V+	V+	V+	V+	V+	V+	V+	V	V	V
4	V+	V+	V+	V+	V+	V+	V+	V+	V	V	IV
5	V+	V+	V+	V+	V+	V+	V+	V+	V	IV	III
6	V+	V+	V+	V+	V+	V+	V+	IV	IV	V	III
7	V+	V+	V+	V+	V+	V+	V+	V	V+	V	III
8	V+	V+	V+	V+	V+	V+	V+	V+	V+	IV	III
9	V+	V+	V+	V+	V+	V+	V+	V+	V+	IV	IV
10	V+	V+	V+	V+	V+	V+	V+	V+	V+	IV	V
11	V+	V+	V+	V+	V+	V+	V	V	V+	III	III
12	V+	V+	V+	V+	V+	V+	V	IV	V+	II	III
13	V+	V+	V+	V+	V+	V+	V	V	V+	III	IV
14	V+	V+	V+	V+	V+	V+	IV	V+	V+	II	III
15	V+	V+	V+	V+	V+	V+	IV	V+	V	II	III
16	V+	V+	V+	V+	V+	V	IV	V+	IV	III	III
17	V+	V+	V+	V+	V+	V	V	IV	V	II	III
18	V+	V+	V+	V+	V+	IV	V	IV	V	III	III
19	V+	V+	V+	V+	V+	IV	IV	IV	V+	III	III
20	V+	V+	V+	V+	V+	IV	V	V	IV	IV	II
21	V+	V+	V+	V	V+	IV	V	V+	V	IV	IV
22	V+	V+	V	V+	V+	IV	V+	V	V	IV	III
23	V+	V+	IV	V+	V+	IV	V+	IV	IV	III	III
24	V+	V+	V+	V+	V+	IV	V	V+	V	★	IV
25	V+	V+	V+	V	V	V	V+	V+	IV	IV	IV
26	V+	V+	V+	IV	IV	V	V	V+	IV	III	IV
27	V+	V+	V+	V	IV	V	V	V	IV	IV	IV
28	V+	V+	V+	IV	IV	V	III	V	V	III	III
29	V+	V+	V+	V	V	V	V	V	IV	IV	III
30	V+	V+	V+	V+	V	V	III	V	V	IV	III
31	V+	V+	V+	V+	V	V	III	V	IV	III	III
32	V+	V+	IV	V+	V	V	III	IV	IV	IV	III
33	V+	V+	IV	V	V	V	III	IV	III	III	III
34	V+	V+	V	V	V	V	III	IV	IV	III	III
35	V+	V	V	V	V	IV	V	V	IV	III	IV
36	V+	V+	V+	V+	V	V+	III	IV	IV	IV	IV
37	V	V+	V	V	V+	V	IV	IV	V+	IV	IV
38	IV	V	V	V	V	V	IV	III	IV	IV	IV
39	V	V+	V	V+	V	V	IV	IV	IV	III	IV
40	IV	V+	V	V	V	V+	III	IV	IV	III	IV
41	V	V+	V+	V	V	IV	IV	IV	IV	III	III
42	V+	V+	V+	V	V	IV	IV	IV	IV	IV	IV
43	V+	V+	V+	V+	V+	IV	III	IV	IV	III	III
44	V+	V+	V	V+	V	IV	IV	IV	IV	III	IV
45	V+	V+	V+	V+	V	V	V	IV	IV	III	III
46	V+	V+	V+	V	V+	IV	V	IV	IV	IV	III
47	V+	V+	V+	V	V	V+	V	III	IV	IV	III
48	V+	V+	V+	V	V+	V+	V	V	IV	IV	III
49	V+	V+	V+	V+	V+	V+	V	V	V	IV	III
50	V+	V+	V+	V+	V+	V	V	V	IV	V	IV
51	V+	V+	V+	V+	V+	V+	V+	V+	V	V	III
52	V+	V+	V+	V+	V+	V+	V+	V+	V	V	IV

★: no flow of the river section

V+: worse than Grade V

Data source: MEP (2015)

Even if the surface water quality in the NE and YRD was improved from 2004 to 2014 in a certain degree, industrial and agricultural pollution is still quite serious. By the end of 2014, Songhua River in the NE and Huai River in YRD were slightly polluted, while Liao River in the NE and Lake Tai in YRD were moderately polluted.

In spite of the improvement on the grades of water quality from 2004 to 2014, the water quality in YRD remains a challenge by the end of 2014. For instance, the two sections of Xielugang and Wangjiangting in Jiaxing City of Lake Tai in YRD had all-year-round

pollution: in the 51 weeks with effective monitoring data in 2014, the section of Xielugang was recorded with 18 weeks Grade IV and 33 weeks Grade V and V+ while the section of Wangjiangting with 22 weeks Grade IV and 29 weeks Grade V and V+.

In addition, pollution accidents makes the water quality of the river even worse in the NE and YRD. For instance, in the NE, in November 2005, an explosion at a chemical plant near Jilin poured 100 tons of benzene, nitrobenzene and aniline into the Songhua River (UNEP 2005). In May 2007, 11 companies along the Songhua River were ordered to shut down because they dumped heavily-polluted water into the river with 80% exceeding pollution discharge limits[96]. According to a report of CCTV aired on 5 June 2011, the General Pharmaceutical Factory of Harbin Pharmaceutical Group Co Ltd was discharging wastewater into a brunch of the Songhua River with quite serious water pollution since 8 March 2011[97]. A test conducted on a sample of the wastewater showed a nitrogen compound of 85.075 mg/L, COD 1180 mg/L and chromaticity 892 mg/L (respective national legal limits are 35mg/L, 120 mg/L and 60 mg/L)[98].

In YRD, Yangtze River turned red due to illegal pollution from a factory in 2012. In March 2013, over 2200 dead pigs float in a branch of Huangpu River[99]. In March 2014, a river in Wenzhou, YRD burst into flame after lit cigarette was thrown into it due to years of pollution from factories upstream[100]. In May, July and October 2014, several reaches of rivers in Wenzhou City discovered not only with red water but also with a strong, sharp chemical smell in the air[101]. Accordingly, about 80% of the water off Wenzhou's coast is considered polluted[102].

In a word, surface water pollution remains a rather serious issue in China, as the seven major water systems – Yangtze River, Yellow River, Pearl River, Huai River, Hai River, Songhua River and Liao River – are moderately polluted[103], which means that surface water pollution is still serious in the NE (related to Liao River and Songhua River) and YRD (related to Yangtze River and Huai River). In other words, the water quality of the NE and YRD still needs a lot of improvement to battle with various pollution.

6.4.6 Environmental accidents

According to NBSC (2014), the only indicator of national statistical data related to

[96] Water Pollution in China. http://factsanddetails.com/china/cat10/sub66/item391.html, accessed on 31 August 2015.

[97] Online video: http://tv.people.com.cn/GB/60604/14849025.html, accessed on 31 August 2015. (in Chinese)

[98] http://health.people.com.cn/GB/26466/224179/, accessed on 31 August 2015. (in Chinese)

[99] China's River Turns Red. VOA, 8 June 2014. http://learningenglish.voanews.com/content/china-river-red-pollution/1971413.html, accessed on 31 August 2015.

[100] River of fire: Chinese waterway becomes so polluted it bursts into flame after lit cigarette is thrown into it. Mail Online News, 6 March 2014. http://www.dailymail.co.uk/news/article-2574714/River-fire-Chinese-waterway-polluted-bursts-flame-lit-cigarette-thrown-it.html, accessed on 31 August 2015.

[101] "Red River" in Wenzhou: the origins of frequent river pollution. 6 November 2014. http://epmap.zjol.com.cn/system/2014/11/06/020344812.shtml, accessed on 31 August 2015. (in Chinese)

[102] China's Wenzhou River Turns Red. VOA News, 28 July 2014. http://www.voanews.com/content/china-wenzhou-river-turns-red/1966473.html, accessed on 31 August 2015.

[103] China's major river systems in light pollution. China Daily, 3 June 2011. http://europe.chinadaily.com.cn/china/2011-06/03/content_12641154.htm, accessed on 31 August 2015.

environmental accidents is the number of environmental emergencies[104]. In fact, its predecessor was the number of environmental pollution and destruction accidents[105], applied from 1991 to 2008. In accordance with this change in China's statistical criteria, environmental accidents in this part refer to *environmental pollution and destruction accidents* before 2009, whilst refer to *environmental emergencies* since 2010.

This study analyses the number of environmental accidents of the NE and YRD with reference to China from 1991 to 2013 due to no statistical data available before 1991. Data for the NE and YRD are calculated from provincial data with China Statistical Yearbooks (1992-2014) as the main data sources: data from 1991 to 2008 refers to the number of environmental pollution and destruction accidents, while data from 2009 to 2013 refers to the number of environmental emergencies.

The number of pollution accidents in YRD kept higher than the NE since 1991 (Table 6.8), which implies more negative effects on YRD's environment. Particularly, the number of environmental emergencies in YRD kept increasing since 2009 and accounted for more than half of the total accidents in China since 2012 (Table 6.8).

Table 6.8 Number of environmental pollution accidents, NE, YRD and China, 1991-2013

	NE	YRD	China
1991	201	744	3038
1992	241	507	2667
1993	348	466	2761
1994	246	574	3001
1995	50	432	1966
1996	138	191	1446
1997	127	274	1992
1998	191	281	1422
1999	111	147	1614
2000	104	285	2411
2001	73	219	1842
2002	28	207	1921
2003	108	269	1843
2004	77	137	1441
2005	32	101	1406
2006	31	113	842
2007	No data	No data	462
2008	18	161	474
2009	6	178	418
2010	13	203	420
2011	9	255	542
2012	16	292	542
2013	13	402	712

Source: China Statistical Yearbooks 1992-2014

[104] Environmental pollution and destruction accidents refer to "sudden accidents, due to economic or social activities that are contrary to environment protection laws or due to unforeseen factors or natural disasters, that lead to environment pollution, destruction of protected wild animals, plants or nature reserves, damage to human health, economic and property losses, and other negative impacts on the society" (NBSC 2009).

[105] Environmental emergencies refer to "sudden accidents, due to economic or social activities that are contrary to environment protection laws or due to unforeseen factors or natural disasters, that lead to environment pollution, destruction of protected wild animals, plants or nature reserves, damage to human health, economic and property losses, and other negative impacts on the society" (NBSC 2010b).

Due to the change on national statistical criteria, it is difficult to compare the data before and after 2009, since there was an obvious decrease in the total number of accidents since 2009, at least for the NE and China. Nevertheless, it is still possible to achieve the following conclusion based on the data from 2009 to 2013: the number of environmental accidents has significantly increased in YRD, which implies in a certain degree an unsustainable regional development pattern with intensified human-environment relationship in YRD despite of its leading performance on GRP or other economic indicators in China.

In fact, there are two historical statistical indicators on environmental accidents in China: one is the direct loss of environmental pollution accidents (1995-2009), and the other is total fines and reparations for environmental pollution accidents (1991-2009). Although these indicators are not available after 2009, it might still be necessary to look at them respectively for the data related to the NE and YRD.

On the one hand, the direct loss of environmental pollution accidents[106] in YRD and its percentage to the national total were more than the NE in most of the years from 1995 to 2009 except 2004 and 2008 (Table 6.9).

Table 6.9 Direct loss of environmental pollution accidents (10000 Yuan) and percentage to the national total, NE, YRD and China, 1995-2009

	NE	YRD	China	NE/China(%)	YRD/China(%)
1995	41.7	1278.7	9937.9	0.4	12.9
1997	360.6	436.2	8366.1	4.3	5.2
1998	224.6	8655.7	19843.7	1.1	43.6
1999	221.8	398	5710.6	3.9	7.0
2000	136.2	9634.3	17807.9	0.8	54.1
2001	369.1	8125.9	12272.4	3.0	66.2
2002	57.3	1224.8	4640.9	1.2	26.4
2003	89.2	444.9	3374.9	2.6	13.2
2004	611.3	493.7	36365.7	1.7	1.4
2005	59.9	2229.9	10515	0.6	21.2
2006	150.3	807.9	13471.1	1.1	6.0
2007	No	data	3278		
2008	7420	74	18186	40.8	0.4
2009	550	13653	43354.4	1.3	31.5

Data source: calculated from provincial statistical data in China Statistical Yearbooks at various years

On the other hand, the total fines and reparations for environmental pollution accidents were much less than the direct loss of environmental pollution accidents in most of the years from 1991 to 2009, with exception of YRD in 1998 and the NE in 2000 (Table 6.10, with reference to Table 6.9). In the 18 years with statistical data since 1991, there are only 5 years in which the NE with more fines and reparations than YRD, which implies that the outstanding economic development in YRD since the 1990s has been realized by environmental pollution and damage in a certain degree.

[106] No data available for the year of 1996; for the year of 2007, no provincial data available but only national data.

Table 6.10 Total fines and reparations for environmental pollution accidents (10000 Yuan) and percentage to the national total, NE, YRD and China, 1991-2009

	NE	YRD	China	NE/China(%)	YRD/China(%)
1991	1032	857	4614	22.4	18.6
1992	386.6	563.8	5526.3	7.0	10.2
1993	396.5	774.2	4602.8	8.6	16.8
1994	489	1124	5093	9.6	22.1
1995	206	1034	4260	4.8	24.3
1996	144.8	342	2999.4	4.8	11.4
1997	355.2	342.3	3050.1	11.6	11.2
1998	479.6	9110.6	21954.9	2.2	41.5
1999	236.8	79.4	2116.3	11.2	3.8
2000	146.2	814	3682.65	4.0	22.1
2001	315.7	555.9	3263.9	9.7	17.0
2002	30.4	394.2	3140.7	1.0	12.6
2003	70.7	367.3	2391.5	3.0	15.4
2004	389	187.4	3963.9	9.8	4.7
2005	51.5	432.7	3082.1	1.7	14.0
2006	83.4	133.7	8415.9	1.0	1.6
2007	No	data	807	No	data
2008	140	66	927	15.1	7.1
2009	0	20	2168.1	0	0.9

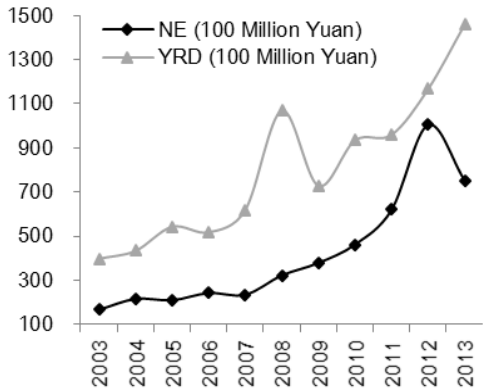
Data source: calculated from provincial statistical data in China Statistical Yearbooks at various years

6.4.7 Investment in pollution treatment

This study analyses investment in pollution treatment in the NE and YRD with two indicators: one is total investment in treatment of environmental pollution, and the other is percentage of total investment in treatment of environmental pollution to GDP. In light of the availability of provincial statistical data, this study mainly analyses investment in pollution treatment in the NE and YRD from 2003 to 2013. The data for the NE and YRD are calculated from respective provincial data, and the main data sources for provincial data are annual Environmental Statistical Data of China from 2003 to 2013[107].

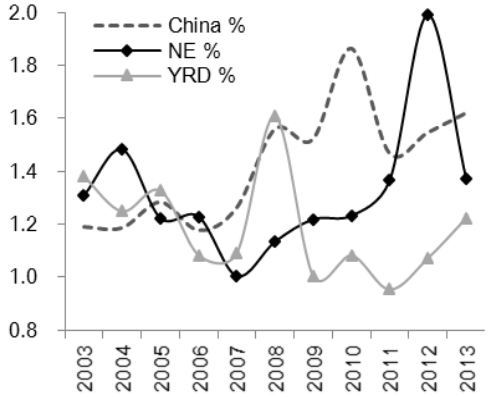
For one thing, the total investment in pollution treatment has increased in both regions since 2003, and there has been more investment in YRD than the NE (Figure 6.10). For another, the percentage of total investment in pollution treatment to GDP almost fluctuates year by year from 2003 to 2013, between 0.95% and 1.99% in both regions as well as in China (Figure 6.11). In detail, the national percentage fluctuates between 1.18% and 1.86%, with an average of 1.43%; the percentage of the NE varies from 1.00% to 1.99%, with an average of 1.32%; the percentage of YRD ranges from 0.95% to 1.61%, with an average of 1.19%.

[107] Available online: http://www.stats.gov.cn/ztjc/ztsj/hjtjzl/, accessed on 25 August 2015. (in Chinese)



Data source: Environmental Statistical Data of China (2003-2013)

Figure 6.10 Total investment in pollution treatment, NE and YRD, 2003-2013



Data source: Environmental Statistical Data of China (2003-2013)

Figure 6.11 Percentage of total investment in pollution treatment to GDP, NE, YRD and China, 2003-2013

6.5 Conclusion

On the consideration of path dependence and lock-in in the process of regional development, this chapter interrelates a historical change in human-environment relationship in Maoist China (1949-1976) and its long-lasting effects on environmental degradation and pollution in the NE and YRD since 1978 as a historical context to the environmental path-assets analysis in the NE and YRD (6.1).

The general information on the environment in the NE (6.2) and YRD (6.3) implies that the processes of industrialization and urbanization in the NE and YRD in the past decades have resulted in serious environmental (air, water and soil) pollution and ecological damage such as loss of biodiversity and land degradation. In other words, ecosystems in the NE and YRD have paid a great price for regional industrialization and urbanization and are under threat due to excessive human activities such as unsustainable resource use, construction, pollution and tourism.

For instance, due to historical land reclamation in wetlands in the NE, original wetland ecosystem has been destroyed by intensive farming and many of the wetlands with subject to flooding. In YRD, rapid industrialization and urbanization processes since 1978, especially since the 1990s, have changed the environment of the region in a large degree with not only ever-increasing proportion of construction land to fulfil the need for urban expansion and industrial construction but also environmental pollution and serious ecological damage.

And what's more, the NE and YRD are sensitive regions of climate change (Zhao *et al* 2007; Gu *et al* 2011). In the context of global and regional warming influenced by climate change, climate disaster has arisen in the NE along with its higher increasing rate in annual mean temperature than the worldwide and national average rate. YRD is one of the most sensitive areas of the sea-level changes in the world and has become China's new eco-environmental vulnerable zone increasingly affected by extreme weather and flooding. According to Gu *et al* (2011), climate change has been shaping YRD and its socioeconomic development, while the urbanization process has

contributed to climate change in the light of YRD's built environment unadaptable to future climate change.

The quantitative environmental path-assets analysis of the NE and YRD from 1978 to 2014 (6.4) based on official statistical data has the following five main conclusions:

(1) As for the forest coverage rate, both the NE and YRD remain above the national average from 2003 to 2013, and the leading position of the NE on the forest area and the forest coverage rate lies in that the NE is China's main forest-harvesting base with abundant forest resources (about one third of total volume of China) (6.4.1).

(2) Industrialization and urbanization in YRD since the 1990s has intentionally or unintentionally occupied part of the nature reserves in the region to meet the needs for urban and industrial construction as well as regional economic growth, which led to the percentage of nature reserves area to total land area in YRD far less than the NE and national average from 2000 to 2013 (6.4.2).

(3) As for energy consumption, the energy consumption per unit of GDP in YRD has been lower than the national average, while energy consumption per unit of GDP of the NE has been higher than the national average since 1978, which demonstrates the energy inefficiency as well as an unsustainable way of regional economic growth in the NE (6.4.3).

(4) The environment has been getting worse with the process of industrialization and urbanization in the NE and YRD with deterioration in air quality (6.4.4) and surface water quality (6.4.5) in both regions. In the NE, water pollution is the most serious environmental problem. Discharge of pollutants far exceeds the purification capacity of rivers, which damages aquatic ecosystems, severely affects water supplies of cities, and influences quality of ground water and even soils (Water Resources in Northeast China Project Group, Chinese Academy of Engineering 2006). In YRD, the worsening contamination of major rivers and lakes and atmospheric pollutants become major environmental problems.

(5) Pollution accidents often happen and make threat to public health as well as to the environment in the NE and YRD. The number of pollution accidents in YRD keeps higher than the NE since 1991. Particularly, the number of environmental emergencies in YRD remains increasing since 2009 and accounts for more than half of the total environmental accidents in China since 2012, which implies that the high-speed economic growth in YRD is at the expense of serious environmental pollution with ecological damage since the 1990s (6.4.6). Accordingly, YRD had to increase the investment on pollution treatment projects (6.4.7).

By the synthesis of the historical context of the change in human-environment relationship in Maoist China (6.1), the general information on the environment in the NE (6.2) and YRD (6.3) as well as the quantitative environmental path-assets analysis of the NE and YRD from 1978 to 2014 (6.4), both regions still have a long way towards regional sustainable development.

On the one hand, due to path dependence and lock-in of regional development path, the

change in human-environment relationship in Maoist China has long-lasting effects on national-wide environmental degradation and ecological damage. Human activities during the processes of regional industrialization and urbanization since 1978 have changed the environment in the NE and YRD with negative effects by unsustainable resource use, construction, pollution and tourism.

On the other hand, the NE and YRD are sensitive to climate change in the context of global and regional warming with increased threat from disasters, which implies the built environment in the NE and YRD is, at least in a certain degree, unadaptable to future climate change. Consequently, both climate change and environmental pollution by human activities are disastrous to local ecosystems in the NE and YRD, and the environment in the NE and YRD are under threat due to the increasing frequency of environmental accidents as well as disasters.

In fact, the NE and YRD has made efforts to protect the environment by use of renewable energy, and YRD takes lead on renewable energy use in China especially on wind power. In addition, both regions start to make research on how to improve regional capability especially adaptability to future climate change.

Serious environmental degradation and pollution in the NE and YRD requires improvement in public awareness on environmental protection, enforcement of laws and regulations as well as corporate social responsibility, which are associated with multilevel environmental governance and will be analysed in Chapter 7 with emphases on the political-institutional dynamics for environmental governance in China and on a qualitative political-institutional path-assets analysis of the NE and YRD based on expert interviews as well as literature analysis.

7 Path-Assets Analysis IV: Political-Institutional Dimension

Political-institutional dimension is the last but important dimension of the path-assets analysis on regional capability in this study, with both common points and differences for the two regions of the NE and YRD. For one thing, in light of no specific administration at the regional level in China, or in other words, no regional government at the regional level but only with the central government above at the national level and provincial governments below at the provincial level, the promotion of regional development and regional governance in China is led and supervised by the Chinese central government, and concrete political-institutional arrangements related to the regional governance process is coordinated by cabinet-level departments constituting the State Council, which are the State's ministries and commissions at the national level such as the National Development and Reform Commission (NDRC). Accordingly, the regional governance process is in a large degree in reference to the arrangements and decisions made by the Chinese central government at the national level, particularly when referred to the actions of the state actors (see 7.1.1). That is to say, in the aspect of political-institutional arrangements for regional development and governance in China, both the NE and YRD by and large face the same context of governance and institutions as one of the backgrounds for regional development tied to regional capability, namely the regional political-institutional arrangements tightly connected with national strategies and policies. For another, beside the national strategies and policies on regional development and governance, there could be some underlying aspects or processes within the regional political-institutional dynamics between the two regions which might form their differences.

In light of the complexity of the multilevel governance process as well as a regional focus on the NE and YRD for case studies, this study mainly lays emphasis on regional governance and planning in China. Within this emphasis, owing to the fact that serious environmental pollution and degradation mentioned previously in Chapter 6 is an important consideration in the governance process of both regions, for the consistency as well as nexus of this study, this chapter will mainly focus on the political-institutional dynamics for multilevel environmental governance in China (7.2) as well as a path-assets analysis for the NE and YRD on a political-institutional dimension (7.3), and tries to provide a qualitative analysis mainly based on expert interviews with scientists with specific insight into regional development and governance in China as well as literature analysis.

This chapter is organized in the following structure: It begins with an introduction to the political-institutional context in China (7.1) with the one-party dominated top-down political system as well as the endogenous bottom-up power rescaling. Next, it analyzes China's environmental governance practice (7.2) in a political-historical perspective, with a multilevel analysis at the national-regional, the provincial and the local level[108].

[108] Levels of China's administrative divisions: China has four levels of formal administration under the central government. The 1st level is officially made up of 34 (23 provinces, 5 autonomous regions, 4 municipalities (Beijing,

Then, it comes to the path-assets analysis of the NE and YRD (7.3), with emphasis on various actors in the practice of multilevel environmental governance in both regions. Finally, it draws conclusion from the analysis of the political-institutional dimension (7.4).

7.1 Introduction to the political-institutional context in China: top-down versus bottom-up

7.1.1 One-party dominated top-down political system

The Communist Party of China (CPC) dominates state and society in China with power resting on the following four institutions under its control: the People's Liberation Army, the institution of the State, the National People's Congress (NPC)[109] and the Chinese People's Political Consultative Conference (CPPCC)[110] (Lawrence and Martin 2013). Generally, the CPC (or the Party) entrusts implementation of its policies and day-to-day administration of the country to the State headed by the State Council, which is often synonymous with the Central People's Government or briefly the central government[111],

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Chongqing, Shanghai and Tianjin) that report directly to the central government and 2 special administrative regions of Hong Kong and Macau) provincial-level governments. The 2nd level of administration includes 333 prefectural-level administrative units, including prefectures and prefectural-level cities. The 3rd level of administration includes 2854 counties and county-level cities. The 4th level of administration is made up of 40381 townships and towns. The 1st, 3rd and 4th levels of administration all have political structures that mirror the central government, with parallel Party and government organizations and people's congresses. At the 2nd administrative level, prefectural-level cities and autonomous prefectures also have government organizations and people's congresses, but regular prefectures do not. Instead, they have administrative agencies. (Source: Lawrence and Martin (2013), p.9) For further information on China's administrative divisions, see: China's Political System: VI. The Local Administrative System. http://www.china.org.cn/english/Political/28842.htm, accessed on 8 November 2015. See also: "administrative divisions of China" from Wikipedia, https://en.wikipedia.org/wiki/Administrative_divisions_of_China, accessed on 8 November 2015.

The local level in this study mainly refers to the prefectural level, which is the second administrative division in China after the provincial level. In China, the provincial-level divisions or first-level divisions include provinces, autonomous regions, municipalities and special administrative regions, which is similar to states of the USA and the federal states (Bundesländer) of Germany. For the NE and YRD in this study, each region includes 3 provincial-level divisions or first-level divisions: the NE includes 3 provinces of Liaoning, Jilin and Heilongjiang, and the YRD region includes 2 provinces of Jiangsu and Zhejiang as well as 1 municipality of Shanghai, which is a higher level of city directly under the Chinese government, with status equal to that of the provinces. All these five provinces related to this study are divided into prefecture-level cities at the prefectural level, and each prefectural-level city includes all of the counties, county-level cities and city districts that the city governed.

[109] According to China's state constitution, the NPC oversees the State Council as well as four other institutions: the Presidency, the Supreme People's Court, the public prosecutors' office and the military. In practice, the NPC, like People's Congresses at every level of administration, is controlled by the CPC and is able to exercise little oversight over any of the institutions officially under its supervision. NPC deputies are expected to approve all budgets, agency reports, and personnel appointments put before them. The NPC's most significant power is its ability to initiate and shape legislation. Source: Lawrence and Martin (2013: 3).

[110] "The formal political system also includes two other categories of institutions, although they have little substantive power. The first is People's Political Consultative Conferences (PPCCs), the most senior level of which is known as the Chinese People's Political Consultative Conference (CPPCC) National Committee. The Party and State ostensibly 'consult' with PPCCs on policy issues. The second set of institutions is China's eight minor political parties, known as the "democratic parties". All the parties were established before the Communists came to power, pledge loyalty to the Communist Party, and accept its leadership. The existence of the PPCCs and the minor parties allows the Communist Party to describe China's political system as one of 'multi-party cooperation and political consultation led by the Communist Party of China'." Source: Lawrence and Martin (2013: 4).

[111] "The State Council, Synonymous with the Central People's Government since 1954 (particularly in relation to local governments), is the chief administrative authority of the People's Republic of China. It is chaired by the Premier and includes the heads of each governmental department and agency." Source: Wikipedia. http://en.wikipedia.org/wiki/State_Council_of_China, accessed on 31 August 2015.

and the national policies or strategies are implemented by the governmental divisions at the provincial level (provincial governments) and further by the governmental divisions in the prefecture-level cities (local governments). Accordingly, the multilevel governance in China has typical 'Chinese characteristics': various state actors as the most important actors dominate the network as well as dynamics of multilevel governance in China.

As one of the main political-institutional assets for regional development in China, this one-party dominated top-down political system mentioned above serves as a common political-institutional framework for regions throughout the country with both positive and negative aspects[112]. In general, its advantage lies in that it significantly shortens the time required for decision- and policy-making compared to time-consuming consulting process in western countries with democratic political systems[113], while its disadvantage is a tendency of the Party to charge itself with the duty of determining almost everything by itself in decision-making but lack of subordinate supervision[114].

In detail, its positive effects mainly lies in the following two aspects. For one thing, in light of a "planning-and-goal oriented" central government, it is possible for China's leadership "to pursue environmental protection or energy efficiency in a top-down manner", which might also provide future direction for economic activities in the country[115]. For another, it is possible to integrate national development strategies into regional development and governance by plans, guidelines or actions in accordance with national strategic demands[116]. Particularly, there are personnel exchanges between the central government and provincial or local governments: officials working for the central government at the national level might be designated as a provincial or local government official for a specific time period during their careers, with local knowledge and working experiences at the local level brought back to the national level after these personnel exchanges, which could be viewed as some kind of state-dominated interaction in the multilevel governance process between the central and the local[117].

Nevertheless, there are negative effects as well. On the one hand, the central government seems to have presented a tendency to strengthen national macro-control since the financial crisis of 2008 and to interfere political decisions at the provincial level[118]. Even though the macro-control and regulation at the national level might be necessary for regional governance in a certain degree, too much interference from the central government might be unnecessary and even hinder local development[119].

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[112] Expert interviews with Dr. Eva Sternfeld at Technische Universität Berlin on 17 April 2013 and with Prof. Dr. Miranda Schreurs at Freie Universität Berlin on 22 April 2013.

[113] Expert interviews with Dr. Eva Sternfeld (17 April 2013), Prof. Dr. Wen Chen (30 June 2015, via Skype) and Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[114] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[115] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

[116] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[117] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

[118] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[119] Expert interviews with Prof. Dr. Doris Fischer (26 June 2015, via Skype) and with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

Therefore, it is quite necessary to make it clear what are the responsibilities as well as duties of the provincial governments and the central government. Ideally, the central government should only have authority over regional governance or other inter-provincial development issues and should not substitute provincial governments for decision- or policy-making within a province[120].

On the other hand, even within the central government, different government officials might have different political opinions or policies, which might also lead to much discussion but *de facto* reach no decision, especially when the central government changes. Consequently, regional development and governance in China is probably mainly subject to the idea of the central government not the local government[121], and the political incentives or policies towards certain regions are quite important to regional development and the development of regional capability[122].

And what's more, in light of an extremely powerful Party with a strict party line and an influential central government at the national level, government officials at the local level have to care about their political careers with the Party and the central government[123]. As a result, local governments compete for fulfilling governmental requests from above and tend to reframe things, more or less, in a cautious way, within the context of what the central government thinks overall and how much the local governments rely on the central government[124]. Nevertheless, there has been signs of an endogenous bottom-up power rescaling of local governments in the arena of competition on local development, and the following section will discover the dynamics of this process.

7.1.2 Endogenous bottom-up power rescaling

Since 1980s, along with the implementation of the opening and reform policy in the eastern coastal areas of China, many local economic initiatives started at the local level but satisfy the central government in the end, such as Wenzhou and Kunshan in the YRD region, famous for the Wenzhou Model and the Kunshan Model with endogenous bottom-up institutional innovation on economic development and reform, which not only forms unique local development path, but also influences the policy-making process for regional development and governance at the national level.

The endogenous bottom-up power rescaling process has become increasingly significant since the reform of the taxation system and fiscal decentralization (Su and Zhao 2004) of the PRC in 1994, by which a provincial government could get tax payback from the central government if it could reach or exceed its annual tax target: the more taxes the provincial government could collect, the more tax payback it could get[125]. This tax payback policy promotes the initiatives of provincial governments on

[120] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[121] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

[122] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[123] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

[124] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

[125] Generally, a provincial government must pay 75% of its total annual add value tax to the central government, and the central government will payback all of the other 25% to the provincial government (Shen 2013). If a

local economic development in some degree, and the relatively developed provinces and municipalities such as Jiangsu and Shanghai in the region of YRD make their efforts to get more governmental revenues, thereby with more financial opportunities for promoting local development.

Presently, there are at least two ways for a successful bottom-up power rescaling. On the one hand, provincial and municipal governments try to lobby the central government for a more favourable policy towards local development. For example, the China (Shanghai) Pilot Free-Trade Zone established on 29 September 2013 actually has experienced a long-time lobbying process with the central government since the initial intention to establish a free trade zone in Shanghai in 1997. In order to get the central government's assent to the proposal, Shanghai Municipal Government agrees to meet all of the requirements of the central government and subject to the national strategy[126]. On the other hand, within a province, a flexible scale adjustment since 2010 has replaced the mandate to adjust administrative divisions from the up-level government from 2000 to 2010[127]. As a new way of endogenous bottom-up power rescaling, the flexible scale adjustment aims to gain special privileges from the central government such as quota of construction land, and one example is Sunan National Self-dependent Innovation Demonstration Zone established in October 2014 in southern Jiangsu[128]. In fact, both ways of bottom-up power rescaling mentioned above underline the political relationship between a provincial (or municipal) government and the central government, and this central-provincial relation (or central-local relation) plays an important role in the multilevel governance process in China[129].

Although more pressure from the bottom-up for change could also become positive pressure for more sustainable economic development, unfortunately, sustainable development as a goal for regional development and governance in China is, at least, not fully reflected in both top-down and bottom-up processes mentioned above due to a multi-actor game for maximum benefit among multilevel governments in China. Conversely, it comes up with an intensified local competition among multiple governments within a region, such as illegal land acquisition by transferring local non-construction land into construction land or building huge local industrial parks far beyond practical economic requirements. And what's more, with this kind of competition in disorder, there is a confusion about the concrete governance issues of a specific government and its respective authority as well as responsibilities. An example is the unclear responsibility between a provincial government and the central government in

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provincial government reaches its annual tax target, the provincial government could get a tax payback from the central government with a payback ratio of 1:0.3; if a provincial government exceeds its annual tax targets, the provincial government could get a tax payback with a payback ratio of 1:0.6 for the exceeding part. (Source: 21st Century Business Herald, 14 November 2004, available online: http://news.hexun.com/2008-08-04/107889818_6.html, accessed on 3 November 2015 (in Chinese))

[126] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

[127] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[128] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[129] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

national demonstration zones located in a province or a municipality[130]. As for the two regions in this study, it might result in a situation of chaos in regional governance especially with issues on inter-provincial coordination. Therefore, under the influence of the political-institutional context in China mentioned above, with consideration on various environmental problems analysed in the environmental dimension (see Chapter 6) and the goal of sustainable development for regional planning and governance (Chapter 8) , the following part will mainly focus on the dynamics of the governance process, specifically, on multilevel environmental governance in China (7.2) as well as a political-institutional path-assets analysis of the NE and YRD (7.3).

7.2 Multilevel environmental governance in China: a political-historical perspective

Due to increasingly serious environmental degradation in the process of industrialization and urbanization, increasingly frequent environmental problems as well as disasters have forced diversified actors including governments, firms, nongovernmental organizations (NGOs), media and scientists to pay more attention to the issue of environment governance in China (see, for example, Economy 2004). This part takes a political-historical perspective and tries to analyze the important aspects of the governance process in China such as institutions, regulation and policies, actors as well as actions of the actors. In light of the dominant role of the State in the governance process in China (see 7.1.1), in this study, actors in the arena of multilevel environmental governance are basically divided into state actors and non-state actors.

State actors are the persons or institutions that "act on behalf of a governmental body"[131]. The main state actors related to this study include the Central People's Government (or the State Council), the ministries and commissions of the State at the national level such as the NDRC and the Ministry of Environmental Protection (MEP), provincial or municipal governments at the provincial level with corresponding provincial departments such as the provincial Development and Reform Commission (DRC) and the provincial Environmental Protection Department (EPD), prefecture-level city governments at the local level with corresponding local DRCs and local Environmental Protection Bureaus (EPBs), state-owned enterprises (SOEs), government-organized NGOs (GONGOs) and government-representative media such as Xinhua.

Non-state actors are persons or organizations "with sufficient power to influence and cause a change even though they do not belong to any established institution of a state"[132], including market, private enterprises as well as transnational corporations (TNCs), NGOs, media and civil society. Along with the development of state actors in the practice of multilevel environmental governance in China, non-state actors have also experienced rapid growth since the 2000s: markets (both international and national), firms, non-official mass media such as Weibo or "micro blog", NGOs and civil

[130] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[131] Source: Wikipedia. http://en.wikipedia.org/wiki/State_actor, accessed on 31 August 2015.

[132] Source: Wikipedia. http://en.wikipedia.org/wiki/Non-state_actor, accessed on 31 August 2015.

society have been influencing the process of environmental governance in China beside the powerful state actors.

In order to have a comprehensive understanding of the political-institutional dimension, this part conducts a multilevel analysis on the governance process in China, namely the national-regional[133] level, the provincial level and the local level. In consideration of no special governments for a region at the regional level in China, but only with the central government above it and provincial governments below it, the promotion of regional development and cooperation is led and supervised by the central government of China or other state organs such as the NDRC. Accordingly, the governance process at the regional level is in a large degree in reference to the arrangements and decisions made by the central government of China at the national level, particularly when referred to the actions of state actors. In light of the tight connection between the regional and the national level in the aspect of political-institutional arrangements, in this thesis, the governance practice at the regional level will be discussed together with the political decisions as well as performances at the national level as a national-regional level.

7.2.1 The national-regional level

(1) Establishment of institutions for environmental governance

Environmental governance in China is largely inherited from China's previous central-planned economy and its hierarchical political system (Carter and Mol 2007; Palmer 1998). As a consequence, the state actors play the most important role in the process of environmental governance at the national-regional level, such as the central government of China or the State Council, the MEP and the NDRC.

Taking a political-historical perspective, China's central government neither recognized its environmental problems nor had an environmental policy until 1972, even if environmental problems had already appeared since the establishment of the PRC in 1949 (Bao 2006: 38). In fact, environmental governance in China has been closely related to dealing with occurred environmental pollution accidents but not to the prevention of polluting accidents[134], even if prevention is better than cure.

In 1972, the interaction of three events sparked a new environmental consciousness in China: several serious national environmental accidents and disasters[135], the rise of environmental problems and environmentalism in the USA and Japan, and attending on the first international environmental conference, the United Nations Conference on

[133] Regions in this study are composed of provinces, and the latter are administrations in China similar to Bundesländer in Germany. The regional level in this study is a non-administrative level above the provincial level, while the latter is an administrative level in China under the national level.

[134] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[135] Here are some examples: (1) "Tainted fish with a foul smell from the polluted Guanting Reservoir outside Beijing appeared in the city's market" (Economy 2004: 93). People who eat these polluted fish due to upstream industrial waste water discharge felt weakness, headache, stomach pain, nausea, vomiting and other symptoms of poisoning. (Source: http://dangshi.people.com.cn/GB/144956/11827359.html, accessed on 5 November 2015, in Chinese) (2) "In the northeastern coastal city of Dalian, the beach turned black, millions of pounds of fish were lost, the port became clogged from polluted shells, and dikes eroded. Other coastal cities recorded similar incidents" (Economy 2004: 93). (3) Minamata disease appeared in the Songhua River in the Northeast China (Bao 2006: 38).

Human Environment (UNCHE) in Stockholm, Sweden[136] (Qu 1999: 214; Economy 2004: 93; Bao 2006: 38). Induced by these factors, the Chinese leaders began to pay attention to environmental problems[137] and to start "the formulation and implementation of Chinese environmental policy for the first time" (Bao 2006: 38). In particular, the attendance at the first UNCHE "signaled a turning point in China's approach to environmental governance" (Economy 2004: 93). In the wake of growing pollution, the central government began to seriously involve in environmental protection with the introduction of economic reforms in the late 1970s (Mol and Carter 2006). Later on, China began to develop a system of environmental institutions, regulations and programs (Jahiel 1998; Ma and Ortolano 2000) and "Chinese environmental protection policy entered a period of rapid improvement" (Bao 2006: 43).

In June 1973, Chinese Premier Zhou Enlai organized China's first National Conference on Environmental Protection, which played a very important role in environmental protection in China (Qu and Li 1981). Since then, China began to construct institutions on environmental protection. In May 1974, the State Council established a top-level inter-ministerial Environmental Protection Leading Group to instruct China's work on environmental protection, even though it only met twice during the following 9 years (Economy 2004: 95). In 1978, the State Council Leading Group Office for Environmental Protection was established under the division of the National Construction Committee of China. In 1982, the Office was reorganized into an environmental protection bureau under the Ministry of Urban and Rural Construction and Environmental Protection. In 1984, the Bureau was renamed the National Environmental Protection Agency (NEPA), still under the division of the Ministry of Construction. In 1987, NEPA was restructured and promoted to an independent agency at deputy ministerial level directly under the State Council. In March 1998, NEPA was renamed the State Environmental Protection Administration (SEPA) and became a ministerial level government department[138]. SEPA, often quoted as the "environmental watchdog" of China, "is responsible for overall supervision and administration of environmental protection work" (Stokoe and Gasne 2008: 41). In 1993, the NPC established the Environmental Protection Committee[139], renamed the Environment and Natural Resources Protection Committee (ENRPC) in 1994. "The ENRPC and SEPA have helped raise awareness of the need for tighter

[136] "It was an opportunity for China to portray its environmental consciousness in the international political arena. The Chinese government sent a big delegation to attend the conference. As a result, Chinese leaders were motivated to undertake environmental policy work after the delegates reported to them on this conference." (Bao 2006: 38)

[137] "Premier Zhou Enlai stated, 'Industrial pollution is a fresh question. If industrialization begins, this question becomes more and more serious. Now pollution is becoming the biggest problem in the world'." (Bao 2006: 38)

[138] Source: Yang Xi. SEPA gets stronger. China.org.cn, 10 March 2008. http://www.china.org.cn/environment/news/2008-03/10/content_12143406.htm, accessed on 31 August 2015.

[139] "The Environmental Protection Committee under the State Council is made up of leaders of various related ministries under the State Council. It is the State Council's consultancy and coordination agency for environmental protection work. Its major tasks are studying and examining the principles, policies and measures relating to coordinative development of the country's economy and environmental protection, giving guidance to and coordinating efforts in tackling major environmental problems, exercising supervision over and conducting checks on the implementation of the environmental protection laws and regulations by various localities and departments, and promoting the development of environmental protection undertakings throughout the country. The people's governments at the provincial, city and county levels have also established corresponding environmental protection committees." (Source: State Council 1996)

environmental regulations, and thus perhaps have played a role in altering how China's leaders conceive of environmental problems" (Alford and Liebman 2001: 736). In March 2008, the 11th NPC of China elevated SEPA to the Ministry of Environmental Protection (MEP)[140], which "strengthens the environmental protection sector's administrative stability, political will, decision-making power and access to resources", but the new ministry still "confronts insufficient legislation, ambiguous authority allocation and weak central-local management" notwithstanding (Qiu and Li 2009).

In general, "China made genuine advances in environmental protection in the wake of both the UNCHE and the UNCED" (Economy 2004: 100), and has transformed "from one with no environmental protection apparatus, no environmental legal system, and only the smallest environmentally-educated elite, to one in which numerous bureaucracies are engaged in protecting the environment, the legal infrastructure embraces virtually every aspect of the environment, and there is a vast, ongoing environmental education effort throughout the society" (Economy 2004: 217-218). Nevertheless, China is suffering from more and more environmental crises caused by environmental pollution.

> "China's environmental crisis is, at its core, a crisis of policies and perceptions. While the Chinese state is not alone in making detrimental environmental policies, China's top-down authoritarian control, by limiting alternatives discourse and management opinions, has only been more detrimental to environmental sustainability." (Jiang 2010: 35)

(2) Environmental regulation and policies

Environmental regulation is country-specific influenced by its economic, social and political-institutional contexts (Shapiro 2001). The National People's Congress (NPC)[141], as the highest state body and the only legislative house in China, enacts statutory environmental laws. In 1978, the Chinese constitution was amended to acknowledge concern for the environment, with the proviso that the state had to protect the environment and natural resources as well as prevent pollution and other public hazards (Economy 2004: 95-96). In 1979, after several years of deliberation and preparation, the NPC approved the draft Environmental Protection Law of the PRC, which established basic principles to safeguard the environment and promoted the development of a legal network for environmental protection (Qu 1999: 219; Economy 2004: 96). Since then, a new stage in the work of environmental protection in China began with law enforcement. According to MEP (2015), by the end of November 2015, China has promulgated 31 laws, 48 administrative regulations and 92 department regulations specialized or partly involved in environmental protection and environmental governance, among which the new Environmental Protection Law of the PRC published on 24 April 2014 comes into

[140] CCICED (2006) recommends elevating SEPA to full cabinet rank "to adequately meet its responsibilities of regulation, enforcement, analysis, monitoring, regulation, and professional training" in order to enhance the capacity of environmental administrative system of China's central government.

[141] The National People's Congress (NPC) "is the national legislature of the People's Republic of China." … "In theory, the NPC is the highest organ of state power in China." … "However, it is still reckoned as a rubber-stamp for decisions already made by the state's executive organs and the Communist Party of China." (Source: Wikipedia. http://en.wikipedia.org/wiki/National_People%27s_Congress, accessed on 31 August 2015.)

force since 1 January 2015[142].

With the construction of environmental protection institutions, China started to develop its environmental policies as well. In the 1980s, China established its first systems of environmental management collectively known as the three magic weapons: environmental impact assessment (EIA) (Ning *et al* 1988; Wenger *et al* 1990), pollutant discharge fees and the three synchronizations[143] (Sinkule and Ortolano 1995). The EIA is one of the key management regimes in China's environmental regulatory scheme (McElwee 2011: 126), and Chinese governments have increasingly utilized EIA as the major policy tool for active control since the 1980s (Qu 1987). In addition, EIA has provided governments at various levels with a policy instrument for pollution prevention and environmental planning, especially at the local and provincial level, though the EIA process does not include formal provisions for citizen notification or involvement (Wenger *et al* 1990). Later on, China has gradually developed several typical Chinese environmental policies (Mol 2009a) including the three synchronizations, Urban Environmental Quality Examination System (UEQES) and the subsequent National Environmental Model City program (Economy 2006).

China is striving for both feasible environmental policies and effective measures aimed at changing the traditional development approach since the *Agenda 21* (UNCED 1992) adopted as a comprehensive program for global action in all areas of sustainable development by the United Nations Conference on Environment and Development (UNCED) in 1992. China's participation in the UNCED 1992 "had a profound effect on environmental policies, institutions and thinking in China", which "gave a dramatic boost to the establishment of a formal institution for international and Chinese cooperation on environmental protection" (Economy 2004: 187), "contributing to the development of environmental NGOs and the formation of an Administrative Center for China's Agenda 21" (Economy 2004: 188). In the same year, China Council for International Cooperation on Environment and Development (CCICED)[144] began to serve as a forum

[142] The list, release date and detail information as well as contents of the 31 laws, 48 administrative regulations and 92 department regulations on environmental protection are available at the Online Data Center of Environmental Protection of China of the MEP. For the 31 laws, please visit http://datacenter.mep.gov.cn/main/template-view.action?templateId_=ff8080812e8b3901012e8e72572f0014&dataSource=TRS, accessed on 1 December 2015 (in Chinese); for the 48 administrative regulations, please visit http://datacenter.mep.gov.cn/main/template-view.action?templateId_=ff8080812e8b3901012e8f0a001b0030&dataSource=TRS, accessed on 1 December 2015 (in Chinese); for the 92 department regulations, please visit http://datacenter.mep.gov.cn/main/template-view.action?templateId_=ff8080812e8b3901012e8ec6ee7e001b&dataSource=TRS, accessed on 1 December 2015 (in Chinese).

[143] The three synchronizations require that "design, construction and operation of a project must be synchronized with the design, construction and operation of an appropriate pollution treatment facility" (MacBean 2007: 299).

[144] "Established in 1992 with the approval of the Chinese Government, CCICED is a high level non-for-profit international advisory body composed of high level Chinese and international figures and well-known experts in the field of environment and development. The main tasks of CCICED are exchanging and disseminating international successful experience in the field of environment and development; studying key environment and development issues of China; providing forward-looking, strategic and early warning policy recommendations to State leaders and decision makers of all levels in China, facilitating the implementation of sustainable development strategy and the development of resource-saving and environment-friendly society in China." (Source: http://www.cciced.net/encciced/aboutus/overview/, accessed on 31 August 2015).

The CCICED has 5 to 7 short-term task forces focusing on environment and energy issues (Economy 2004: 312 Note 17). In 2004 CCICED established a Task Force on Environmental Governance consisting of 6 international and 6

for international and Chinese experts to exchange views and provide concrete recommendations for top-level Chinese leaders on various aspects of environmental conservation.

In 1994, the State Planning Commission (SPC)[145] published *China's Agenda 21 - White Paper on China's Population, Environment and Development in the 21st Century* (SPC 1994), which made series of policies towards sustainable development at the national level[146]. With support from the United Nations Development Program (UNDP), the Chinese government has conducted research and training courses in integrating *China's Agenda 21* into national economic and social development plans, which is essential to the national strategy of sustainable development (Sun *et al* 2002). Cleaner production as a central element of China's Agenda 21 action plan, Chinese government instituted a cleaner production program in 1993 and ISO 14000 environmental management system certification procedures in 1997 (Economy 2004: 198).

> "China declared environmental protection a basic national principle in 1983, laid out a broad strategy to achieve sustainable development in 1994, and in 1996 developed its first five-year plan on environmental protection. In 2003, the government proposed a new development concept emphasizing humanism and attempting to achieve sustainable development and harmony between man and nature ……" (Liu and Diamond 2005: 1181)

Following the promulgation of the Environmental Protection Law in 1979 (revised in 1989 and 2014), China began to establish its environmental regulatory system (Mol and Carter 2006). There are various laws and regulations on pollution prevention and environmental protection in China since 1979[147]. Particularly, there have been more and more new environmental laws in China since the 2000s, such as the 2002 Cleaner Production Promotion Law, the 2003 EIA Law and its 2006 public participation provisions, the 2004 Administrative License Law, the 2008 Environmental Information Disclosure Decree and the 2009 Law on Promoting Circular Economy.

Chinese experts. The report of Task Force on Environmental Governance submitted to CCICED in November 2006 at Beijing presents 25 major recommendations in 4 major issue areas including government, business, civil society and public participation, and international cooperation (Xue *et al* 2006, 2007).

[145] State Planning Commission (SPC) of China is the former name of the National Development and Reform Commission (NDRC) of the PRC, or NDRC is a successor to the SPC. The SPC had managed China's centrally planned economy since 1952, and was renamed as the State Development Plan Commission (SDPC) in 1998. Since 2003 the organization further shifted its policy from plan economy to socialist market economy, and the restructured organization was then merged into a newly created NDRC.

[146] Beside general strategies and legislation for sustainable development, China's Agenda 21 covers 17 related policy areas including economic policies, financial resources, education and capacity building, population and social services, eradication of poverty, health and sanitation, human settlements, agriculture and rural development, industry and transportation, energy production and consumption, natural resources, conservation of biodiversity, desertification management, disaster mitigation, protection of atmosphere, solid wastes management, and public participation. Chapters and concrete program areas of the White Paper is available online at: http://www.acca21.org.cn/ca21pa.html, accessed on 9 November 2015.

[147] For more information on the development of environmental legislation in China, see: China's History of Environmental Protection, released by the Environmental Resources Management (ERM) on 1 June 2010. http://www.erm.com/en/Analysis-and-Insight/publications/archived-publications-2009---2010/chinas-history-of-environmental-protection/, accessed on 31 August 2015.

> "Although China boasts a wide range of reasonably sophisticated environmental laws and regulations, their enforcement is far from efficient and unified, and it is generally felt that enforcement agencies fail to fully perform their mandate. Inconsistencies in enforcement are mainly due to: (1) a lack of coherence between regulations; (2) structural deficiencies in the environmental management system; and (3) the general policy framework which favours economic development over environmental concerns." (Stokoe and Gasne 2008: 41)

China's legal system concerning environment is widely criticized for lack of transparency, ill-defined laws, weak enforcement capacity and poorly trained advocates and judiciary (Cohen and Lange 1997; Hanson 2001; Economy 2004; Liu *et al* 2012; Stern 2013). Enforcement of environmental laws through prosecution is scant: according to unofficial estimates, in 60% to 70% of pollution cases victims are not successful in court (Stokoe and Gasne 2008: 41). The inefficient implementation of environmental laws in China is "partly due to the insufficient institutional capacity and unclear legal systems" (Song 2007: 26).

In the past decade, the Chinese government has elevated the importance of environment protection in its national development strategy due to unprecedented rapid deterioration of environmental quality in the country, and has "started experimenting with the greening of all kinds of economic categories and principles" (Economy 2006: 175) and focused on renewable energy policy and energy efficiency policy[148] along with the implementation of the Renewable Energy Law of the PRC[149] since 1 January 2006.

In April 2006, Chinese Premier Wen Jiabao emphasized the importance of three transitions in his speech during the 6th National Environmental Conference: the transition from a focus on economic growth to a focus on environment and economic development; from environment as a lagging objective to equal importance with economic development; and from the primary use of administrative methods of environmental management to a more comprehensive system combining many approaches (see (4) Economic instruments and incentives and (5) Public participation and the role of non-state actors in the coming part of 7.2.1 in this study). Following this direction, the government began to consider evaluating the performance of local government leaders on environmental performance rather than just focusing solely on economic growth categories. For instance, there have been experiments on measuring Green GDP of a number of cities and provinces in China (Xue *et al* 2006).

> "On a political level, PRC environmental planning and policies are primarily shaped and determined by the Five-Year Social and Economic Development Plans, which are elaborated by the Chinese Communist Party and government and approved by the National People's Congress. These Five-Year Plans (FYPs) are supplemented by more specific Five-Year Environment Plans (FYEPs), which are further broken down into

[148] Expert interview with Dr. Eric Martinot at Freie Universität Berlin on 3 May 2013.

[149] The Renewable Energy Law of the PRC is adopted at the 14th Meeting the Standing Committee of the 10th NPC on 28 February 2005 and is amended according to the Decision of the 12th Meeting of the Standing Committee of the 11th NPC on 26 December 2009. The full text of the Law is online available at http://english.mofcom.gov.cn/article/policyrelease/Businessregulations/201312/20131200432160.shtml, accessed on 9 November 2015.

five-year sectoral plans in areas such as water management of key rivers and lakes, hazardous waste management or the reduction of air pollution in designated zones." (Stokoe and Gasne 2008: 41)

China started very early with environmental policies in the 1970s with establishment of institutions for multilevel environmental governance, even if these institutions were quite weak compared to the economic institutions[150]. China has issued more stringent regulations and standards for waste emission reduction than energy saving, and the end-of-pipe treatment is effective in emission reduction (Zhang *et al* 2015c). Moreover, China has also improved its environmental legislation and presently there are a lot of regulations and laws, though the implementation might be a problem[151] due to lack of penalties for non-complies[152].

Chinese environmental policy is impressive and comprehensive, but its implementation is incomplete (Bao 2006). China's specific institutional settings create a number of implementation failures (He *et al* 2012). China already has many regulations and "needs to implement them in a serious and fair way", above all to implement "*environmentally sustainable* development *without* the current Faustian bargain of economic growth at the expense of environmental and human health" (Harris 2008: 176). A national environmental policy should be a policy *for the environment* instead of merely environmental policy only haltingly implemented, as is too often the case, for reasons other than the environment (e.g. energy security, cleaning up Beijing's dirty air for the Olympic games) (Harris 2008: 176).

Political centralization on pollution reduction goals played an important role in the 11th FYEP, and due to its success, China continues to rely on the hierarchical pollution reduction mechanism in the 12th FYP (Liu *et al* 2012). In China's 12th FYP (2011-2015), the Chinese central government further recognizes the priority of sustainable development and establishes the policy orientation of promoting green and low-carbon development. In a word, sustainable regional development becomes more and more important in China, which is in accord with sustainable development as a government policy of China. However, due to China's centralized political system, China's environmental policy was formulated and implemented from top to bottom, and the grassroots did not participate in the formation of environmental policy (Bao 2006: 37). Decentralization in China's environmental policy is weakened by the absence of critical correction mechanisms due to poorly developed active civil society and accountability mechanisms (Mol and Carter 2006: 156).

In addition, along with the international debate on climate change, China also seeks to act as a responsible stakeholder in the international system and begins to integrate climate change and environmental issues into the national strategy and long-term development framework incorporated with climate change issues such as carbon emission reductions (Yu and Zhu 2015).

[150] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[151] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[152] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

In general, China has established its specific legislation as well as institutions on environmental protection. Nevertheless, as representation of the central-local dynamics in a multilevel environmental governance process, China might still need flexibility in the implementation of local laws with consideration of concrete financial sources and specific implementing policies for the local, since it is not enough to only make policy pronouncement at the national level without explicit directions on its implementation at the local level[153]. Moreover, considering that changes in environmental policies could substantially influence the status of multilevel environmental governance, China still needs to intensify the unity among various environmental policies (Zhang *et al* 2015c).

(3) Capacity, knowledge and technology

Considering that China's political history is related to go and study abroad, learn from the experience of developed countries and then bring knowledge back to China, Chinese governmental officials could have good qualifications on capacity and knowledge[154]. In fact, the growth of government officials employed for environmental protection in quantity and quality is impressive in China since 1995 (Mol and Carter 2006: 153). Table 7.1 presents the capacity building of agencies and staff in China's environmental protection systems from 1995 to 2014. Particularly, the ratio of environmental protection staff to the total population of China has increased prominently from 0.75‰ in 1995 to 1.57‰ in 2014 (Table 7.1).

Table 7.1 Capacity building of agencies and staff in China's environmental protection systems, 1995-2014

Year	Number of environmental protection agencies	Number of staff at environmental protection agencies (10^4 persons)	Population of China (10^4 persons)	Environmental protection staff ratio (‰)
1995	no data	9.03	121121	0.75
1996	8400	9.56	122389	0.78
1997	9207	10.32	123626	0.83
1998	9937	11.26	124761	0.90
1999	10811	12.10	125786	0.96
2000	11115	13.11	126743	1.03
2001	11090	14.28	127627	1.12
2002	11798	15.42	128453	1.20
2003	11654	15.65	129227	1.21
2004	11555	16.02	129988	1.23
2005	11528	16.68	130756	1.28
2006	11321	17.03	131448	1.30
2007	11932	17.70	132129	1.34
2008	12215	18.36	132802	1.38
2009	12700	18.90	133450	1.42
2010	12849	19.39	134091	1.45
2011	13482	20.12	134735	1.49
2012	13225	20.53	135404	1.52
2013	14257	21.20	136072	1.56
2014	14694	21.50	136782	1.57

Data source: MEP. National Environmental Statistics Report 1995-2014. Available online: http://www.mep.gov.cn/zwgk/hjtj/qghjtjgb/, accessed on 1 December 2015. (in Chinese)

[153] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

[154] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

According to Yu and Zhu (2015), technology is the most important long-term strategy for China to deal with climate change. In fact, in the past three decades, China has greatly increased its technological capacities, with particular interest in some key technology related to clean energy and environmental protection such as wind power technology and solar power energy. Accordingly, the Chinese government would like to become a world-wide leader on wind power technology, albeit not as a solution for climate change but as a must-have key technology from an industrial point of view like the aerospace technology[155]. Nevertheless, in light of the current global trend of low-carbonizing development, despite confronting huge pressure for CO_2 emission reductions, China also has an opportunity to setup a low-carbon development path with new energy know-how, such as the progress of low-carbon technology, especially the low-carbon technology development of the energy industry and its equipment manufacturing industry, since at least at the technical level, China has provided some good tools to address climate change in the direction of energy-saving and energy-efficient technologies, renewable energy and new energy technologies, and clean coal (Yu and Zhu 2015).

(4) Economic instruments and incentives

Economic instruments and incentives involve both state actors and non-state actors. The state actors such as the MEP as well as the provincial and local EPBs have formulated a variety of economic instruments for pollution control across China. The "*Polluter Pay*" policy as a major economic incentive for pollution control in China mainly focused on point source control and concentration control, including the pollution levy fee, non-compliance fines, discharge permit system and sulfur emission fee[156]. Three state departments jointly promulgated a national plan which aimed to exercise control over the gross emissions of 12 primary pollutants such as smoke dust, SO_2, COD, cadmium, lead and solid wastes, etc. (SDPC *et al* 1996; Wang 2010).

China has introduced a series of environmental economic policies since 2007 (Pan 2007), and 18 provinces implemented emissions trading schemes on a trial basis by the end of 2010 (He *et al* 2012). The pilot eco-compensation program was conducted involving mineral rehabilitation, urban sustainable development, water function zoning and water basin environmental protection and natural reserves, and different departments have set up special funds for specific projects (Bennett 2009). Other environmental economic instruments included green credit, green insurance, green trade and green taxation (He *et al* 2012). These economic incentives have been implemented and will be further promoted in the 12th FYP (Wang *et al* 2006). Currently China mainly has environmental economic instruments and incentives in the following four aspects: 1) environmental taxes, primarily pollution levies and wastewater treatment tariffs; 2) markets, for example, water pollutant discharge rights trading, watershed water rights trading and ecological and environmental compensation; 3) guaranties-deposits; and 4) subsidies and incentives, such as special subsidies for

[155] Expert interview with Dr. Eric Martinot (3 May 2013).

[156] Source: Wikipedia. https://en.wikipedia.org/wiki/Environmental_protection#China, accessed on 5 November 2015.

irrigation water, special subsidies to enterprises for pollution abatement and special subsidies for the construction and operation of urban sewage treatment plants (ADB 2011).

Environment-friendly labeling and cleaner production certification as a market-driven non-state voluntary instruments by firms has developed rapidly in recent years. Product and process labelling and certification schemes such as the International Organization for Standardization (ISO) 14001, the Hazard Analysis and Critical Control Point (HACCP) programs and good manufacturing practices (GMP) schemes do impact environmental performance in China, though they are promoted not by domestic regulations but by informational governance arrangements that link international markets to local producers and traders (Mol 2009b: 121). Along with the process of economic globalization, Chinese companies become increasingly active in the field of environment-friendly labelling and certification, which also reflects the interaction between Chinese firms and the global market. For instance, China experienced a dramatic increase of firms certified with ISO14001 environmental management standard (Table 7.2), from only 9 firms in 1996 (Mol and Carter 2006: 154) to 117758 firms in 2014 (ISO 2014), and China is currently the largest adopter of the ISO 14001 standard in the world. According to McGuire (2012: 93), the adoption of ISO 14001 "can improve environmental outcomes even where regulations are weakly enforced". In this sense, the ever increasing adoption of ISO 14001 certificates by Chinese firms in the past two decades also makes its own contribution to China's capacity building on environmental management.

Table 7.2 Evolution of ISO 14001 certificates in China, 1996-2014

Year	Total number of ISO 14001 certificates adopted by Chinese firms
1996	9
1999	222
2000	510
2001	1085
2002	2803
2003	5064
2004	8862
2005	12683
2006	18842
2007	30489
2008	39195
2009	55361
2010	69784
2011	81993
2012	91573
2013	104735
2014	117758

Data source: ISO (2014)

(5) Public participation and the role of non-state actors

Thanks to the legal advocacy of the EIA Law (2003), the Administrative License Law (2004) and the new Environmental Protection Law (2014) in environmental public participation in China[157], in addition to the spontaneous growth of Chinese firms on environment-friendly labelling and certification mentioned above, public participation and the role of non-state actors in environmental protection and governance has also been ever increasing in the past two decades. Nevertheless, due to the fact that "public has been largely absent in Chinese policy-making for a long time" (Zhong and Mol 2008: 901), one can witness increased opportunities for public involvement in policy making processes of environmental governance in China, even though the opportunities fall far short of western practices and standards (Wang *et al* 2003).

More and more studies demonstrate the role of public participation in the process of developing civil society in China. China seems to face a rocky road in terms of citizen activism with political and legal action against pollution (van Rooij 2010). Pesqué-Cela *et al* (2009) assess the growing importance of grassroots self-governing social organizations in rural China due to political distrust. In fact, incidents of environment-related protest on environmental damage as well as illegal construction and production have also multiplied in China (Otsuka 2009; Alpermann 2010; Xie 2011). In addition, according to a report of China's official press agency — Xinhua News Agency, data from the MEP showed that the number of mass demonstrations related to environmental concerns has increased at an annual rate of 30% (Xinhua 2012b).

Nevertheless, public concern about environmental protection has been ever increasing in China since the middle of 1990s, and the emergence of "an environment-oriented civil society has been increasingly visible" (Shi and Zhang 2006: 288). For instance, according to the official statistical data published by the MEP in the annual National Environmental Statistics Report (1995-2014)[158], the number of proposals raised by delegates of People's Congresses and People's Political Consultative Conferences (PPCCs) has increased from 6177 in 1996 to 21236 in 2014 (Table 7.3). And what's more, there has been rising public discontent on environmental protection administrations of governments at all levels in China with an ever-increasing total number of citizen complaints up to 1.625 million in 2014, which is 27.7 times of the total complaints of0.059 million in 1995 (Table 7.3).

[157] See *Article 53-58* of *Chapter V Information Disclosure and Public Participation* of the Environmental Protection Law (2014), http://zfs.mep.gov.cn/fl/201107/t20110701_214304.htm, accessed on 2 December 2015 (in Chinese). For an unofficial translation of the Environmental Protection Law of the People's Republic of China (published on 24 April 2014) compiled by the EU-China Environmental Governance Program, please visit https://www.chinadialogue.net/Environmental-Protection-Law-2014-eversion.pdf, accessed on 2 December 2015. For the legal advocacy in environmental public participation in China, see also Moore and Warren (2006).

[158] The annual National Environmental Statistics Reports (1995-2014) of China are available online: http://www.mep.gov.cn/zwgk/hjtj/qghjtjgb/, accessed on 1 December 2015. (in Chinese)

Table 7.3 Public concern about environmental protection in China: citizen complaints and proposals raised by delegates of People's Congresses and PPCCs at all levels, 1995-2014

Year	Total number of citizen complaints by letter, telephone and internet on environmental protection (million)	Total number of proposals raised by delegates of People's Congresses and PPCCs at all levels
1995	0.059	No data
1996	0.067	6177
1997	0.106	6590
1998	0.148	9637
1999	0.230	10686
2000	0.248	11467
2001	0.367	10577
2002	0.435	11665
2003	0.526	11791
2004	0.596	12532
2005	0.608	12343
2006	0.616	10295
2007	No data	11992
2008	0.705	13271
2009	No data	11341
2010	0.701	11889
2011	1.054	12974
2012	0.999	19467
2013	1.214	18212
2014	1.625	21236

Data source: MEP. National Environmental Statistics Report 1995-2014. Available online: http://www.mep.gov.cn/zwgk/hjtj/qghjtjgb/, accessed on 1 December 2015. (in Chinese)

With these ever increasing proposals, complaints as well as protests mentioned above, people are also better organized into the nascent environmental civil society organizations in China. "Officials and the press see that NGOs 'serve as a bridge for mutual communication that will link government and society' and expect NGOs to consult their constituencies and voice their interests, to participate in drafting policies and laws, and to disseminate expertise information" (Salmenkari 2008: 413). "China's civil society has certainly raised awareness about the ecological costs of past and present economic strategies and has thus been able, at times, to obstruct projects that would have grave and negative environmental impacts", though the influence is "mostly with regard to individualized, local projects and problems" (Betz 2013: 29). Despite increasing public participation, most citizens "remain in a weak position in terms of influencing policymakers who are dealing with environmental issues", and "adding that open discussions on environmental protection are still relatively scarce in the public sphere" (Xinhua 2012a). China "still places important constraints on NGOs' organizational independence, pluralism, and growth, which is why a civil society in China is still only in the making" (Alpermann 2010: 130). According to the official statistical data of the Ministry of Civil Affairs (MCA), the total number of registered environmental NGOs in China has increased from 6716 in 2008 to 6964 in 2014, while the total number of registered environmental civil society organizations in China has decreased from 7624 in 2008 to 7362 in 2014[159] (MCA 2015), which implies that the

[159] Environmental foundations are not included in, no data available for environmental foundations by MCA (2015).

growth of environmental civil society organizations in China might remain under control from the State[160].

NGO as an important non-state actor for China's environmental governance has experienced rapid development since the UNCED in 1992, though with some obvious "Chinese characteristics". The UNCED in 1992 "triggered a profound change in the Chinese leadership's conception of environmental governance" by introducing Western ideals of public participation and NGO into Chinese society (Economy 2004: 99). At that time China did not deliver any genuine NGOs in the NGO forum, but was represented by a set of government-organized NGOs (GONGOs) (Economy 2004: 99). In June 1993, the Chinese government cited public participation as a goal in the environmental protection for the first time (Dai and Vermeer 1999: 143). On 31 March 1994, China's first NGO for environmental protection – *Friends of Nature* (FON) was approved by the MCA.

Environmental NGOs become increasingly visible players in China's environmental politics and their rise interacts with four institutional fields: political conditions, media, internet and international NGOs (Yang 2005). "Media professionals have established a journalist network to distribute environmental information" (Salmenkari 2008: 398). Worrying about the relationship of environmental NGOs and media which might add difficulty and complexity to political control[161], China's regulative framework still constrains the creation and growth of environmental NGOs (Yang 2005). "Many of the NGOs outside Beijing suffer from lack of funding, staff, office space, and other politically induced constraints, they continue to pursue their work" (Economy 2004: 160).

> "The government's support of NGOs remains qualified. The range of restrictions it has placed on NGOs regarding registration, funding, staffing, and location have constrained the number of NGOs as well as the range of their activities. If the government is committed to an active and engaged public effort to protect the environment, especially as a means of overcoming the state's decreasing capacity to meet the country's environmental protection needs, it will need to relax these restrictions and free NGOs to flourish." (Economy 2004: 174).

Environmental NGOs are at the forefront of China's budding civil society (Yang 2005; Cooper 2006; Thompson and Liu 2006). With the promotion of civil society as an independent service provider, the Chinese State uses NGOs as objects of consultation for improving its policy making to obtain specialist information, while NGOs indeed inform the State on environmental and social tasks, moreover, many of them with policy formulation in mind (Salmenkari 2008). NGOs for environmental protection have played an important role in "educating and guiding the public, improving public participation, promoting and assisting the government in the implementation of policies for environmental protection and sustainable development" (Sun *et al* 2002). China's environmental NGOs not only make it possible for citizens to practise political skills,

[160] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[161] Expert interviews with Prof. Dr. Bettina Gransow at Freie Universität Berlin on 26 April 2013 and with Dr. Eva Sternfeld (17 April 2013).

organize and participate in civic action and test political limits (Yang 2005), but also potentially relate more directly with grassroots problems than government agencies and link up with international NGOs and multilateral institutions to deal with environmental problems (Chan *et al* 2008). According to MEP (2006, 2011), with the rise of environmental NGOs in China over the past two decades, public environmental awareness as well as public participation in China has grown rapidly.

Chinese central government and environmental NGOs have operated under the tacit agreement that their mission and work are mutually reinforcing (Economy 2004: 136). Both state-owned and private enterprises may cause cross-border pollution accidents, while environmental NGOs (both national and international) such as Greenpeace and media try to make positive influence during the process by disclosure of pollution accidents and raising public environmental awareness. Some NGOs try to cooperate or negotiate with governments to protect the environment. Environmental NGOs could "help" governments on environmental governance by applying their specialist local knowledge through tools of "awareness campaigns, leafleting, news media publications, photo exhibitions, suggestions to local governments for project-based cooperation, and lobbying" (Zawahri and Hensengerth 2012: 289).

For a long time GONGOs such as the Beijing Environmental Protection Organization and China Environment Fund dominated the environmental civil society sector (Mol and Carter 2006: 166). "Many kinds of GONGO, including foundations, education centers, research institutions and industry associations", play a major role in environmental governance in China "due to less restrictive institutional structure, expertise and personal connections" (Mol and Carter 2006: 166, Note 11). National and international environmental NGOs in China focus on nature protection, biodiversity conservation and environmental education, but they rarely act against official environmental policies[162] (Sternfeld 2006: 33).

Environmental NGOs interrelates and cooperates with each other in China. There is an Annual Meeting of Environmental Civil Society Organizations on Sustainable Development organized by the All-China Environment Federation (ACEF, a GONGO) and other NGOs to promote mutual understanding and cooperation among NGOs to protect the environment since 2006. About 450 NGOs participated in the meetings, which were widely covered by the public media[163]. The environmental NGOs and media interconnect with each other in promoting environmental governance in China as well. For instance, CCTV[164] discloses the illegal dumping of drilling wastewater by PetroChina in Songyuan City, Jilin Province on 26 November 2013. Afterwards, the ACEF filed a lawsuit against PetroChina for illegal dumping of drilling wastewater in Jilin Province on 29 November 2013 asking for RMB 60.75 million (around 10 million US$) to

[162] Original in German: „Nationale und internationale Umwelt-NGOs in China beschäftigen sich schwerpunktmäßig mit Themen des Natur- und Artenschutzes sowie Umweltbildung. Nur selten agieren sie konfrontativ zur offiziellen Umweltpolitik" (Sternfeld 2006: 33).

[163] Source: www.acef.com.cn/en/programmes/2013/1216/1012.html, accessed on 31 August 2015.

[164] China Central Television, commonly abbreviated as CCTV, is the predominant state television broadcaster of China.

cover associated environmental damage[165]. The court has taken this case in Beijing, and it becomes the largest lawsuit of environmental protection based on public interest litigation in China (Zhang 2014). Nevertheless, all major environmental organizations including GONGOs are under tight government control and perform mostly the functions of promoting China's green image, facilitating foreign assistance, conducting environmental research, mobilizing popular support in the implementation of the government's green policies, and socializing green values (Lo and Leung 1998).

Under current political situation, the environmental governance at the regional level is propelled primarily by the political decision at the national level (e.g. the MEP or State Council) and is achieved through negotiation as well as cooperation among provincial governments in the region. In other words, the political-institutional cooperation on environment issues at the regional level in China is to a certain degree rests on the decision by the central government at the national level. On the one hand, scientists, researchers as well as planners will provide professional consultations and suggestions based on investigations and research in each field referred to the topic during the decision-making process. On the other hand, environmental NGOs and public participation also push on the process either by international cooperation with international environmental NGOs or sometimes by active citizens themselves. Although public participation happens normally at the local level, people might search for solutions at the provincial or even at the national level if thdy could not meet their objectives at the local level.

All and all, NGOs as well as civil society in China are still very weak. Although there have been thousands of environmental groups, most of them remains week and small. Environmental NGOs are still not allowed to talk about certain environmental problems. For instance, there is almost a boycott discussion about the Three Gorges Dam[166]. Nevertheless, it is gratifying to see the growth of these groups as an implication for interests on public participation in the governance process, and China's political system might still need some opening to civil society further[167].

7.2.2 The provincial level

A provincial Environmental Protection Department (EPD) as part of the provincial government is an active state actor in China and dominates the environmental governance process at the provincial level[168]. A provincial EPD, under supervision of the MEP at the national level and served as an actor in the multilevel system of Environmental Protection Bureaus (EPBs) at various governmental levels, safeguards the crucial position of the state in the task of environmental protection at the provincial level. In fact, China's provincial EPDs have several internal agencies as well as affiliated institutions, covering almost all the aspects of environmental governance, from planning

[165] Source: PetroChina Sued by ACEF for Toxic Dumping. chinawaterrisk.org/notices/petrochina-sued-by-acef-for-toxic-dumping, accessed on 31 August 2015.

[166] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

[167] Expert interviews with Prof. Dr. Bettina Gransow (26 April 2013) and Prof. Dr. Miranda Schreurs (22 April 2013).

[168] For Shanghai Municipality, the Shanghai Environmental Protection Bureau is equivalent to a provincial EPD.

to environmental supervision, from policies, laws and regulations to human resource management, from science, technology and standards to total pollutants control, from environment monitoring to pollution prevention and control as well as from finance to international cooperation.

The main responsibilities of a provincial EPD are, on the one hand, to implement national environmental strategies, policies, laws and regulations; on the other hand, to formulate and implement local environmental regulations, ordinances and policies based on local situations, to establish provincial or municipal environmental strategies, and to compile and implement local environmental medium and long-term plan and annual plans. In addition, the provincial EPD may also organize and inspect local EPBs in the province to cooperate and share information with each other in order to deal with outbreak of environmental pollution incidents more effectively.

In the unitary administrative system of China (see 7.1.1), local and provincial governments accept the unified leadership of the State Council[169], whereas "the heavy top-down governance structure" by and large has been "proven counterproductive to sustainable development" (SEI and UNDP China 2002: 67). In fact, important actions on the environmental protection issues at the provincial level reflect the political decision on environmental governance at the national level in some degree. Usually a mandate from the central government serves as the most important impetus to promote environmental protection in a province, especially for regional environmental projects related to several provinces.

Just as the MEP remains relatively weak when compared to other ministries at the national level, similarly, a provincial EPD is not the keystone of political decision at the provincial level as well compared to other provincial departments. In most cases, especially when there is a contradiction between environmental protection and the political performance of government officials such as the annual growth rate of the provincial GDP, provincial government officials are prone to choose GDP growth instead of environmental protection. As a consequence, serious environmental pollution accidents and ecological damage occur due to the neglect of the environment.

When an environmental pollution accident happens in a province, caused by either state-owned or private enterprises, no matter it is only a local pollution accident or it is more serious as an accident within or across the provincial borders, the provincial EPD has its duty to investigate the accident. The more serious the accident or damage is, the more attention from the provincial government, and sometimes even the attention from the MEP at the national level is required, particularly when it comes to be a very serious environmental protection accident with significant ecological damages[170]. According to

[169] Souce: China's Political System: VI. The Local Administrative System. http://www.china.org.cn/english/Political/28842.htm, accessed on 31 August 2015.

[170] One of the 13 missions of the MEP is to "Take charge overall coordination, supervision and management of key environmental issues. As the leading organization coordinate the investigation and handling of very serious environmental protection accidents and ecological damages; guide and coordinate the activities of local governments in terms of early warning and emergency response to very serious environmental protection accidents; coordinate and address trans-province pollution disputes; make overall arrangement for pollution prevention and control of key watershed, regions and marine areas; guide, coordinate and supervise marine environment protection

Article 68, Chapter VI of the Environmental Protection Law (2014), provincial government officials might get punishment from higher authorities, even dismissal from the office, if they could not solve the environmental problem or pollution accident[171].

Provincial EPDs also turned out to be active actors along with the MEP in the field of regional restrictions on EIA approval — a field of environmental governance with Chinese Characteristics. According to Article 44, Chapter IV of the Environmental Protection Law (2014), provincial EPDs and the MEP could "suspend the EIA approval for their new construction projects that may cause increase of the total key pollutants emission in the region" in order to achieve the environmental quality targets assigned by the State[172]. By the end of July 2015, a total of 120 EIA restrictions have been imposed in China: 48 issued by the MEP (or its predecessor SEPA), 67 by provincial EPDs and 5 by EPBs at the local level (Wang and Hao 2015). In fact, even if regional restrictions on EIA approval in China as an environmental authoritarian measure is to some extent environmentally effective in the past decade (Zhu *et al* 2015), use of EIA restrictions is currently neither standardized nor unified, and even tends towards the casual due to a lack of clear norms from the State on the applicability, scope and procedures for EIA restrictions (Wang and Hao 2015).

Environmental NGOs and media are active actors in the process of environmental governance at the provincial level beside the provincial EPD. For one thing, the

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work." (Source: Mission of the MEP. http://english.mep.gov.cn/About_SEPA/Mission/200803/t20080318_119444.htm, accessed on 2 December 2015)

[171] *Article 68* of *Chapter VI Legal Liability* of the Environmental Protection Law (2014):
"Article 68. Where the local people's governments at various levels, competent environmental protection administrative departments of people's governments at or above county level or other departments with environmental supervision responsibilities commit any of the following acts, the persons directly in charge and other personnel subject to direct liabilities shall be given a demerit, a serious demerit or be demoted; where grave consequences are caused, the foregoing persons shall be removed from office or be dismissed, and the primary persons in charge of the relevant departments shall take the blame and resign from office:

(1) Where they grant administrative permits to applicants that fail to meet requirements;
(2) Where they cover up environment-related illegalities;
(3) Where they fail to make decisions on suspension of production or closure despite being so required pursuant to the law;
(4) Where they fail to promptly investigate upon discovery or receiving reports on acts of excessive discharge of pollutants and discharge of pollutants through means that evade regulation that cause environmental incidents, failure to enforce ecological protection measures that causes ecological damage, etc.;
(5) Where they violate this Law and seal up and detain the facilities and equipment of enterprises, public institutions and other producers and business operators;
(6) Where they tamper or forge, or instigate others to tamper or forge the monitoring data;
(7) Where they fail to disclose environmental information that should be disclosed in accordance with the law;
(8) Where they withhold, misappropriate or divert for other purposes the pollutant discharge fees collected;
(9) Where they have committed other illegal acts as prescribed by laws and regulations." (Source: https://www.chinadialogue.net/Environmental-Protection-Law-2014-eversion.pdf, accessed on 2 December 2015.)

[172] *Article 44* of *Chapter IV Prevention and Control of Pollution and Other Public Hazards* of the Environmental Protection Law (2014): "Article 44. The State shall adopt total emission control system for key pollutants. The total discharge quota of key pollutants is assigned by the State Council, and allocated to provincial, autonomous region and provincial-level municipality governments for implementation. While conforming to national and local pollutants discharge standards, enterprises and institutions shall also fulfill the total emission control quota for key pollutants as assigned to them. For regions that fail to fulfill the total emission control quota or achieve the environmental quality targets assigned by the State, environmental departments at or above provincial level governments shall suspend the EIA approval for their new construction projects that may cause increase of the total key pollutants emission in the region." (Source: https://www.chinadialogue.net/Environmental-Protection-Law-2014-eversion.pdf, accessed on 2 December 2015)

provincial EPD may support as well as participate in the work of grassroots environmental NGOs in the province. For another, the news media on environmental protection including internet, newspapers, TV, radio, internet as well as *Weibo* (Micro Blog) has played an increasingly important role in raising public awareness on environmental protection, in disclosing pollution accidents or environment-related illegalities and in promoting interaction between government and the public. Particularly, nowadays each provincial EPD has its homepage[173] served as a platform for an interactive E-governance, from which enterprises and citizens could find the information and database they need on environmental issues, including government affairs and services, provincial and local environmental news, environmental plans, environmental technological standard, environmental policies and regulations, environmental projects, finance, environmental quality, guide for applications, publications, environmental education as well as environmental communications. Moreover, enterprises and citizens could make online-consultation by sending an E-mail or using online-message for disclosure, inquiry or discussion besides telephone consultation.

7.2.3 The local level

In theory, local EPBs safeguard the crucial position of the state in environmental protection at the local level; by way of contrast, in practice, local EPBs are heavily dependent on both higher level environmental authorities and local governments (Mol and Carter 2006: 155). Although China's transition is characterized by decentralization and flexibility, decentralization does not automatically result in better protection of the environment, since local authorities typically give preference to economic growth and investments over the progressive development of environmental policies and stringent enforcement of environmental regulation and standards (Mol and Carter 2006: 155).

In fact, the 1994 reform of the taxation system and fiscal decentralization (see 7.1.2) results in moving-up fiscal authority to the central government while moving-down corresponding responsibilities to local governments, which objectively intensifies the asymmetry between fiscal authority and responsibilities at the local level. Consequently, local governments have to get out of the dilemma of being responsible for more affairs but with much less finance. With this intention, considering that local land-transfer payments belongs to the local government, land transfer payments become the main source of local government finance budget revenue. According to a survey by the Development Research Centre of the State Council, more than 60% of local fiscal budget revenue come from local land transfer payments. For example, in 2003, the land transfer revenue of Shaoxing County, Zhejiang Province was 1.92 billion Chinese yuan, accounting for 69.3% of its annual total budget revenues (Liu 2006). For this reason, local governments exhibit extraordinary enthusiasm on the sale of land and on

[173] For instance, in the NE and YRD, each provincial EPD has a homepage, though mostly in Chinese, except the homepage of Shanghai EPB with an English version.
Homepage of Liaoning EPD: www.lnepb.gov.cn, accessed on 31 August 2015;
Homepage of Jilin EPD: hbj.jl.gov.cn, accessed on 31 August 2015;
Homepage of Heilongjiang EPD: www.hljdep.gov.cn, accessed on 31 August 2015;
Homepage of Jiangsu EPD: www.jshb.gov.cn, accessed on 31 August 2015;
Homepage of Zhejiang EPD: www.zjepb.gov.cn, accessed on 31 August 2015;
Homepage of Shanghai EPB: www.sepb.gov.cn, accessed on 31 August 2015.

excessive construction of development zones.

Furthermore, under China's unified top-down political system (see 7.1.1), the central government could create a "yardstick competition" on the basis of economic performance among local governmental officials (Zhang 2006) by rewarding or publishing them, and the target responsibility system is one of the major institutional responses to such competition. In addition, due to fact that the rule of law in China is still weak (Stern 2010), local government leaders have been more interested in economic growth than environmental protection in the past decades (Mol and Carter 2006), and some local governments even have more enthusiasm than the central government on economic development[174]. Government officials often ignore the existent more than 100 environmental laws and regulations in China (Liu and Diamond 2005, 2008), on account of economic development still as the main criterion for judging their performance at the local level (Liu and Diamond 2005: 1181).

Fortunately, due to increasingly serious environmental pollution, the central government has been much more supportive for environmental protection and has decided to initiate a change in the evaluation system of local government officials since the 11th FYP (2006-2010). For instance, local government leaders will fail the evaluation and could not get promotion if they do not attain SO_2 emission goals. As a result, local governments greatly enhanced their goal commitment through external pressure from the central government and peer pressure among local governments (Xu 2011). In addition, the revised Water Pollution Prevention and Control Law (2008) "lays the foundation for a national-level assessment mechanism for water protection, and water protection projects will be accounted for in the evaluation of local governments and their officials' performances" (Stokoe and Gasne 2008: 41). And what's more, under the provisions of Article 26, Chapter II of the Environmental Protection Law (2014), the State adopts environmental protection target accountability and performance evaluation system since 2015, and local governments shall incorporate the fulfillment of environmental protection target as an appraisal criteria into the performance evaluation of local EPBs and their responsible persons[175].

According to Stokoe and Gasne (2008: 41), local EPBs make the "actual implementation of environmental policies at the sub-national level" and are "in charge of monitoring industrial pollution discharge, site inspections, issuing discharge fees/fines and prosecution, inter alia". In fact, local EPBs rely on their local governments for virtually all their support (Jahiel 1998: 759) and are quite responsive to the needs and concerns of the local government (Economy 2004: 108). Along with the decentralization

[174] Expert interview with Dr. Eva Sternfeld (17 April 2013).

[175] *Article 26* of *Chapter II Supervision and Management* of the Environmental Protection Law (2014):

"Article 26. The State adopts environmental protection target accountability and performance evaluation system. People's governments at or above the county level shall incorporate the fulfillment of environmental protection target as an appraisal criteria into the performance evaluation system for the departments with environmental supervision responsibilities at the same level government and their responsible persons, as well as performance evaluation for the lower level governments and their responsible persons. The evaluation results shall be made public." (Source: https://www.chinadialogue.net/Environmental-Protection-Law-2014-eversion.pdf, accessed on 2 December 2015)

of fiscal authority in China, local governments have greater authority to retain financial resources for investments to promote economic development as well as other public affairs including environmental protection (Jin and Zou 2005). Nevertheless, there are few incentives for local officials to carry out the initiatives of the central government. Although domestic environmental policy has been increasingly integrated into China's national economic policy framework, environmental policy is still competing with economic policy at the local level[176], because in the short-term the costs of environmental protection measures are usually higher than the benefits from improved environmental situation (Richerzhagen and Scholz 2007: 9-10). Moreover, some local government officials have interests in companies that damage the environment, and it is hard for them to enforce environmental policies (Liu and Diamond 2005: 1185). When confronted with a choice between upholding environmental protection laws and supporting a polluting factory employing thousands of local residents, local government officials usually choose the latter, and similar conflicts of interest are frequently resolved in favor of local official's priority on economic development (Economy 2004: 92).

The misbehavior of local government officials is endogenous to China's central-local structure, because under a still-centralized political system with extensive expenditure decentralization but with little revenue decentralization, local government officials are more responsive to higher-level government policies than they are to local needs (Liu *et al* 2006). Indeed, many local EPBs are ill-equipped to manage the task of environmental protection at the grassroots level (Economy 2004: 108) and are lack of meeting public needs even with media attention and strong public support (Economy 2004: 165). That's the reason why environmental protection remains weaker at the local level.

Market-based approaches to environmental protection implemented in China "often lack the necessary administrative, market and enforcement mechanisms" (Economy 2004: 92). "China's weak legal tradition, too, enables corruption to flourish, although there are increasing opportunities for Chinese citizens to seek redress for environmental wrongdoing through the judicial system" (Economy 2004: 92). Some local EPBs make corruption on the arbitrariness and even abuse in the pollution discharge fee (Economy 2004: 109-112). Private environmental activities like private nature reserves and garbage collection only points up further the weakness of the local EPBs (Economy 2004: 165). As a result, people see the failure of local officials to enforce environmental regulations or government corruption contributing to pollution around them (Harris 2006: 11). Local governments are generally lack of the driving-force for local environmental governance[177], only if a quite serious pollution accident happens at the local level but with close attention from the MEP or the State Council, then local as well as provincial governments just follow with the political decision at the national level.

Adherent to national agencies as well as policies set by the central government, a high degree of uniformity in environmental governance exists among different cities and localities in China in the regulatory process of environmental governance (Sinkule and

[176] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

[177] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

Ortolano 1995; Tang *et al* 1997). Moreover, there is no significant relationship between environmental performance and the environmental governance level: local governments with high environmental performance owing to their proactive environmental policies have no significant incentives to inform other stakeholders of their environmental policies by disclosure on their websites; on the other hand, inferior environmental performers might tend to disclose more superficial information about their environmental performance (Yu 2015). As a result, shaped by China's single-party regime, the regulatory style of environmental governance in China is characterized as "formal in requirement, agency-dominated in the regulatory process, legalistic in enforcement, and informal politics as the substance of regulation" (Lo *et al* 2000). Despite of rapidly modernized and updated environmental laws, China keeps some of the Chinese characteristics such as an emphasis on promotion rather than regulation (Mol 2009a: 96).

Moreover, China's environmental laws are more like policy statements rather than laws, and most Chinese environmental protection laws are too broad, providing local officials with little guidance on implementation (Economy 2004: 101). "The Chinese even have a common saying, 'national policies, local countermeasures', to describe the practice of exploiting the ambiguity of national laws and regulations to figure out ways around them" (Ma and Ortolano 2000: 92). Although China's existent laws do have rules requiring local governments to conduct environmental assessments before approving some projects as well as "encouraging individuals and institutions to participate in the assessment", such rules have been powerless due to the absence of mandatory terms for governments to disclose assessment information (Xinhua 2012b). Municipal leaders approving sites for economic development projects prior to the initiation of the EIA process. An example was the case of Sony's relocation of its production lines from Japan to the Pudong New Area after the Kobe earthquake in 1996 (Lo *et al* 2000: 312): Shanghai government gave Sony favorable treatment by allowing the construction work to commence well before the completion of the EIA process in order to compete with the government of Dalian City in Liaoning Province, the NE for this investment, and the subsequent EIA report was hastily completed and quickly approved in a month's time to fulfill the prescribed formal requirements. In this sense, Lo *et al* (2000) point out that "the accountability of China's environmental governance system to the public is basically non-existent" due to "lack of institutional channels for external review" (Lo *et al* 2000: 317).

NGOs especially environmental NGOs as non-state actors are active in the environmental governance process at the local level[178]. Compared to most of the environmental NGOs at the provincial level organized by the provincial government, environmental NGOs at the local level are more diversified, including grassroots environmental NGOs, environmental NGOs organized by universities as well as government-organized environmental NGOs. Grassroots environmental NGOs could be founded by local volunteers for environmental protection, such as the *Association of Volunteers for Environmental Protection of Tiexi District, Shenyang* (Shenyang City,

[178] Expert interview with Dr. Eva Sternfeld (17 April 2013).

Liaoning Province) in the NE and the *Head Service Team of Volunteers for Environmental Protection of Changshu* (Suzhou City, Jiangsu Province) in YRD. There is at least one environmental NGO organized by students at almost every university in the cities of the NE and YRD, and in some cases there are several environmental NGOs in one university. For example, Nanjing University (Nanjing City, Jiangsu Province, YRD) has at least 4 and Harbin Institute of Technology (Harbin City, Heilongjiang Province, the NE) has at least 3 environmental NGOs organized by students, which demonstrates a passion for environmental protection and governance by the students at universities and colleges.

State-owned enterprises (SOEs) as state actors may bring a dilemma of path dependence at the local level. SOEs, especially the SOEs in the manufacturing sector, often play a negative role in the environmental governance process at the local level. Indeed, the SOEs have made their contribution to local economic development, and sometimes the contribution is quite predominant compared to other local private companies. For instance, in the NE, many SOEs have been located there since the 1950s and have influenced the development path of a city or the region, which will be further explained in 7.3.1.

7.3 Political-institutional path-assets analysis of the NE and YRD

Based on the multilevel governance dynamics of China analysed in 7.2, this scetion focuses on the political-institutional path-assets analysis of the NE and YRD with emphasis on the multilevel environmental governance process in the two regions, and tries to discover the dynamic coordination and cooperation process among the network for environmental governance in both regions with consideration on both state and non-state actors.

7.3.1 The NE

(1) Environmental governance network of state actors

The environmental governance process in the NE is determined in a large degree by state actors that form a network composed by provincial EPDs and local EPBs under supervision of the MEP. In the region of NE, a system of provincial EPDs and local EPBs dominates the environmental governance process at the provincial and local level.

The provincial EPD of each province (Liaoning Province, Jilin Province and Heilongjiang Province), under supervision of the MEP at the national level, is part of the provincial government and is responsible for the implementation of national environmental policy, laws, regulations, plans and standards, for the organization and implementation of environmental quality monitoring and pollution supervisory monitoring at the provincial level, for the drafting of provincial laws, regulations and plans related to environmental protection, for the scientific research on and technology demonstration projects of environmental protection, for the organization and coordination of education, training, communication and cooperation in the field of environmental protection in the province, for promotion of public participation in environmental protection and for the tasks

assigned by the provincial government[179]. In addition, there are GONGOs in the form of research institutions, industry associations or education centers, organized and supervised by the provincial EPD to promote public participation in environmental protection. For example, in Liaoning Province, the *Liaoning Society for Environmental Sciences* and the *Liaoning Environmental Protection Industry Association* are actually GONGOs under supervision and administration of Liaoning EPD.

Under a top-down political system, at the local level, local EPBs are dominate actors in the process of local environmental governance. A Local EPB is under supervision of its provincial EPD and is part of the local government. For example, Shenyang EPB is a local EPB of Shenyang City, Liaoning Province with many responsibilities. It is responsible for the implementation of national and provincial environmental policy, laws, regulations, plans and standards, for the organization and implementation of environmental quality monitoring and pollution supervisory monitoring at the local level, for the drafting of local laws, regulations and plans related to environmental protection, for giving suggestions or opinions to local government on local environmental protection including special financial arrangements about local environmental protection of local government funds, the control of local environmental pollution and damage from source prevention, for the scientific research on and technology demonstration projects of environmental protection, for the organization and coordination of education, training, communication and cooperation in the field of environmental protection at the local level, for promotion of public participation in environmental protection and for the tasks assigned by the local government[180].

Notably, the most significant duty of a local EPB lies in that a local EPB bears full responsibility for the control of local environmental pollution and damage from source prevention. In contrast, the local EPB could only give suggestions or opinions to local government on local environmental protection, whereas the local government has much more power than the local EPB on decision-making in reality. Even if the local EPB gives good suggestions to the government on local environmental protection, the local government does not necessarily adopt these suggestions from the local EPB. As a result, the local EPB might have to take responsibility for local environmental pollution instead of the local government, though it's not the fault of the local EPB in essence.

(2) SOE and environmental pollution accident

Environmental pollution accidents caused by SOEs have serious consequences in the region of NE. Although a pollution accident happens at the local level, the accident could scale its influence up to the provincial, regional and even national and international level. Considering that the NE has served as a national heavy industry base since the 1950s, currently there are still many SOEs in this region. In most of the cases, the SOEs are under direct administration of their headquarters at the national level. In other words, the SOEs make their own contribution to local or provincial

[179] Source: Missions of Liaoning EPD. http://www.lnepb.gov.cn/zfxxgk/jggk/gzzn/, accessed on 2 December 2015. (in Chinese)

[180] Source: Missions of the Environmental Protection Bureau of Shenyang City. http://www.syepb.gov.cn/hbtx/panel.asp?code=0101, accessed on 2 December 2015. (in Chinese)

revenues but often fall outside of the jurisdiction of local or provincial governments.

A typical example is Jilin Petrochemicals (JPC), a chemical plant of the PetroChina Company Limited located in Jilin City, Jilin Province. As one of the most powerful SOEs in Jilin City, JPC could influence and even determine the development path of the city, which has made Jilin City well-known as a "chemical industry city" not only in the NE, but also in China since the 1950s.

Jilin City is embraced by mountains and hills, and the Songhua River twines through the city. In account of the beautiful natural scenery of Jilin City, the municipal government tried to change the orientation of Jilin City as a "chemical industry city" and planned to develop tourism in Jilin City in the 1990s. Nevertheless, due to state-owned chemical companies with environmental pollution as the JPC, the air and water quality of Jilin City was very poor. Moreover, the reputation of "chemical industry city" made it quite difficult for Jilin City to attract tourists. A vice general manager of JPC said that it was unnecessary to make a plan for developing tourism in Jilin City, since it would be much easier for the municipal government to get financial support directly from JPC, which was equivalent to the total income by developing tourism for several years[181]. At last, all the efforts by the municipal government on developing tourism and getting rid of the reputation of "chemical industry city" for Jilin City failed completely due to the powerful SOE of JPC[182].

Along with the increasing power of JPC on the decision-making process of local development, the supervision on JPC has been increasingly separated from the local government[183]. Although JPC contributes more than half of the GDP of Jilin City, it is not under administration of Jilin City or even Jilin Province, but under direct administration of the PetroChina at the national level; its leader is sub-provincial level and appointed directly by PetroChina[184]. A slogan of the 50th anniversary of JPC is "Son of the Republic", which reflects the relation between Jilin City and JPC just like an owner and a tenant[185]. As a consequence, even the local government seems to become less influential on decision-making for local development in front of the powerful SOEs like JPC.

As mentioned previously in Chapter 6, environmental pollution accidents caused by SOEs are quite common in the NE. In fact, small accidents happened almost every year in JPC (before the 11.13 explosion, see below), but it was not obligatory for the local EPB as well as the local government to report to the provincial or national government if less than 3 people died in the accident[186]. Nevertheless, some extremely serious environmental pollution accidents, which could be taken as contingency in the process

[181] Informal talk with a retired government official of Jilin City on 6 January 2006. (in Chinese).

[182] Informal talk with a retired government official of Jilin City on 6 January 2006. (in Chinese).

[183] Informal talk with a government official of the Administration of Work Safety of Jilin City on 9 January 2006 (in Chinese).

[184] Informal talk with a retired government official of Jilin City on 6 January 2006. (in Chinese).

[185] Informal talk with a retired government official of Jilin City on 6 January 2006. (in Chinese).

[186] Informal talk with a government official of the Administration of Work Safety of Jilin City on 9 January 2006 (in Chinese).

of local and regional development, may also influence multilevel environmental governance in China by political decision of the State at the national level.

The 11.13 explosion accident of JPC is one of the most serious pollution accidents happened on 13 November 2005 due to a series of chemical explosions, which poured 100 tons of cancer-causing pollutants including benzene and nitrobenzene into the Songhua River. After the disaster happened, JPC and the local government had tried their best to cover up the accident for almost 10 days. Newspapers as well as the news media tried to disclose the truth behind the disaster. As an example, *China Youth Daily* criticized the failure of the local government on the cover-up of an especially big ecological disaster once again reduced public trust in the government[187]. The disaster resulted in a drinking water crisis in Harbin, the capital city of Heilongjiang Province in the NE, which caused close attention from the central government. After the accident, the areas along Songhua River in the NE have become an emphasis on national environmental governance against water pollution by SEPA and the State Council since 2006, and local governments are responsible for local water quality and local environmental governance against water pollution with financial support from the state[188]. The accident also led to political fall-out at the national level: Xie Zhenhua, director of the SEPA, resigned[189].

In some degree, JPC as a powerful SOE has decided the destiny of Jilin City. However, government officials and citizens feel feebly to change the fate[190]. JPC has by and large formed a development path for Jilin City as a "chemical industry city", while Jilin City is in a dilemma of path dependence. Although there is air and water pollution, the local government could not close an influential SOE as JPC, which covers half of the area of Jilin City, contributes half of the revenue of Jilin City as well as 1/8 of the total revenue of Jilin Province. It is quite difficult to thoroughly solve the problem of environmental pollution caused by large SOEs such as JPC, and even if cut off the pollutant source, there are still a lot of debts on environmental contaminant due to historical discharge[191]. For instance, in the heavily-polluted Songhua River, even though governments have made efforts to control the pollutant source since the 1980s, the contaminant such as mercury deposition in the Songhua River remains at a very high level[192].

After the 11.13 explosion accident of JPC, apprehensive about the risks and repercussions of aniline projects, PetroChina shut down all the aniline production within

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[187] Chinese papers condemn Harbin 'lies'. BBC News, 24 November 2005. news.bbc.co.uk/2/hi/asia-pacific/4465712.stm, accessed on 31 August 2015.

[188] People's Daily, 30 March 2006. env.people.com.cn/GB/1072/4252012.html, accessed on 31 August 2015. (in Chinese)

[189] Director of the SEPA Xie Zhenhua resigns following the Songhua River pollution incident. Xinhua News Agency, 2 December 2006. news.xinhuanet.com/politics/2005-12/02/content_3869352.htm, accessed on 31 August 2015. (in Chinese)

[190] Informal talk with a retired government official of Jilin City on 6 January 2006. (in Chinese).

[191] Informal talk with a volunteer of the environmental NGO - Green Union of Harbin Institute of Technology on 18 February 2006 (in Chinese).

[192] Informal talk with a volunteer of the environmental NGO - Green Union of Harbin Institute of Technology on 18 February 2006 (in Chinese).

its production system including the aniline production of JPC. However, the left equipment of the 11.13 explosion was moved from JPC to Jilin Connell Chemical Company[193] (JCCC) and used for aniline production again after the explosion accident since the spring of 2009. In April 2009, chemical pollution incident happened again in Jilin City by a chemical leak of JCCC[194] and led to up to one thousand workers of the neighboring factory suffering from serious health problems. However, no local media dared to expose the truth while local government insisted that the reason of the incident was not a leek of aniline by JCCC but the "mass hysteria"[195]. In fact, the Connell affair was "only one of hundreds of cases of environmental degradation in China affecting the lives of millions" (Dodson 2011).

In a word, these environmental pollution accidents happened in Jilin City are a reflection of the power of the SOEs in the governance process of the NE, and even local governments including local EPBs could not make their own decision without consultation with the SOEs in certain aspects. Although local EPBs, provincial EPDs or even the MEP at the national level might have to take responsibility for serious local environmental pollution and accidents, it is not entirely the fault of the EPB, EPD or the MEP in essence. On the contrary, it reflects the strong influence of the central-planned economy and centralized political system in the NE since 1978. The NE has suffered from path dependence and lock-in since the 1980s, and the environmental pollution accidents caused by the SOEs only represent the difficulites and dilemma of the reform of the NE: the weakness of the EPBs, EPDs and the MEP becomes apparent in front of the power of the SOEs originated from China's one-party dominated political system. Along with the Northeast Phenomenon related to deindustrialization mentioned previously in this study, the reform of the SOEs becomes crucial for the future of the NE: not only for effective environmental governance, but also for sustainable development of the NE region. Therefore, effective environmental governance relies on the reform of the SOEs in the NE in a certain degree, which needs essential reform on the political and economic institution, not just multilevel investment, policy or projects to revitalize the NE.

7.3.2 YRD

(1) Cooperation between provincial EPDs, local EPBs and environmental NGOs

The environmental NGOs at the provincial level are mostly organized by the provincial

[193] Jilin Connell Chemical Company (JCCC) is a Hong Kong invested chemical plant put into operation on 30 March 2009.

[194] "Weeks after opening, however, more than a thousand residents protested at the gates of the factory, complaining about toxic emissions that were making citizens ill. The complaint saw the company promise to repair leaks in its operations, and the government post an online warning to other violators to take Connell as an example. Hours later, the website proclamation disappeared. Connell continued on with operations without making the necessary fixes." Source: Dodson (2011)

[195] Tania Branigan. Chinese Regulators Admit Chemical Leak after Workers Fall Sick: Illnesses reported by up to 1,000 people near factory initially blamed on 'mass hysteria'. The Guardian, 29 May 2009. http://www.theguardian.com/world/2009/may/21/china-factory-chemical-leak, accessed on 31 August 2015.

See also: Andrew Jacobs. Chinese Workers Say Illness Is Real, Not Hysteria. The New York Times, 29 July 2009. http://www.nytimes.com/2009/07/30/world/asia/30jilin.html?_r=0, accessed on 31 August 2015.

government. For example, in YRD, the *Jiangsu Society for Environmental Sciences* and the *Jiangsu Environmental Protection Industry Association* are under supervision and administration of the Jiangsu EPD. The *Jiangsu Environmental Protection Industry Association* represents the interest of enterprises of the environmental industry in Jiangsu Province with more than 200 member units, which cover about 20% of the backbone enterprises in environmental protection industry of China[196]. Besides the NGOs organized by provincial governments, there are some 'real' environmental NGOs at the provincial level such as the *Friends of Green Environment Jiangsu*, a member of the China Civil Climate Action Network and the membership teams of the FON. As the oldest environmental NGO in China, the FON has its own network of 11 membership teams across the country and 4 of them (the Nanjing, Suzhou, Shanghai and Zhejiang team) are located in YRD.

An EPD may support and participate in the work of grassroots environmental NGOs in the province. For example, Zhejiang EPD have provided support on the activities of environmental NGOs and cooperated with them on environmental governance in Zhejiang Province. In this sense, a provincial EPD actually serves as a bridge for mutual understandings as well as cooperation between the provincial government and environmental NGOs when there is no direct interaction between them. For one thing, the EPD assists the activities of environmental NGOs and gives affirmation to their activities; for another, the EPD writes report on the activities of environmental NGOs to the provincial government and let the government officials acquiring the information in time[197]. For instance, the *Green Eyes of China*[198], a grassroots environmental NGO established in Wenzhou, Zhejiang Province, aimed to protect the wild animals and the nature, gets support from the Zhejiang EPD with cooperation of Alibaba Foundation for the project of "*Qingyuan Action*" on water protection since January 2011[199]. However, the activities of environmental activists and groups in YRD are under control by governments. For example, in 2005, police arrested Zhejiang province-based activist Tan Kai after he opened a personal bank account for his environmental group *Green Watch*. The group, which had protested against a chemical plant, was designated an illegal organization and Tan served a jail term[200].

(2) Dynamics of actors, actions and environmental accidents

In the region of YRD, some serious local environmental accidents also caused attention from the MEP (or SEPA) and the NDRC at the national level, though not by chemical explosion but by algae outbreak. One of the most serious algae outbreaks in Lake Tai happened on 28 May 2007. It could be viewed as contingency to a large degree, but it resulted in a drinking water crisis in Wuxi[201], in which 2 million residents of Wuxi City

[196] Source: http://www.ep898.com/industryUnion/xhjj.asp, accessed on 31 August 2015. (in Chinese).

[197] Interview with a government official of Zhejiang EPD on 21 June 2012. (in Chinese)

[198] Homepage: greeneyeschina.org/English, accessed on 31 August 2015.

[199] Interview with a government official of Zhejiang EPD on 21 June 2012. (in Chinese)

[200] Bill Savadove. Grime and punishment. South China Morning Post. 25 August 2007. http://www.scmp.com/article/605468/grime-and-punishment, accessed on 31 August 2015.

[201] When algal bloom turbulently strikes… Xinhua News Agency (Nanjing). 31 May 2007.

without access of clean tap water for 5 days (Tai and Ellis 2008).

The central government established a National Restoration Action Plan led by the NDRC in order to treat the algae outbreak as well as to achieve remediation of Lake Tai, and this Plan was also supported by the Australian China Environmental Development Partnership, an initiative aiming to support and enhance policy development in China in environmental protection and natural resources management[202]. The attention from the SEPA and the state at the national level laid much pressure on local government officials of the EPBs in Wuxi City and led to 5 government officials of Yixing subject to administrative demerits or dismissals[203].

Media remains active in the environmental governance process by disclosure of pollution. The CCTV News Channel broadcasted "Wuxi algae bloom crisis not eliminated while enterprises still discharging pollution" on 3 June 2007 with "appalling footage" of several chemical plants of Yixing, Wuxi City on the west bank of Lake Tai, which were still illegally discharging untreated waste water directly into Lake Tai even at the height of the algae bloom crisis[204].

Lack of public participation and supervision in local environmental governance is one of the reasons of heavy pollution of Lake Tai in Wuxi City. The municipal government of Wuxi City had known the importance of non-governmental private and public participation in the process of local environmental governance. However, when the algae bloom crisis happened, there was no active environmental NGO in Wuxi at all. Although at least 2 environmental activists had tried many times to found an environmental NGO in Wuxi in the past years, but their applications were denied by the local government. When the crisis happened, the only environmental NGO in Wuxi had no action any more for a long time according to investigation[205].

Actually, environmentalist Wu Lihong, a resident of Yixing, known as the "Bodyguard of Lake Tai", had warned local government for years that pollution in Lake Tai was building up to an environmental catastrophe. However, the local EPB as well as local government just ignored him. Between 1998 and 2006, Jiangsu EPD recorded receiving 200 reports of pollution incidents and regulatory violations from Wu[206]. In 2006, Wu proved on China's state television broadcaster CCTV how the bosses of polluting factories, local government officials, employees and local residents worked together to disguise the fact that textile factories painting rivers black with dyes, but the local

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news.xinhuanet.com/politics/2007-05/31/content_6181872.htm, accessed on 31 August 2015. (in Chinese)

[202] Tackling algal blooms in China. www.ewater.com.au/h2othinking/?q=2011/06/tackling-algal-blooms-china, accessed on 31 August 2015.

[203] China punishes five officials for lake pollution. 11 June 2007. www.reuters.com/article/2007/06/11/idUSPEK150965, accessed on 31 August 2015.

[204] China punishes five officials for lake pollution. 11 June 2007. www.reuters.com/article/2007/06/11/idUSPEK150965, accessed on 31 August 2015.

[205] Nine years of tackling Lake Tai in dispute: environmental protection needs public participation urgently. 7 June 2006. www.chinanews.com/gn/news/2007/06-07/952293.shtml, accessed on 31 August 2015. (in Chinese)

[206] Joseph Kahn. In China, a Lake's Champion Imperils Himself. The New York Times. 14 October 2007. www.nytimes.com/2007/10/14/world/asia/14china.html, accessed on 31 August 2015.

government arrested Wu a year later during the summer of 2007 on trumped-up charges, just as provincial government officials forced Yixing to close its water sluices to the lake, to prevent an outbreak of noxious green algae from travelling into the city's water supply (Dodson 2011). When the algae bloom crisis happened, the activist was already in jail with his sentence of three years for alleged extortion and fraud. His wife, Xu Jiehua, maintained that he was innocent and said he was the target of a local government grown irritated by his decade-long campaign to shut down polluting factories around his hometown of Zhoutie in Yixing[207].

Chinese Premier Wen Jiabao visited Wuxi after the algal bloom and said: "The pollution of Tai Lake has sounded the alarm for us. But the problem has never been tackled at the root."[208] Although the State has invested more than 10 billion Chinese Yuan on water environmental governance in Lake Tai since 1991[209], after the algae bloom crisis in 2007, algae bloom every year as before[210]. Even after the Zero Hour Action, the water quality of Lake Tai has been continually getting worse[211].

The nonfeasance of local governments may be a fundamental cause for China's unceasing environmental problems (Cai 2007). Normally local government officials neither take the responsibility for local environmental protection nor pay the bills of local environmental pollution, and they even try to cover up the truth after environmental pollution accidents, unless the damage of the accident is too big to cover up. Especially in the towns and counties not so developed, for the sake of political performance as well as competition with neighboring towns, local government officials have to develop local economy by starting enterprises with heavy pollution, even if they know clearly that those enterprises could not reach the discharge standard[212]. During my visits to several manufacturing enterprises in Wuxi from 2003 to 2006 for participation in urban and regional planning projects for Wuxi City and Jiangsu Province, I find that the environmental protection equipment in some enterprises are simply for ornament — in use in less than one third of the time during production. Some of the factories even only turn on their environmental protection equipment when under an inspection from EPB or the municipal or provincial government. Some of them even know when the EPB will come and inspect. Even if they are caught by the EPB for illegal discharging untreated waste air or water, they only need to temporarily close their factories for some days and pay a fine, and then everything goes on as usual. "Fines for environmental offenses are

[207] Bill Savadove. Grime and punishment. South China Morning Post. 25 August 2007. http://www.scmp.com/article/605468/grime-and-punishment, accessed on 31 August 2015.

[208] Bill Savadove. Grime and punishment. South China Morning Post. 25 August 2007. http://www.scmp.com/article/605468/grime-and-punishment, accessed on 31 August 2015.

[209] Liang, Guorui and He, Hanfu 2012 Lake Tai failed in "treatment after pollution" for 20 years. https://www.chinadialogue.net/article/show/single/ch/4767, accessed on 31 August 2015. (in Chinese)

[210] Liang, Guorui and He, Hanfu 2012 10 billion invest in Lake Tai against pollution for 20 years without effect, the lake water getting clear requires at least 30 years. Guangzhou Daily. 1 February 2012. news.xinhuanet.com/politics/2012-02/01/c_122638366_2.htm, accessed on 31 August 2015 (in Chinese)

[211] Deng Jiansheng. Continually getting worse after the "Zero Hour Action", pollution of Lake Tai remains shocking-by-the-sight. People's Daily. 8 December 2004. www.people.com.cn/GB/huanbao/1073/3040297.html, accessed on 31 August 2015. (in Chinese)

[212] Interview with a town government official of Yixing, Wuxi on 1 September 2006. (in Chinese)

so paltry that it is much cheaper for factory owners to risk paying them rather than installing and using pollution controls" (Yu 2009: 671-672), which has been approved by the statistical analysis in 6.4.6 of this study. Sometimes the local government just turns a blind eye on the illegal discharge by local enterprises for revenue or other economic benefit. As a result, under the protection from the local government, pollution by enterprises is going on while the environmental quality is getting worse and worse.

If fact, "the environmental awareness of the citizens in Wuxi has increased since the *'Focus on Lake Tai' Zero Hour Clean-up Action*[213] ordered by the central government in 1998. Citizens care more than the government about the local environment, and they inform the government in time by a tip-off on illegal discharging by which company at what time or the abnormal color of the water from sewerage outfall."[214] Although Lake Tai basically realized the discharge standard at the end of 1998 by the Zero Hour Action, due to lack of forceful and effective environmental supervision from the third party, environmental pollution caused by illegal discharge of enterprises in Wuxi is very difficult to eliminate only by the efforts of local EPBs or local governments. Therefore, the most important thing is to introduce public participation into environmental protection and to give the public a smooth channel to maintain their legal rights (Cai 2007).

When an accident happens, a local EPB should not try to cover up the accident but should inform other EPBs immediately, in order to let other cities get the information at the first time and make preparations in advance. For instance, in the light of pollution accidents in the Yangtze River, EPBs of the 8 cities (Nanjing, Zhenjiang, Yangzhou, Taizhou, Changzhou, Wuxi, Suzhou and Nantong) along the Yangtze River in Jiangsu Province have signed an agreement to share information and software on building a dynamic environmental information database in order to effectively deal with outbreak of environmental pollution incidents, eliminate pollution accidents in this area and to protect the safety of drinking-water quality of the Yangtze River in Jiangsu[215].

7.4 Conclusion

This chapter discovers the political-institutional dimension of the path-assets analysis of the NE and YRD with emphasis on the process of multilevel environmental governance based on expert interviews as well as literature analysis. Generally, all the interviewees think that the political-institutional assets for regional development in China have both positive and negative aspects, and single asset might be both positive and negative as

[213] "Focus on Lake Tai" Zero Hour Clean-up Action is an environmental governance project initiated by Chinese central government designed to significantly reduce the industrial discharge of waste water as well as control the industrial pollution in the Lake Tai basin. SEPA set up the Front-line Headquarters for Focus on Lake Tai on 2 December 1998 in Wuxi, which represents the final counting down of 30 days. The Zero Action called on all of the 1035 major polluting enterprises and the 1052 minor polluting enterprises in the Lake Tai basin to reach the State pollutant discharge standards by 0:00, 1 January 1999. Although an official announcement stated that this Action had basically realized its pollution-control goals at that stage, Lake Tai is still serious polluted and the worsening of water quality has not been stopped.

[214] Interview with a government official of Wuxi EPB on 2 September 2006. (in Chinese)

[215] 8 cities along the Yangtze River of Jiangsu Province establishing an information sharing platform to deal with pollution accidents in the Yangtze River. 7 November 2013, people.com.cn (Nanjing). js.people.com.cn/html/2013/11/07/266776.html, accessed on 31 August 2015 (in Chinese).

well. Moreover, in both the NE and YRD, environmental governance at the regional level remains loose and weak. Even in the process of regional cooperation between provinces in a region, environmental governance has never become the most important issue when compared to industry or transport. Usually only if a severe pollution accident happens, which could not be solved by efforts of one province, governments begin to think about environmental cooperation between provinces at the regional level.

In the NE and YRD, each province has a provincial EPD as part of the provincial government, which is under the supervision of the MEP at the national level and is in charge of local EPBs in the province at the local level at the same time. In the multilevel governance system, a provincial EPD serves as a vertical joint point between the national and local level. Provincial EPDs as state actors dominate the environmental governance process at the provincial level and are responsible for the implementation of national policies, laws and regulations on environmental governance. In each region, provincial EPDs as active actors may also build a horizontal linkage through information sharing, cooperation and discussion with each other on specific projects following the lead of the central government. For the EPBs at the local level in a province, the provincial EPD functions as both a supervisor and a coordinator.

Since China does not have specific government at the regional level, the relationship between the national government and provincial governments, or provincial-national relationship, is particularly important for regional development and governance. On the one hand, regional governance as well as the multilevel governance process in China has been under strict macro-control by the central government since 2008 for the reason of response to the global financial crisis, and the role of provincial governments in the multilevel governance process has been *de facto* weakening since then[216]. On the other hand, there has been more and more lobbying by provinces since 2008[217], referring to various fields including regional development policy, regional planning, industrial policy and some 'privilege' such as land use (especially quota of construction land) or revenues[218]. As a consequence, provincial-national relationship becomes a core of the multiple game of benefits in the multilevel governance process in China. The more powerful the provincial government is, the easier its own benefits from the central government gets, and the more enthusiasm for regional development it has. In other words, the central-local relation is reflection of and is key to the dynamic process of multilevel environmental governance in China. At the regional level, the governance process is operationalised by both national decisions and local activities.

Multilevel environmental governance reflects the current political-institutional framework in China. No matter in the NE or YRD, local or provincial actions on environmental protection in some degree reflect the political decision on environmental governance by the central government at the national level, which also represent the loyalty of government officials at the provincial and local level to the central government. However,

[216] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

[217] Expert interview with Prof. Dr. Doris Fischer (26 June 2015, via Skype).

[218] Expert interview with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone).

the central government seems failed to control local actors (Lo 2015), which makes local governments and energy-intensive as well as polluting enterprises enjoy a high degree of freedom and flexibility to manage their own energy consumption as well as pollutant emission in spite of the overt authoritarian rule. The analysis on the main political-institutional assets indicates that understanding the nature of the complex process of environmental governance in China requires a thorough understanding of national policy, local politics and their interacting ways (Lo 2015).

This study analysed two serious environmental pollution accidents happened in Jilin City of the NE and in Wuxi City of YRD, which happened at the local level but attracted attention at the national level. In both cases, local government tried to hide the fact of water pollution, neglect environmental laws and regulations, ignore public participation in the environmental governance process, cover up the truth from local and national media and keep citizens out of the information about the pollution accidents, which reflects the institutional defect in China's environmental governance. Although public awareness on environmental protection has increased a lot in the past decades, it is still quite difficult to influence political decision by the governments due to weak enforcement of laws in China.

The reaction to environmental pollution accidents in the NE and YRD reflects the current deficiency of China's environmental governance system. At the national level, China's "state-led development" (Burton 2004) model as well as dominance of the administration makes governments play a particularly important role in governance and institutions in China, and could be considered as a determinant for the performance of governance in China. However, the most significant weakness of China's environmental governance system is the insufficient institutional framework for policy coordination (Richerzhagen and Scholz 2008).

Under the pressure of ever-increasing environmental accidents and protests, Chinese governments at all levels "no longer ignores environmental problems and environmental quality", and "a vast literature gives evidence of the considerable legal, economic, social and political resources spend on designing and implementing new environmental institutions and practices" (Mol 2009a: 98). Although "reliability, completeness and transparency of environmental data remain major obstacles in China" (Mol 2009b: 119), with the process of decentralization step-by-step, there will be more flexibility in environmental policy-making as well as implementation in China (Mol 2009a).

The accountability of governments is often blamed by citizens as well as the public, especially at the local level. In face of an environmental pollution accident, local authorities "either do not want to be bothered by complaints of illnesses, or are being bribed by operators to remain inactive" (Dodson 2011).

> "Typically, the local government works to keep issues local, where its power base resides, and beyond which administrators would find their careers cut short if the story broke nationally. Many local residents, clearly knowledgeable about the extent of the damage the polluting factories has on the environment and their health, collude with business owners and with local officials to hide the issue from the national media" (Dodson 2011).

Public participation in environmental decision-making process (Webler *et al* 2001), which is essential for a more effective, efficient and accountable system of environmental governance, is still weak in China (Zhong and Mol 2008). “In the absence of public participation, accountability in the environmental regulatory process is almost non-existent”, and environmental agencies play a dominant role in the formulation and enforcement of environmental policies, rules and regulations (Lo *et al* 2000: 306). In addition, the activities of environmental activists, NGOs and groups remain under control by Chinese governments, which makes it rather difficult for real environmental protection without a sufficiency of democracy.

In general, the main problem of environmental governance in China is “the mis-match of the speed of change driven by global market forces in the business sector and the relatively slow pace of institutional change to cope with the unwanted and damaging by-products of rapid economic growth” (Xue *et al* 2006: 51). It is represented by powerful governments versus weak public participation in the environmental governance process with weak enforcement of laws (including corruption) due to insufficient institutional capacity. Good environmental governance in China requires diffusion of public information on the costs of environmental degradation and the rule of law (Richerzhagen and Scholz 2008) while the political system in China does not provide an institutional channel for general public to exercise a strong influence on the process of formulating environmental policies (Ross 1988; Sinkule and Ortolano 1995). Henceforce, China might still need to improve in the following aspects to strengthen its regional capability in political-institutional dimension[219]: (1) strengthening of legal institutions and the independence of the courts and improving governments’ capacity to enforce environmental laws and regulations; (2) transparent monitoring and reporting of data as well as improving public access to environmental information; (3) promoting corporate social and environmental responsibility with penalties for non-complies as well as incentives for complies to arise awareness of environmental protection; (4) strengthening of civil society and enhancing NGO capacity; (5) conducting environmental education, research and training.

[219] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

8 Regional Planning: A Proposal for Regional Governance towards Regional Sustainability

Regional planning has developed itself along with China's transition with some Chinese characteristics and has served as a proposal for regional governance towards regional sustainability since the 2000s. Based on the path-assets analysis of in the NE and YRD (Chapter 4 to 7), this chapter intends to analyze the regional planning practices in both regions as a continuation of regional governance process as part of China's multilevel governance dynamics discussed in Chapter 7. It also reviews the development of planning theories and practices in China with a focus on regional planning.

In order to have a better understanding of the development of planning practices, this chapter starts from an introduction to the context ─ an analysis of regional planning in China as a background (8.1), including a historical overview of planning in China (8.1.1), the characteristics, changes and continuities of regional planning in China (8.1.2) and the recent planning approaches (8.1.3). Then it comes to the case studies of regional planning practice in the NE and YRD (8.2). Finally, it draws the conclusion on regional planning in China from the theoretical and practical analyses (8.3).

8.1 Introduction: regional planning in China

8.1.1 Background: a historical overview of planning in China

Planning has played an important role in policy coordination in China's political system since the foundation of the PRC in 1949, and the general purpose of planning in China "has been ─ and continues to be ─ to support the achievement of state-led economic goals, whether in the previous era of the socialist command economy or in the present period of the ostensibly socialist market economy" (Leaf and Hou 2006: 554-555). This part makes a historical overview of planning in China in the following four periods: (1) center-led economic planning before 1978, (2) territory planning from 1970s to the beginning of 1990s, (3) urban planning since 1990s, and (4) a new era of development planning since 2000s.

(1) Center-led economic planning before 1978

The first step of planning in the PRC is the 1st five-year plan (FYP) (1953-1957) with emphasis on the new construction of 694 large and medium-sized industrial projects[220] of heavy industry distributed in 120 cities, with a majority of the large projects clustered in 18 cities (Schenk 1977: 154). For example, Anshan in the NE was among one of the three centers in China for the processing of iron and steel, together with Wuhan and Baotou. The 1st FYP (1953-1957) followed a vertical rule with a clear hierarchy starting at Beijing by a sizeable number of central ministries and reaching down to appropriate enterprises via corresponding provincial ministries and district departments (Schenk 1977: 154). Nevertheless, due to the inherent inefficiency of the planning pattern as well

[220] Source: Wikipedia. Five-year plans of China: First Plan (1953-1957). https://en.wikipedia.org/wiki/Five-year_plans_of_China#First_Plan_.281953.E2.80.931957.29, accessed on 14 December 2015.

as too limited potentialities for mobilizing and involving the population, a number of preliminary attempts were made to decentralize economic planning and production during the 1st FYP. As a consequence, the coordination of production was for a large part brought down from the national to regional levels after 1954 (Schenk 1977: 155). In 1958, in order to coordinate inter-provincial economic relations, Chinese central government divided the country into 7 economic cooperation regions (ECRs)[221], which formed an initial regional concept in the planning field of China (Robinson 1973: 20). Therefore, White (1998: 373) believed that China's economy was already regionalized in the 1970s. In a word, the concept of ECRs in planning could be viewed as a first step of regionalization in China with a principal feature of regional planning given the fact that it led to a shift in the practical planning focus from the whole country to several ECRs.

The FYPs are important planning practices in China since the 1950s characterized by centralized communist economy, and one plan established for the entire country of China normally contains detailed economic development guidelines for all of its regions[222]. The FYPs are actually a series of social and economic development initiatives of China shaped by the Communist Party of China (CPC) through the plenary sessions of the Central Committee and national congresses, and the FYPs today also serve as a guideline for national economic and social development in China.

After the establishment of the PRC in 1949, state-led economic plans predominated the thinking of planning in China before 1978, since economic development was the most important task at that time. In fact, the history of the PRC at that time was less than thirty years. Consequently, planning also had to consolidate the political power of the CPC, and the keynote of planning at that time was "to grasp the policy of the Party and mobilize the masses" (Jeffrey 1977: 121). In fact, before 1978, under a center-led economic planning system and fiscal administrative system in China, "almost all projects were proposed by the central ministries and approved by the State Planning Commission" (SPC) (Zhao and Zhang 1999: 253). However, due to the fact that the national economic plan made by the SPC on behalf of the State "was exclusively responsible for the overall balance of national economic and social development", the FYPs as "the actual central directives for national economic development, normally did not concern itself with the issues of regional balance and development" at that time (Zhao and Zhang 1999: 254).

(2) Territory planning from late 1970s to the beginning of the 1990s

In the late 1970s, Chinese academic geographers led the concept of territory planning with emphasis on "the best use of local human and natural resources", though it still took "economic efficiency as a central objective" (Wang and Hague 1993: 564). Territory

[221] The 7 ECRs in 1958 in China are the Northeast ECR (namely the NE in this study), the North ECR, the East ECR, the Central ECR, the South ECR, the Southwest ECR and the Northwest ECR. In 1961, the Central ECR and the South ECR are incorporated into the Central-South ECR, and there are 6 ECRs in China at that time. The ECRs have served as China's basic economic regions. In the fourth FYP made in 1970, China is divided into 10 ECRs; in 1978, the CPC promotes again the 6 ECRs. (Source: Baidu Baike. Economic Cooperation Regions. http://baike.baidu.com/view/950428.htm, accessed on 14 December 2015 (in Chinese))

[222] Source: Wikipedia. Five-year plans of China. https://en.wikipedia.org/wiki/Five-year_plans_of_China, accessed on 14 December 2015.

planning had drawn on experience both in China and abroad: from the early practice of river control and land survey in China as well as from the land use planning system in Japan and UK (Wang and Hague 1993: 564). As China's first real attempt at integrating economy and environment in planning practice, territory planning operated at the national, regional and local level potentially played an important role in reforming China's socialist planning system in the 1980s and at the beginning of the 1990s (Wang and Hague 1993: 564). However, due to a lack of legitimacy, most territory plans were actually only preserved as planning documents without playing their roles (Hu 2002: 23).

According to Mao and Fang (1997), planning in China during the 1980s still had a strong mandatory characteristic due to the influence of the central-planned economy. Firstly, planning was made mainly according to different levels of administrative territory such as a city or a province while seldom according to regional economic linkages (Mao and Fang 1997). Secondly, planning patterns had changed from focusing on resource to an all-inclusive or a complete set of economy, population and environment, whilst the solution of principle contradictions in terms of population, resources, environment and economic development remained unrecognized (Mao and Fang 1997). Thirdly, the function of market as a guide to enterprises in resource allocation remained neglected, with governmental unified instructions and actions predominant during the process of planning design and implementation (Mao and Fang 1997).

(3) Urban planning since the 1990s

Urban planning as a relatively new activity in China is integrated with the overall economic planning of the nation and is deeply affected by the political character of the Communist regime (Xie and Costa 1993). There has always been a support from the field of urban planning to regional planning[223] (Hu 2007b: 41), and the rise of city-region planning at the end of 1990s is in essence regional planning for highly urbanized areas (Hu 2002: 24). However, there are contradictions between regional planning and urban master planning (physical planning) (Cui 2002: 41). For instance, urban planning organized by the Ministry of Construction, territorial planning organized by the Ministry of Land and Resources and regional planning organized by the NDRC are carried out separately without coordination, resulting in tremendous repetitious work similar in contents, which is a waste of planning resources (Hu 2002, 2006, 2007b; Niu 2004). The essential problem is that the State failed to establish the institution of regional planning in China at that time.

As a passive response to reforms in China, planning is less effective in guiding urban development and growth management (Wei 2005). Urban master plans often lag behind reforms initiated at the national and local levels and have to be revised constantly to follow the new direction of the reforms rather than guiding development and policies, resulting in chaos in Chinese cities with development and new construction lack of proper planning guidance (Wei 2005).

[223] "Under the circumstance that there was no regional planning to provide guidelines, urban system planning was carried out in the field of urban planning. The Regulations on City Planning issued in 1984 proposed for the first time that the master planning of a city should take the administrative territory of the city as a whole to lay out the urban system in a reasonable way." (Hu 2007b: 41)

Since 1 May 2003, foreign-invested urban planning service companies have been allowed to undertake planning projects in China (Ministry of Construction and Ministry of Foreign Trade and Economic Cooperation 2003). Nowadays planning is a profitable industry in China linked to the strongly market-oriented development industry, with private planning and design firms flourishing in the relatively more developed regions of the country (Leaf and Hou 2006: 572), and it has been common for top international firms to join urban design competitions organized by governments as well as local developers in China (Wu and Cui 2003).

The number of planning practitioners in China has increased from only a few thousand at the beginning of the implementation of the opening and reform policy in 1978 to more than 50000 in 2001 (Zhao and Lin 2001: 48) and to about 65000 in 2004 (LeGates and Zhang 2007: 17). However, according to Ma (2004), in addition to compliance with laws and regulations, Chinese urban planners are often "responding to the exigencies of specific development projects dictated by the financially and politically powerful interest groups, including many with global connections" (Ma 2004: 257).

(4) A new era of development planning since the 2000s

Development planning, known as the FYPs as well as respective sector plans issued by the State Council, as a traditional planning field in China has entered a new era with new function, new content and new methods since the 2000s, particularly since the 11th FYP (2006-2010). The planning processes of the FYPs represent a five-year policy cycle of information gathering, analysis, policy formulation, policy implementation, evaluation and revision (Heilmann and Melton 2013: 601). Taking a political economic perspective, despite the decentralization of administrative and fiscal powers from central to local, the one party dominated State still has continuously powerful and multiple roles as the ultimate decision-maker, regulator and participant in urban and regional development (Ma 2002). Although planning continues to be subservient to economic planning and policy, the field of planning has changed tremendously (Leaf and Hou 2006: 555). "Despite continuing statist dominance, planning is no longer entirely monopolized by central or provincial governments, and has become increasingly decentralized and diversified" (Leaf and Hou 2006: 572).

FYPs have been playing an increasing important role in spatial governance in China, especially since the 11th FYP (2006-2010) implemented in 2006. In the 11th FYP, the role of planning was actively reinvigorated and institutionalized as it reemerged as a central component of economic and public policy coordination and oversight. A new type of binding targets was introduced in the 11th FYP (2006-2010) and 12th FYP (2011-2015) to reinforce the Party influence over administrative action, especially in disputed spheres such as environmental protection and land management (Tian 2010).

In general, planning in China is still understood as a fundamentally and an almost exclusively governmental activity (Zhang 2002a; Leaf and Hou 2006: 564). With regard to spatial rationalization of society as the core function of planning in China (Yeh and Wu 1999: 182; Leaf and Hou 2006: 565), "planning continues to be structured as a top-down administrative practice" (Leaf and Hou 2006: 565), and a prime example is regional planning, which is the focus of the following part.

8.1.2 Regional planning in China

Regional planning is one of the most important means by governments to intervene and coordinate regional relations (Zhang *et al* 2002: 32). As an essential part of spatial governance for a vast country like China (Liu and Lu 2005), regional planning has attracted increasing attentions from the Chinese governments in the 2000s for its positive influence on comprehensive spatial administration and coordination (Hu 2007b: 40). Since the 11th FYP (2006-2010), regional planning has been incorporated into China's national FYPs as national strategies, which is coordinated by the NDRC[224] and is approved by the State Council[225] at the national level.

(1) The evolution of regional planning in China: a historical perspective

In China, regional planning started in the late 1950s, became popular in the 1980s with the implementation of the openning and reform policy and has developed itself as an effective means of regional governance since the 1990s (Mao and Fang 1997).

Hu (2002; 2006; 2007b) reviews the development and evolution of regional planning in China. In the 1950s, in the 1st FYP (1953-1957), China made its first major attempt at regional planning on directing major new industrial projects away from the coastal provinces into its inland areas at a regional scale with emphasis on heavy industry growth in urban locations (Wang and Hague 1993: 563). However, regional planning in China had been suspended for 20 years since 1958 until the initiative of China's opening and reform policy in 1978 (Hu 2002: 23) attributable to several systemic failures in central planning (Li and Yang 2005) including the Great Leap Forward in 1958 and its following three-years' famine (1959-1961)[226] as well as the Cultural Revolution (1966-1976). In general, before 1978, under a central-planned economy in Maoist China, regional planning was taken as "a means of increasing overall economic efficiency" besides other non-economic factors such as policy and ideology (Wang and Chen 1987: 99), while the process of planning and the authority of planners might not be central to the Maoist style of development (Buck 1984).

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[224] The NDRC (National Development and Reform Commission) is one of the departments under the State Council. The NDRC is China's top economic planner and is responsible for regional planning in the FYPs and planning for major functioning zones. There are many functions of the NDRC, such as to coordinate planning implementation and carry out monitoring and assessment; to formulate strategies, plans and major policies for promoting the coordinated development of regional economy, including revitalization of the NE and other old industrial bases; to study and put forward development strategies and major policies concerning urbanization; to guide and coordinate regional economic cooperation, as so on. (Source: Main Functions of the NDRC. http://en.ndrc.gov.cn/mfndrc/, accessed on 14 December 2015).

[225] The State Council is the Central People's Government of the People's Republic of China. It is the executive body of the supreme organ of state power and the supreme organ of State administration. The State Council is chaired by the Chinese Premier and is composed of the following: the Premier; the Vice-Premiers; the State Councilors; the Ministers in charge of ministries; the Ministers in charge of commissions; the Auditor-General; and the Secretary-General. The Premier assumes overall responsibility for the work of the State Council. (Source: The State Council. http://english.gov.cn/archive/china_abc/2014/08/23/content_281474982987314.htm, accessed on 14 December 2015)

[226] In 1958, the Chinese government wishfully expected a great leap in agricultural productivity from collectivization and accelerated its aggressive industrialization timetable, which led to the Great Leap Forward disaster, characterized by a collapse in grain production and a widespread famine in China between 1959 and 1961, and is found attributable to a systemic failure in central planning (Li and Yang 2005).

In the 1980s and the 1990s, regional planning in China still had its own problems during the transition from central-planned economy to market-oriented economy (Mao and Fang 1997). Many regional development plans during this period were over-weighted with macro development strategies and only served as a slogan with little guidance on regional economic and social development (Mao and Fang 1997: 3). Some regional development plans were similar to the national economic plan, with excessive emphasis on quantitative indicators such as economic growth objectives and growth rate while regardless of qualitative aspects of growth and efficiency (Mao and Fang 1997: 3).

Since 2000, with the rise of inter-regional development problems as well as flexible state control measures at the macro level, it becomes quite urgent to make new regional plans with consideration on the key features of the present socio-economic development, effective governance measures, a global perspective and thinking on marketization (Liu and Lu 2005). In this new period, a regional plan generally includes the following 8 aspects: the overall orientation and development object of the region, industrial division and spatial distribution, urban system construction, infrastructure construction and allocation, development and protection of resources, environmental protection and ecological construction, spatial governance and regional policy recommendations (Mao 2005: 5).

Urban and regional strategic planning has been strengthening in China since the 1980s as a combined effort of overseas strategic planning theories with domestic reality (Luo *et al* 2002). On account of lack of regional analysis, long-term prospect and concrete plan for implementation in China's urban master plans in the 1980s, Zaremba (1986) advised making regional plans and long-term plans before urban master plana in China. Particularly, since the 1990s, with the rapid growth of economy and population in China, more and more problems on urban and regional development have concentrated due to a lack of strategic planning (Xiong *et al* 1995; Ye *et al* 1998). Consequently, Chinese planners began to appreciate significance of strategic planning at the end of 1990s (Luo *et al* 2002). Regional strategic plans could reposition a region in the national and even global economic landscapes to overcome political fragmentation (Xu 2008). Nevertheless, regional strategic plans might also hide the intensifying competition within major city-regions in China, since current urban and regional strategic planning represents a locally and regionally articulated political process, through which national and provincial governments reassert their functional importance on local economic governance (Xu 2008).

(2) Regional planning as a guideline for national development

There have been signs of destructive competitions[227] among Chinese provinces and cities contrary to the goal of harmonious development. For one thing, increasing disordered competition among provinces and cities on growth of GDP, FDI or other

[227] According to renowned Chinese economist Wu Jinglian, "the excessive power of governments at all levels in distributing resources, the pursuit of 'political achievements' by some officials, the pressure of taxation and financial revenues on industrial output, and the distorted pricing system for key means of production and resources" are the four institutional obstacles hindering the smooth shift of China's economic growth mode (Xinhua 2006b), and these institutional obstacles have resulted in not only intensifying disordered competition at the provincial and local level but also increasing environmental pollution in China.

kinds of investment prevents the progress of harmonious regional development. For another, increasing environmental pollution in China partly demonstrates failure in pollution source control by efforts of single province or city such as water pollution caused by upriver provinces. In order to prevent destructive competition among provinces and cities and to promote coordinative regional development, since the 11th FYP (2006-2010), regional planning has been included into the FYPs[228] and served as a guideline for regional development in China.

On 4 July 2015, the NDRC further publishes *Provisional Administrative Measures on National Regional Planning* (abbreviated as the Provisional Measures in this study) for the management of regional planning at the national level. The compilation of regional planning in China is organized by the NDRC with other departments of the State Council as well as provincial governments in the region[229], and the NDRC is responsible for the organization and coordination of regional planning in China[230] (NDRC 2015). Aimed for regional economic and social development, regional planning in China is the refinement and implementation of national strategies in specific regions[231] (NDRC 2015). In this sense, regional planning in China reflects the political decision of the State in accord with its regional policies. An inter-provincial regional plan is authorized by the State Council, coordinated by the NDRC and served as the basis for master and special plans at the provincial level (State Council 2005). In fact, the compilation of regional plans in China does not have legal status as urban master plans but only have some Provisional Measures on management of regional planning at the national level by the NRDC. Nevertheless, a regional plan is examined and approved by the State Council[232] (NDRC 2015), which is thought to have quasi-legal status, since the State Council is the supreme organ of state power and administration in China.

For the central government, regional planning as a starting-point of regional governance in China provides an incentive for regional sustainable development. In the 11th FYP (2006-2010) and 12th FYP (2011-2015) of China, promotion of coordinated regional development is among the overall national strategies. Particularly, revitalization of the old industrial base of the NE and support for the leading position of Eastern China including the region of YRD as national strategies on regional development are closely related to the case studies on regional planning practices in this study in 8.2.

(3) The instrumentality of regional planning

In accord with the theoretical framework (Chapter 2), this study argues that the instrumentality of regional planning lies in the following three aspects. First, regional planning is both an instrument towards the improvement in regional capability and a tool for regional governance, and the improvement in regional capability could be realized by

[228] FYPs include 3 categories of planning (master planning, special planning and regional planning) and 3 levels of planning (national level, provincial level as well as city and county level) (State Council 2005).

[229] See: Article 9, Chapter 2 of the Provisional Measures (NDRC 2015).

[230] See: Article 5, Chapter 1 of the Provisional Measures (NDRC 2015).

[231] See: Article 2, Chapter 1 of the Provisional Measures (NDRC 2015).

[232] See: Article 7, Chapter 2 and Article 17, Chapter 4 of the Provisional Measures (NDRC 2015).

the implementation of the regional plan. Second, regional planning could facilitate regional governance by setting up a new network of collaboration or strengthening an existent network of collaboration among actors both horizontally (at the regional level) and vertically (top-down and bottom-up, between the national, provincial and local level). Third, regional planning could contribute to sustainable regional development by providing not only a blueprint of a region with regional sustainability as a planning objective but also specific regional policies as well as projects or programs for future regional development towards regional sustainability (see 2.4.3 in Chapter 2).

In essence, harmonious regional development as a common goal for all of the regions in China accords with sustainable regional development, though both have not been realized in China yet. Presently environmental pollution as a serious problem of regional governance in China needs inter-provincial coordination strategies provided by regional plans towards regional sustainability. In the current situation, regional plans authorized by the State Council is the basis for master and special plans at the provincial level. Moreover, regional planning as a category of the FYPs in China could discover and correct problems and find proper solutions for a region in time along with the five-year planning circle of the FYPs. In a word, regional planning plays an important role in spatial governance and serves as guidelines for regional development in China. In light of the instrumentality of regional planning in China mentioned above, considering regional development as important components of national development, regional plans actually serve as guidelines for national development in China, which is in accord with regional plans as important basis for national policies related to the development of specific regions[233] (NDRC 2015).

8.1.3 Recent planning approaches

This part introduces three recent planning approaches related to the field of regional planning ─ pilot projects, principal function zones and participatory planning ─ in order to have a better understanding of the recent changes and progresses of regional planning in China. These three approaches getting popular in China in the past decade are either original creation with Chinese characteristics or developed by learning from the planning experience in developed countries.

(1) Pilot projects of regional planning as bottom-up adjustment since 2006

The NDRC has included pilot projects of regional planning as a measure for bottom-up adjustment in regional planning processes since the 11th FYP (2006-2010). In fact, the Chinese government has already taken pilot project as an approach for the promotion of regional sustainable development since 2001 by setting up national sustainable development experimental zones and ecological demonstration zones in line with regional characteristics concerning China's Agenda 21 (Preparatory Committee of China for the United Nations Conference on Sustainable Development 2012: 5). Since pilot reforms under hierarchy in China is not a just trial-and-error process but a purposeful and controlled process (Heilmann 2008), the NDRC considers pilot projects compatible with China's national planning objectives. For this reason, pilot projects are

[233] See: Article 2, Chapter 1 of the Provisional Measures (NDRC 2015).

designed to connect national and local policy and to align local policy incentives with central goals (Heilmann 2010). By the implementation of experimental planning projects at the regional and the local level, the NDRC could get feedback from "local knowledge about practicable policy instruments" and make use of "effective *corrective mechanisms*[234]" (Heilmann and Melton 2013: 612). The NDRC has attempted to systematically combine regional development programs with decentralized pilot projects since 2005, and China has formed a preliminary multilevel pilot reform system across the country since 2010 including the national comprehensive supporting pilot reform, national major special pilot reforms, contact points of the NDRC and the provincial-level comprehensive supporting pilot reforms (Xinhua 2010a).

The pilot projects could be taken as a planning approach with Chinese characteristics. The significance of pilot projects lies in a learning process composed by doing the projects, finding the problems, trying various solutions, learning from the achievements and failures and extending to wide application in China. In this sense, the pilot projects might find appropriate new ways of planning with Chinese characteristics and enrich the development of regional planning practices in China.

(2) The Plan for Principal Function Zones[235] since 2006

The 11th FYP (2006-2010) has been described as a revolutionary plan of China (Fan 2006), in which the promotion of the principal function zones is advocated and taken as an important strategy for promoting regional coordinated development, and the Plan for Principal Function Zones is an important attempt at the national strategic level in the field of regional development and planning since the 11th FYP by the Chinese government (State Council 2007b, 2011; Fan *et al* 2010). The keynote of the Plan for Principal Function Zones substitutes a function-principle for an administration-principle in spatial classification in regional development and planning in China.

The 11th FYP applies the approach of zoning in geography into practical national FYPs by dividing land space into the following four types of principal functional zones, namely the *Optimized Development Zone*, the *Key Development Zone*, the *Restricted Development Zone* and the *Prohibited Development Zone*, according to the bearing capacity of resources and environment, existent development density as well as development potential of each region. Consequently, regional policy and performance evaluation should be based on different types of principal function zones. The Plan for

[234] According to Heilmann and Melton (2013: 612-613), some corrective mechanisms were observed already in other East Asian countries: the limitation of imperative planning to only a few tightly controlled sectors; the expansion and refinement of contractual and indicative (incentive-based, non-hierarchical) planning; the opening of diverse channels for absorbing foreign expertise and adapting it to local conditions; the exposure to world markets with resulting competitive and innovative pressures. Other core governance mechanisms appear unusual and distinctive even in the East Asian context: the encouragement of extensive and sustained decentralized policy experimentation across a large spectrum of sectors; reliance on transitional, hybrid and informal institutions ("institutional layering") over an extended period; under-institutionalized, oscillating patterns of centralized and decentralized coordination; imposition of top-level policy initiatives through the Communist Party hierarchy ("red letterheads", party meetings, campaign-style mobilization) in the case of emergency measures; reorganization of human resources management through the party-controlled cadre system.

[235] Principal Function Zone is one of the translations of *zhǔtǐ gōngnéng qū* (Chinese: 主体功能区) in the 11th FYP, other translations including Development Priority Zone (State Council 2007b, 2011) and Major Function-Oriented Zone (Fan *et al* 2010).

Principal Function Zones is approved by the State Council at the national level, and it not only inaugurates a substitution of function-principle for administration-principle in the regional planning field in China, but also serves as an outline for all kinds of spatial planning in China including regional planning.

In the past decade, rapid industrialization and urbanization processes in China have resulted in overgrowth of industrial space sprawl with serious environmental deterioration and pollution. Under the circumstances, regional development in China should focus not on the growth in quantity but on the adjustment of spatial structure. As to the adjustment of inner-regional spatial structure, which is essential to regional development and planning in China in future, the principal function zones as a new planning approach to zoning lays emphasis on the principal function of a region by integrating both the natural ecosystem and the socio-economic demand of human system in the region, and the future development path of a region is based on the function orientation of the region. The key of this approach of the principal function zones lies in ensuring the sufficiency of living space and ecological space simultaneous with the appropriate adjustment of industrial space in a region. In this sense, this approach might contribute to stop the existent disorder land use and resource exploitation in the process of regional development in China and to move a preliminary step towards regional sustainability.

(3) Participatory planning processes

Western communicative or collaborative planning theory (Healey 1992, 1996, 1997, 1999, 2003; Sager 1994; Innes 1995, 1996; Innes and Booher 1999a,b; Tewdwr-Jones and Allmendinger 2002) has also been integrated into planning issues associated with public participation in China, such as participatory development planning (Ye *et al* 2005), public hearings in EIA planning (Enserink and Koppenjan 2007) and public participation in urban planning (Liu 1990; He and Zhao 1999; Yeh and Wu 1999; Zhou 2000; Luo and Zhang 2001; Sun 2002; Zhu 2004; Hu 2005; Xiong 2005; Wang 2012; Cheng 2013). In light of the fact that the study on participatory process in China mainly focuses on public participation in field of urban planning, Hu (2002: 26) demonstrates that regional planning in China must take public participation seriously in order to serve as a guideline for regional development.

Since the 11th FYP, FYPs also take account on public participation in the planning process at the national, provincial and local level. For example, at the national level, the Department of Development Planning of the NDRC set a special theme on advice and suggestions for the FYP at its homepage[236], and the public could write their opinions or comments by online-message or by E-mail. It is similar at the provincial and local level with opportunities of online public participation at the official homepage of the provincial or local government.

However, public participation remains inadequate in China, even in the field of urban planning, which is thought to have more participation opportunities than regional planning. For one thing, the general public is “unaware of planning”; for another, a vast

[236] http://ghs.ndrc.gov.cn/, accessed on 14 December 2015. (in Chinese)

number of state work units are “left uninformed and sometimes overlooked” (Yeh and Wu 1999: 236). Although “public participation also takes place at the planning institution level” (Zhang 2001: 196), according to Arnstein’s ladder of citizen participation (Arnstein 1969: 217), public participation in China’s urban planning practice is mainly at the third rung of informing. In other words, public participation in urban planning is still at the beginning stage in China (Zhu 2004), with only limited and indirect public participation in the urban planning process (Zhang 2001, 2002b).

Although public participation and community planning are considered as core values of urban planning in western developed countries, Zhu (2012) demonstrates that the urbanizing developing countries such as China should not follow Western planning theories in planning practice without knowing their contexts, and argues that strengthening a zoning system is more important than public participation for developing countries like China. In fact, it is difficult to apply theories with Western origin directly to the case of China, especially when some implicit assumptions of the theory (such as democratic political system) are not given. In the specific context of China, public participation has “no real meaning in the context where negotiations mainly took place among government agencies” (Yeh and Wu 1999: 236). Therefore, Western theories may need fundamental adaptations to become useful tools for explaining China’s regional restructuring (Wei and Liefner 2012: 104).

In the field of regional planning in China, public participation is only at its first stage. On the one hand, there has been increasing opportunities for the public to express their opinions and advices during the process of planning in the past decade such as the opportunities for public participation in the planning process of FYPs mentioned previously in this part, which is a positive progress in the field of regional planning. On the other hand, many Chinese citizens still lack of adequate knowledge on planning, which makes it difficult for the public to provide valuable or professional suggestions[237]. As a planner myself, I believe that there will be more opportunities for public participation in the field of planning in China in future, and the public could also learn from the participation process and accumulate knowledge and experience on planning which will contribute to future participative activities.

This part gives a brief overview of recent planning approaches getting popular in China related to the field of regional planning ─ pilot projects, principal function zones and participatory planning for a better understanding of the recent changes and progresses of regional planning in China in the past decade. These three approaches are either original creation with Chinese characteristics or developed by learning from the planning experience in developed countries. Based on the introduction and discussion on regional planning in China described above, the next part will focus on case studies for regional planning practices of the two regions of the NE and YRD.

8.2 Case studies: regional planning practices of the NE and YRD

For the case studies, this part first analyzes the regional planning practices of the NE (8.2.1) and YRD (8.2.2) respectively, and then comes up with some main findings of the

[237] Expert interview with Prof. Dr. Wen Chen (30 June 2015, via Skype).

case studies at the end of this part (8.2.3). In each case study, it begins with the background of regional planning in each region and then investigates the regional planning practices, with emphases on the regional planning projects coordinated by the NDRC in each region.

8.2.1 Regional planning practices of the NE

As a national manufacturing base of China since the 1950s, the region of the NE had made great contribution to the national economy under central-planned economy before the opening and reform policy implemented in 1978. However, due to its poor performance in the arena of market-oriented economy, the NE has gradually lost its position as a leading national industrial region since the 1980s whereas has become a problematic region with economic recession as well as social unrest. Therefore, regional sustainability of old national industrial region like the NE is not only an inherent requirement of the national strategy of constructing harmonious society as well as achieving coordinated regional development in China, but also an important mission to achieve sustainable development in the country. Considering that my working experience as a planner was mainly restricted in the region of YRD, I did not participate in any planning projects in the NE personally in the practice. Therefore, this part is mainly based on references, interviews, fieldtrip as well as other scholar's presentation at the conference.

(1) Background: Northeast Phenomenon and revitalization of the NE

Since the term "Northeast Phenomenon" was put forward by Chinese scholar Feng Shunhua in 1991[238] (Feng 1991), it has been widely used for the description of regional economic recession as well as regional economic decline in the NE, and has also attracted attention from the Chinese central government. On the surface, the Northeast Phenomenon represents a relative descent of the economic status of the three provinces in the NE (Liu and Zhao 1997; Ding 2003); in essence, the Northeast Phenomenon is a long-term problem related to deindustrialization[239] (Li and Nipper 2009). In general, the Northeast Phenomenon is an issue of regional development in the NE (Li and Li 1996; Wei 2003; Chen *et al* 2004; Deng *et al* 2004; Jin *et al* 2006; Zhu 2008), which made the region suffer from decline after its boom years, and shaped a unique development path of the region with both institutional and structural causes[240].

On the one hand, taking an institutional perspective, the NE failed to sustain regional economic vitality during the institutional transition from central-planned to

[238] According to Feng (1991), "although the policy of economic deflation by the central government exerts general influence on national economic growth rate, there are vast disparities among regions, and the NE is the most difficult one … The industrial production in the three provinces of Liaoning, Jilin and Heilongjiang is confronted with an extremely difficult situation with negative or zero growth and is hard to get out of the slump; local fiscal deficit remains serious without signs of fundamental improvement yet. It is the 'Northeast Phenomenon'." (translated from Chinese)

[239] Informal talk with Prof. Dr. Dietrich Soyez at Universität zu Köln in July 2008. According to Prof. Dr. Dietrich Soyez, the Northeast Phenomenon is deindustrialization, even though the Chinese scholars don't call it deindustrialization.

[240] The State Council also verified it after 5 years of the implementation of the NE revitalization policy by stating that "the deep-rooted contradictions, such as the institutional and structural problems, need to be further solved" (State Council 2009).

market-oriented economy, which is an essential cause of the Northeast Phenomenon (Li 2000: 206). As a region thoroughly built as an entity of central-planned economy, the NE has been intensively restricted from the institution of central-planned economy with impressive proportions of state-owned economy since 1950s, which made the region manifest unfitness, stagnancy and resistance during transition to market economy. More importantly, the existent institution of central-planned economy restrained the state-owned enterprises (SOEs) in the NE from implementing quick and complete restructuring (Lu 2004; Qiao 2004; Wang and Li 2004; Chen and Liu 2005). For instance, the SOEs in the NE are used to following the instructions from the leaders of the enterprises without actively reacting to the market signal or even paying no attention to the market at all (Li 2000: 206). Moreover, under a long-term central-planned economy, the SOEs in the NE have been accustomed to waiting for, relying on and asking for financial funds, subsidies and policy supports from the state (Lan 2003; Liu and Chang 2005), even though most of the scholars believe that the NE should lay emphasis on establishing a new market economy with open, uniform and transparent market-operation rules, not on preferential policies or funds from the central government. As a consequence, significantly influenced by previous central-planned economic institution, the enterprises especially the SOEs as well as provincial and local governments in the NE are insufficient for self-renewal motivation and capacity-building during transition, which leads to the situation that the reform of the large and medium-sized SOEs in the NE hardly gets rid of the traditional concept of central-planned economy but merely reflects strong path dependence on it. In other words, the NE is lacking in diversified economic elements besides central-planned economy featured by many SOEs compared to YRD or other coastal areas in China (see Table 4.1 in 4.1.1). In this sense, with relatively stronger path dependence on the central-planned economy, it became more difficult for the NE to get rid of the constraint of the long-lasting central-planned economy. As a consequence, the transformation of the NE remains a problem today for the Chinese government and is still under discussion by Chinese scholars, though there have been many studies and discussions on it since the 1990s[241].

On the other hand, following a structural view, the Northeast Phenomenon as a "structural crisis" (Lu *et al* 1999: 499) reflects the unfavorable industrial structure of the NE resulting from being China's heavy industrial base since the 1950s, with excessive capacity on heavy industry such as iron and steel, oil, petrochemicals, shipbuilding, machine tools and automobile manufacturing. For one thing, there has been increasing pressure on re-employment and environmental protection in some natural-resource-based old industrial cities due to the depletion of mineral resources, which has caused serious environmental depredation in these cities such as land subsidence. Although national policy has supported these cities in some degree, the

[241] See, for example, Li (1996), Chen (2003), Deng *et al* (2004), Chen and Liu (2005), Jin *et al* (2006), Zhu (2008) and Jin (2015). In addition, support by the State Council (2014) brings more discussions on the revitalization of the NE. For instance, Support for Revitalization of the Northeast, http://www.gov.cn/zhuanti/2014dbzx/, accessed on 15 December 2015 (in Chinese). There are also symposia on this topic, for example, *the Forum for Innovative Development and Revitalization of the Northeast (the first phase)* held on 8-9 January 2016 in Changchun, Jilin, http://www.gsc.org.cn/n1313394/n1330237/16894587.html, accessed on 21 January 2016 (in Chinese).

problems have not been resolved fundamentally yet (Lu *et al* 1999: 499; Wei 2003: 8). For another, most of the heavy industry such as iron and steel, oil, petrochemicals, machine tools, automobile manufacturing and energy industry are predominated by large and medium-sized SOEs with general problems like aging of plants, lack of funds and poor enterprise profits (Li and Li 1996; Sun *et al* 2005). And what's more, the SOEs have been dependent heavily on national industrial policy as well as arrangements, but with little competence of independent development or innovation. In a word, neither entrepreneurism nor commercialism prevailed in the NE.

A lot of research focuses on strategies of revitalization of the NE (e.g., Chen 1996; Liu and Zhao 1997; Chen 2003; Qiao 2004; Wang and Li 2004; Chen and Liu 2005; Mei *et al* 2006; Zhang 2008) including adjustment of economic structure, regional coordination and institutional innovation, with intention to change the fortune of the old manufacturing base. In addition, there are also studies with special focus on cultural perspectives of the Northeast Phenomenon and cultural revitalization of the NE (e.g., Liu and Chang 2005; Ma and Chen 2006; Yin *et al* 2010; Zeng and Wang 2013). Generally, it is assumed that manufacturing in the NE is still critical to the future of China, and it seems that the Chinese government tries to rebuild manufacturing in the region and wants the NE to serve further on as a centerpiece to manufacturing for national security reasons (Li and Nipper 2009).

Chinese central government has attached great importance to the revitalization of the NE since 2003, with both preferential policies and institutional instruments. On the one hand, revitalization of the NE has served as a national policy of China since October 2003 (State Council 2003a, 2009, 2014). On the other hand, the State Council established the Leading Group for Revitalizing the Northeast and Other Old Industrial Bases in December 2003, with the Chinese Premier as the chairman (State Council 2003b). In 2008, after the institutional reform of the State Council, the duties of the Leading Group have been transferred into the NDRC with the establishment of the Department of Northeastern Region Revitalization, NDRC (Zhu 2009).

(2) The Plan of Revitalizing Northeast China

The Plan of Revitalizing Northeast China (NDRC 2007), started in 2006, is a regional planning project of the NE made by the NDRC and approved by the State Council in August 2007 (State Council 2007a). The Plan is formulated in accordance to *Several Opinions on the Implementation of the Strategy for Revitalizing the Northeastern Region and Other Old Industrial Bases* (State Council 2003a) and *Outline of the 11th FYP for National Economic and Social Development (2006-2010)* (NDRC 2006), with focus on regional development of the NE during the 11th FYP (2006-2010) and an outlook of key issues to 2020. The Plan envisages the region as "an internationally competitive equipment manufacturing base, a state base for new materials and energy supply, a key state base of grain commodities and agricultural and animal husbandry production, a key state base of technological development and innovation, as well as a strategic area for national ecological safety" (NDRC 2007).

The planning process of the Plan of Revitalizing Northeast China is almost pure government-dominant without public participation. Government as the predominant

actor has not only decided almost everything during the preparation period, but also compiled the Plan single-handed. Few clues to public participation could be found in the preparation for the Plan, and the planning process was even not known to the general public at all. Citizens are only limited informed with the publication of the Plan by news as well as reports from the mass media, such as from newspaper or via internet[242].

The NDRC also followed the Chinese-style planning methodology of "learning from the experience of developed countries" for the Plan of Revitalizing Northeast China. In June 2007, the Department of Regional Economy of the NDRC organized a delegation of governmental officials from provincial DRCs in the NE as well as scholars from academic institutes to visit Germany and to learn the theory and practice of deindustrialization of the German experience. The delegation visited Essen, Oberhausen, Duisburg and Dortmund in the Ruhr area and the Garzweiler surface mine of brown coal in Germany, and discussed with German experts from University of Cologne[243]. During the investigation, the delegation learned three ways out of deindustrialization in the Ruhr area[244]: first, attract investment from the EU to preserve the original industrial locations as cultural heritage; second, transform the old factory plants into public parks as well as public areas with sport or recreation facilities; and third, rebuild the factory district into modern central business district (CBD) to attract new employment by upgrading the industry. The Chinese delegation found it helpful for them to draw on the experience mentioned above and they would consider and discuss its feasibility in China.

(3) Enthusiasm for planning after the Plan of Revitalizing Northeast China

The Plan of Revitalizing Northeast China aroused much enthusiasm for planning among the local and provincial governments in the NE. Compared to their former interest in how to get the investment from the State in specific sectors or projects of local economy, some of the local and provincial governments in the NE began to ask the central government for planning projects related to local development. The main reason lies in that revitalization of the NE has been upgraded to a national strategy since the Plan of Revitalizing Northeast China approved by the State Council in August 2007, consequently provincial and local governments in the NE either directly or indirectly benefited from the preferable policy for the region of NE with contribution to local development. In a word, the real need of the local governments for potentially preferable national or regional policy lied behind the planning itself, and that's the reason why some of the local and provincial governments in the NE exhibited their enthusiasm for planning projects after the Plan of Revitalizing Northeast China, albeit superficially.

With the enthusiasm for planning among the local and provincial governments in the NE

[242] For instance, homepage of Revitalization of the Northeast. http://www.chinaneast.gov.cn, accessed on 15 December 2015. (in Chinese)

[243] At that time, I was a visiting scholar at the Geography Institute, University of Cologne, and I went with the delegation together during their visit in Germany and worked as a translator for them. Prof. Dr. Josef Nipper and Dr. Johannes Hamhaber, both worked at the Geography Institute, University of Cologne, shared the German experiences with the delegation and discussed with them on their questions.

[244] These three ways as the German experiences on the Ruhr area were introduced by Dr. Johannes Hamhaber.

mentioned above, planning was booming in the NE after the Plan of Revitalizing Northeast China. In 2009, State Council approved several new planning projects related to the local, provincial or regional development in the three provinces of the NE, including the establishment of the *Suifenhe integrated Free Trade Zone* in Heilongjiang Province approved in April 2009, the *Development Plan for Liaoning Coastal Economic Zone (2009-2020)* in Liaoning Province approved in July 2009 and the *Outline of the Plan for Regional Cooperation along the Tumen River ─ Changchun-Jilin-Tumen as a Pilot Zone (2009-2020)* in Jilin Province approved in August 2009. It was the first time that the three provinces of the NE almost simultaneously took the initiative in regional development and planning and upgraded their initiatives to national approval, which also implied their intention of getting preferable policy and support from the central government for promoting provincial and local development behind these planning projects. Indeed, all of these planning projects were in accordance with the Plan of Revitalizing Northeast China. Moreover, afterwards in September 2009, *Several Opinions of the State Council on Further Implementing the Strategy for Revitalizing the Northeast and Other Old Industrial Bases* (State Council 2009) approved several regional development programs in the NE related to these planning projects mentioned above.

As constancy of the enthusiasm for planning in the late 2000s mentioned above, there have been diverse regional planning projects implemented in the NE in the 2010s with the following three major categories. First, planning projects focus on promoting transnational regional cooperation in the NE such as the *Outline of the Plan for Cooperation between Northeast China and Far East and Eastern Siberia Russia (2009-2018)* and the *Outline of the Plan for Northeast China Opening-up to the Northeastern Asia (2012-2020)*. Second, the comprehensive and sector FYPs. For example, the *12th FYP of Revitalizing the Northeast (2011-2015)* (NDRC 2012) as well as its sector plans such as the 12th FYP of Tourism and the 12th FYP of Logistics. Third, special regional planning projects on environmental protection and resource management such as the *Daxing'anling and Xiaoxing'anling Forest Areas Ecological Protection and Economic Restructuring Plan (2010-2020)* and the *Integrated Plan of the Songhua River Basin (2012-2030)*.

However, there is still insufficiency of regional cooperation especially inter-provincial coordination of the three provinces in the NE with reference to the diversified plans. For instance, the three planning projects approved by the State Council in 2009 mentioned previously in this part belong to the three provinces of the NE, but their principal planning objectives are quite similar. Although they do not exactly use the same word or term, at least all of them want to expend their local potentials and become a development engine for Northeastern Asia. If the three provinces make efforts to realize this objective, it would be probably similar to the situation of the region of YRD before the YRD Regional Plan with an accomplished fact of intensified inter-city and inter-province competition on investment, resources, establishment and enlargement of local industrial park and infrastructure construction. Therefore, it is important to find a solution in practice for the three provinces in the NE to coordinate their activities toward their principal planning objectives without excessive competition.

Fortunately, there has been some progress on regional coordination in the NE since the publication of *Several Opinions of the State Council on Further Implementing the Strategy for Revitalizing the Northeast and Other Old Industrial Bases* (State Council 2009). For instance, a coordination mechanism by the administrative leaders in the NE has been established since 2000, with an annual conference of the administrative leaders in the NE for discussion as well as exchange of views on large infrastructure construction, industrial distribution, coordinated regional development, regional cooperation as well as other regional development aspects in the NE[245].

8.2.2 Regional planning practices of YRD

(1) Background: endogenous inter-city cooperation in YRD since the 1980s

Along with the promotion of the opening and reform policy in China, inter-city cooperation has spread in YRD since the 1980s, which could be interpreted as an endogenous motivation for regional planning in this region.

In 1981, more than 100 scholars and experts met in Wuxi City, Jiangsu Province to confer on the economic future of YRD, and concluded that the two provinces of Jiangsu and Zhejiang and one municipality of Shanghai should cooperate with each other to research on the agrarian areas, industrial network and allocation of the cities in YRD and to make a new plan under a "natural and economic" perspective (White 1998: 375). In October 1982, Chinese Premier Zhao Ziyang proposed a Shanghai Economic Zone to overcome the compartmentalization between the top-down sector management by governmental departments and the territorial administration by provincial and local governments, and the State Council in principle approved the Zone on 22 December 1982, including 4 cities in Jiangsu Province (Suzhou, Wuxi, Changzhou and Nantong City) and 5 cities in Zhejiang Province (Hangzhou, Jiaxing, Shaoxing, Huzhou and Ningbo City) besides Shanghai (White 1998: 375). In the following decade, the endogenous inter-city cooperation in YRD achieved further progress, and another 4 cities (Nanjing, Zhenjiang and Yangzhou City in Jiangsu Province and Zhoushan City in Zhejiang Province) joined together with the former 10 cities, with an annual joint meeting of the inter-city cooperation office directors of the 14 cities in YRD from 1992 to 1996. And what's more, driven by the annual joint meetings mentioned above, the Yangtze River Delta Urban Economic Coordination Committee (YRDECC)[246] as a new spontaneous economic coordination organization for inter-city cooperation in YRD was established in 1996.

The YRDECC is the first regional cooperation organization in China with independent

[245] This conference is organized by four provinces. Besides the three provinces of Liaoning, Jilin and Heilongjiang in the NE, it also includes the administrative leader of the Inner Mongolia Autonomous Region. Source: http://baike.baidu.com/view/6185374.htm, accessed on 15 December 2015. (in Chinese)

[246] The YRDECC had 15 member cities in 1997, with Taizhou City in Jiangsu Province as a new member. In August 2003, Taizhou City in Zhejiang Province also joined the Committee. In March 2010, the Committee accepted 6 new member cities after six-year's observation and review, including Yancheng and Huai'an City in Jiangsu Province, Jinhua and Quzhou City in Zhejiang Province, and Ma'anshan and Hefei City in Anhui Province, and the total number of cities in the Committee was up to 22. In April 2013, another 8 cities joined the YRDECC, including Wenzhou and Lishui City in Zhejiang Province, Lianyungang, Xuzhou and Suqian City in Jiangsu Province, and Chuzhou, Wuhu and Huainan City in Anhui Province, and presently the YRDECC has 30 member cities.

office[247] in Shanghai (Xinhua 2013a), which serves as an inter-city cooperation mechanism in YRD with an annual Mayors' Joint Session[248] of the member cities. Moreover, the YRDECC has received support from the Department of Regional Economy of the NDRC since 2003, with the participation of its Deputy Director in the annual joint sessions. Furthermore, in 2009, the YRDECC established its *Research Center for Inter-city Cooperation in YRD* in Fudan University in Shanghai.

In a word, the inter-city coordination and cooperation in YRD deepens in the past decades based on voluntary impulsions of the cities within the region since the 1980s, and the support from NDRC at the national level demonstrates the approval of the Chinese central government with the progresses achieved in the region of YRD on regional development and cooperation.

(2) Planning practices and policy consultancy before the YRD Regional Plan

In addition to the YRD Regional Plan coordinated by the NDRC, there had been more and more new planning projects in the two provinces (Jiangsu Province and Zhejiang Province) and one municipality (Shanghai Municipality) in the region of YRD in the 2000s.

In Jiangsu Province, for example, besides the FYPs, there were many different kinds of plans with the characteristics of regional planning, such as the *Industrial Development Plan for the Region along the Yangtze River of Jiangsu Province*, *Master Plan for Developing the Region along the Yangtze River of Jiangsu Province (2001-2010)*, *Master Plan for Developing the Coastal Region of Jiangsu Province (2005-2015)* and the *Plan for the Metropolitan Regions in Jiangsu Province* started in 2002, which includes the *Plan for the Metropolitan Region of Nanjing (2002-2020)*, the *Plan for the Metropolitan Region of Xuzhou* and the *Plan for the Metropolitan Region of Suzhou-Wuxi-Changzhou*.

As a matter of fact, strategic plans became more and more popular at both provincial and local level in the 2000s. For instance, at the provincial level, there was the *Strategic Plan for Port Development along the Yangtze River in Jiangsu Province* made by Jiangsu DRC and Tokyo Keizai University, Japan in 2006. At the local level, besides respective Urban Master Plan of each city, major cities in Jiangsu Province such as Nanjing, Suzhou, Wuxi, Nantong have made their own strategic plans, and some cities even made strategic plans for a district of a part of a city, such as the *Strategic Plan of Suzhou Industrial Park* (Suzhou City) and the *Strategic Plan of Guangling District, Yangzhou City*. Nantong City even launched two strategic planning projects within three years: the *Strategic Plan of Nantong (2005)*[249] and the *Strategic Planning of Nantong in*

[247] The YRDECC Office has been located at the Cooperation and Communication Office of Shanghai Municipal Government in November 2004, which is in charge of the routine work of the association.

[248] The Mayors' Joint Session was previously held every two years before 2004, and it was since the 5th meeting in November 2004 held annually (CRI 2012). Xinhua (2013b) provides general information on the previous Mayors' Joint Sessions of the YRDECC from 1997 to 2012.

[249] The Strategic Plan of Nantong (2005) is a planning project launched in 2003 and finished in 2005. It was made by Nantong DRC and Zhongke Urban and Regional Research Center, Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, and I participated in this project and was responsible for the development orientation and strategies.

the YRD[250] (APA *et al* 2006).

Particularly, as for local governments, a way of strategic thinking in their practical working fields in line with the concept of strategic planning also got popular. In addition to the existant strategic plans, some local governments extended their interest in strategic planning to specific topics and financed specific planning projects with the spirit of strategic planning. For instance, the local government of Suzhou City launched a project of *Strategic Research on River Traffic in Suzhou* in 2003[251].

Notwithstanding an inclination towards strategic thinking and planning, the local government might get even more confused by the different strategies put forward by different planning teams for the same planning topic. In the hope of selecting from diverse strategies for future decision-making, the local government sometimes invited independent planning teams to work respectively for the same planning project and asked each team to hand in its own final report. When in fact, the local government might receive planning reports quite different in focus, contents, style and feasibility, which made it even more difficult for the local government to determine the strategies for future decision-making. For instance, Suzhou Planning Bureau made a strategic planning project of *Development Strategies of Suzhou City* in 2002, with two planning teams from Nanjing University and Tsinghua University working independently for the same topic with their respective planning reports[252]. As to the local government, even if the intention of having two reports might be better for the preparation of decision-making, the truth was that it was not easy to find solutions from two different planning reports, since the two reports were completely different. The Tsinghua report looked like a planning atlas with many complicated planning maps, while the other report was mainly composed by words with analyses of the development background, present situation, problems and opportunities, future development emphasis, development strategies on spatial, industrial and urban development as well as several related planning maps. Owing to this fact, it was not easy for the local government to make solutions just from one report and refuse the other one, but it would be even more difficult to synthesize them in practice. In this sense, basic coordination in a certain degree between different planning teams and the local government might be still necessary for feasible planning proposals and reports.

With my work experience as a planner for urban and regional development, I participated in 11 planning projects at the local, provincial as well as regional level in the region of YRD, including several planning projects mentioned above. In my point of view, urban and regional planning projects generally rely much on governmental resources, and even the YRD Regional Plan is no exception. Particularly, almost all of the strategic

[250] The Strategic Planning of Nantong in the YRD was a planning project coordinated by Nantong Planning Bureau. The Nantong Planning Bureau commissioned the American Planning Association (APA) to make the Strategic Plan of Nantong in YRD in 2004, which is re-launched after a pause in July 2005. The project team included the APA, Rivkin Associates, Tulane Regional Urban Design Center and the Matrix Group. (Source: APA *et al* 2006)

[251] This project was finished in December 2003 by the Zhongke Urban and Regional Research Center, Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, and I participated in this project.

[252] The planning team from Nanjing University finished their report in October 2002, and the team from Tsinghua University finished theirs in November 2002.

planning projects rely heavily on local or provincial governments, which more or less reflects the provincialism or localism behind the planning itself. And what's more, in light of strategic planning as non-statutory planning in China, local or provincial governments remain taking a leading role in the compilation of the strategic plans, which has led the planning practice "subject to local political processes" (Wong *et al* 2008: 317). For instance, the local or provincial government could "instruct and even manipulate the aims and planning standards" for local economic growth (Wu and Zhang 2007: 731), and elite actors such as mayors are influential in shaping the development visions or trajectories under political elitism. In other words, local political elites in YRD has treated a planning project "as an opportunity to enforce their own development concepts and gain competitive advantage" in the 2000s (Wong *et al* 2008: 317).

To say the least, as a mission statement of the local political leaders with narrow social foundation as well as little contact to local citizens, a strategic plan largely only serves as a slogan or future-oriented image for the region or the city, whereas local political leaders pay little attention to the implementation of the plan. In consequence, even though there have been already various plans with the label of "regional" or "strategic" within YRD, the planning reality remains ignoring or dodging the conflict among multiple interest groups without safeguarding or increasing public interests (Gu and Li 2006). In a word, most of the planning projects mentioned above were driven by local or provincial interests, hence in the service of the provincial or local government with representation of the provincialism or localism more or less behind, apart from the rationality or feasibility of the plan.

Along with the boom of regional planning practices in YRD in the 2000s, a new trend has arisen in the field of policy consultancy. Provincial governments have increasingly invited policy researchers from central government institutes ─ for example, the Academy of Macroeconomic Research, NDRC ─ to advise them in crafting regional development strategies and policies, and this new trend in policy consultancy serves to "strengthen the coherence, or at least avoid contradictions, in concurrent central and local policy programs" (Heilmann and Melton 2013: 606), which is also helpful to separate the policy makers responsible for plan implementation from the evaluation and monitoring process (Xu 2010). For instance, in order to prepare for the 11th FYP, Jiangsu DRC and the Organization Department of the Party Committee of Jiangsu Province invited policy researcher from the Academy of Macroeconomic Research, NDRC and the Department of Development Plan, NDRC to give lectures at the Development Plan Seminar for Mayors in Jiangsu Province on 22 and 23 November 2003 (Mao 2006).

In addition, provincial and local governments have realized that making strategic plans for their own provinces or cities could not solve the cross-boundary problems like environmental pollution, natural resource supply or infrastructural provision (Wong *et al* 2008: 316). Moreover, local and provincial governments have incentives for inter-city or inter-province coordination in the light of decentralization of the fiscal system with sharing of tax revenues between the local, provincial and the central government. That is to say, regional coordination against administrative fragmentation could directly or

indirectly benefit for the cities and provinces in the region. As for inter-provincial regional coordination in China, presently it is mainly initiated by the NDRC at the national level with responding regional planning projects, and the endogenous inter-city cooperation in YRD plays a positive role in coordination and consultation.

(3) The YRD Regional Plan

As a regional planning project of China's 11th FYP (2006-2010), the YRD Regional Plan (NDRC 2010d) is launched by the Department of Regional Economy of the NDRC and authorized by the State Council. As early as July 2004, the NDRC started preliminary work on the Plan (NDRC 2005). In November 2004, the NDRC formally announced to start the Plan and reported to the State Council afterwards. In November 2006, the NDRC introduced the compilation work of the Plan at the 7th meeting of the YRDECC in Taizhou, Jiangsu Province[253]. The State Council agreed to make the YRD Regional Plan in September 2008 (State Council 2008) and formally approved its implementation in May 2010 (NDRC 2010a; Xinhua 2010b). In October 2010, the NDRC with other related departments of the State Council conducted field supervision on the implementation of the plan in YRD (NDRC 2010b,c).

According to the YRD Regional Plan (NDRC 2010d), YRD will not only consolidate its strategic position as China's leading area but also become an important international gateway to the Asia-Pacific region, provide world-class services, advance manufacturing center and develop into a world-class city-region with strong international competitiveness.

The YRD Regional Plan distinguished itself from other planning projects in YRD by the inter-province planning coordination between Shanghai, Jiangsu and Zhejiang from the beginning. For instance, in Jiangsu Province, Jiangsu DRC coordinated the Plan in Jiangsu Province with Shanghai Municipality and Zhejiang Province from the launch of the compilation work on the outline of the 11th FYP in October 2003, and Jiangsu DRC also established a FYP-based performance appraisal system within Jiangsu Province as an institutional guarantee for the implementation of Plan (Mao 2006).

Public participation became active at the provincial and local level in the preparation process of the plans in YRD since the 11th FYP. At the provincial level, for instance, according to incomplete statistics, in Jiangsu Province, more than 400 experts, scholars as well as research staffs participated in the preliminary research on the 11th FYP, and more than 3000 people from all parts of the society offered advice and suggestions for the 11th FYP (Mao 2006). At the local level, public participation has also expended since the 11th FYP. For example, in Wuxi City, Wuxi DRC selected economic development, social development, urban construction and life of the common people as the 4 themes with nearly 80 topics for public discussion and participation from July to end of October 2004. Citizens could contact the Planning Bureau of Wuxi DRC per post, by telephone or via internet. Wuxi Daily established a special section of "My Advice and Suggestions on the 11th FYP" in August 2010 to publish excellent suggestions, and citizens could

[253] The theme of the 7th meeting of the YRDECC is "making research on regional development plan, increasing international competitiveness of the YRD".

also write their suggestions on special sections at www.wxrb.com and www.wuxi.gov.cn (Wuxi Daily 2004). However, despite the YRD Regional Plan as part of the 11th FYP, there was no engagement of the general public in the preparation process of the Plan, which was a common problem of almost all the strategic planning projects at the provincial and local level in YRD.

As a planner, I participated in the planning process of the YRD Regional Plan and was responsible for the development strategy. During my work, I found that regional planning was taken by the central government as an instrument for spatial as well as resource coordination between provincial and local authorities, while this effort remained "economically driven and urban focused" (Wong *et al* 2008: 322), and "the principles of sustainable development and environmental protection have generally been used in a superficial manner" (Wong *et al* 2008: 324). Although regional planning is expected to surpass the existent administrative boundaries, the conflict between economic zones and administration areas results in the dilemma of the implementation of the YRD Regional Plan, which is attributed by the game of interests and the lack of effective collaborative mechanism criss-crossing the organizational structures of the region as well as a strong trans-regional administrative body to oversee the implementation (Wang and Jiang 2012).

8.2.3 Main findings of the case studies

At the national level, regional planning has served as an instrument of national policy by the Chinese central government for coordinated regional development in China since the 2000s, particularly since the 11th FYP (2006-2010). The NDRC has taken a lead in the regional planning process and has played an important role in coordination.

At the regional level, in both case studies, regional planning as well as a coordinative regional institution contributes to regional sustainable development, though with regional-specific difference. For one thing, regional planning as an instrument for sustainable development serves as a national strategy for coordinated sustainable regional development in China, though with regional-specific planning objectives and focuses. For instance, regional plan of YRD lays emphasis on solving the problem of the intensified inter-city and inter-province competence, while in the NE regional plan serves as a driving-force for accelerating the reform of the SOEs and an out-way to get rid of the Northeast Phenomenon. For another, a coordinative regional institution is helpful to the implementation of the regional plan. In YRD, there had been many existent regional planning practices before the YRD Regional Plan launched by the central government, with the YRDECC as an endogenous inter-city coordinative regional institution, while the NE is more characterized as opening a new era of regional planning after the Plan of Revitalizing Northeast China, with an inter-provincial annual conference of administrative leaders since 2010. The annual conferences of administrative leaders in both regions could be understood as a form of regional governance with efforts between provincial as well as local political leaders, or in other words, inter-governmental communication for regional governance towards regional sustainability.

In addition, in both case studies, the regional planning process remains government-predominant without public participation, which is quite common in China. It is related to the CPC one-party dominated political system in China (see 7.1.1 in Chapter 7), which is quite different from the western countries under the framework of democratic politics such as the UK and USA, with a lot of consultation on stake holders and diversified actors before and during the planning process.

8.3 Conclusion

Planning is both necessary and important for regional development in China. Regional planning could bring a region a clear goal for its development, and without a plan, the region will lose direction and may confront with disorder in economic, social, environmental as well as political development.

Regional planning with Chinese characteristics represents the development of planning theories and practices in China in the past decades. In China, regional plans approved by the central government as a component of the national FYPs are basically in accordance with the dynamic five-year planning cycle of the FYPs. Consequently it is possible to correct the inadequacy of regional plans in time and to make adaptions according to the planning objectives.

In China, regional planning is a way of conflict management for coordinated regional development with specific focus as well as strategies, and the ultimate goal of regional plans is regional sustainable development, albeit regional-specific contents of the plans. In a certain degree, regional environmental depredation results from poor planning. In this sense, regional sustainable development needs regional planning in light that regional planning as a tool of regional governance could build or improve regional capability towards regional sustainability. Although regional capability is at the center of regional analysis, which is composed of regional development, regional sustainability and regional governance including planning, the role of planning is by no means unimportant (see 2.4.3 and Figure 2.6 in Chapter 2). On the contrary, in China, regional planning is a key instrument for the state to coordinate regional development, which has been particularly obvious since the 11th FYP (2006-2010). Presently, in the FYPs, regional planning is connected with regional and national policies and serves as components of China's national development strategies.

Nevertheless, the compilation of regional plans in China doesn't have legal status. Regional planning as part of the FYP is examined and approved by the State Council, which is thought to have "quasi-legal status", though its implementation might remain consistent with the non-compliance and low level of enforcement of laws in the country.

In general, regional planning practice in China is still a government-predominant process, with NDRC as the most important coordinator. Consequently, regional planning in China is compiled in a top-down way and lack of public participation. Nevertheless, considering that China is a country with vast territory and large population, it is quite difficult to apply participatory methods in the macroscopic planning processes. Therefore, lack of public participation in the planning process does not obviously prevent the effective implementation of regional plans in China. On the contrary, China's

one-party political system makes it even more effective on the planning compilation and implementation without long-time consultation and persuasion[254], both for the vertical coordination within the DRC system between national, provincial and local level and for the horizontal integration between different provinces or cities, which could be understood as a kind of “state-organized participation”.

Presently the function of the central government on regional management remains loose and dispersive in China, by which regional planning as an instrument for regional management is also influenced in some degree, especially in the following two aspects. For one thing, the most important as well as the most difficult point is coordination, including vertical coordination of planning at the national, regional and local level and horizontal coordination between different governmental departments at the same administration level. For another, the administrative system should fit to the need of the compilation and implementation of regional plans, which is an essential guarantee of effective planning implementation (NDRC 2005). Accordingly, an appropriate recommendation for regional planning in China is establishing a regional coordination institution at the national level. According to Zhang (2009), this new regional coordination institution could be established as an institution of the State Council, or as an institution directly under the State Council, or as an institution with the NDRC on behalf of the State Council for management.

As a final point, as for the approach of analyzing regional capability put forward in this study, building or improving regional capability could serve as a general objective of regional planning in China from now on. In fact, making a regional plan based on the path-assets analysis of regional capability developed in this study also contributes to get precise information on the status of regional development as well as its advantages and disadvantages, which not only accords with the previous widely-used planning approaches such as the SWOT (strengths, weaknesses, opportunities, and threats) analysis in the planning process, but also provides a relational-dynamic perspective with additional focus on regional assets and on the regional development path. Moreover, the development or improvement of regional capability could ameliorate regional governance by the implementation of the regional plan and might set up a new model of regional governance with focus on regional capability. In a word, regional capability as a concept is central to regional analysis, applicable to regional planning and governance and vital for regional sustainable development.

[254] Expert interviews with Prof. Dr. Jingxiang Zhang (1 July 2015, via telephone) and with Prof. Dr. Wen Chen (30 June 2015, via Skype).

9 Conclusion

This study intends to make a theoretical contribution to regional development studies by analyzing regional capability. Within this intention, in addition to providing a preliminary theoretical concept of regional capability (Chapter 2) as a new analytic framework for a capability-based analysis of regional development (Chapter 3), this study applies the methodology in empirical studies (Chapter 4 to 8) with the two regions of the NE and YRD in China as case studies, conducts a multi-dimensional path-assets analysis of the NE and YRD (Chapter 4 to 7), analyses the regional planning practices in both regions (Chapter 8), and provides a new perspective to regional planners, scholars and policy makers to facilitate regional governance towards regional sustainable development by analyzing regional capability in practice.

This concluding chapter is organized in the following way. First, it summarizes the empirical results and implications of the case studies in 9.1. Next, it reflects on regional capability as a theoretical approach of regional analysis in 9.2, including its origin, definition, characteristics, applicability, limitations and contributions. Then, in 9.3, it develops a six-step methodology for spatial analysis based on the analysis of this study and discusses its application as an interdisciplinary approach with specific consideration on a capability-based spatial analysis featured with a path-assets analysis under a relational-dynamic perspective. Afterwards, in 9.4, it focuses on how to improve regional capability towards regional sustainability in practice and gives future recommendations for regional governance and planning in China. Last, it recognizes the limitations of the study, puts forward some open questions and points out further research directions in 9.5.

9.1 Empirical results and implications of the case studies

This study takes a relational-dynamic perspective to investigate regional development in China with case studies for empirical research, conducts a multi-dimensional (economic, social-cultural, environmental and political-institutional) path-assets analysis of the NE and YRD (Chapter 4-7) and analyses the regional planning practices in both regions (Chapter 8) from 1978 to 2015. This part summarizes the empirical results and implications of the case studies.

9.1.1 Regional development of the NE

Empirical research in this study shows that regional development of the NE is featured by exogenous impetus to regional development and has been influenced by national policies in a large degree since the foundation of the PRC in 1949. Consequently, the regional economy in the NE is mainly based on natural resource extraction with higher ratios on agriculture, forestry, mining and manufacturing in FAI than the national average.

In Maoist China (1949-1976), immigrations were organized by the Chinese central government to “develop the Great Northern Wilderness” in the NE. However, the historical large-scale migration into the NE was almost not voluntary but forced, planned and State-induced migration between the 1950s and the 1970s. Since 1978, many

people have moved out from the NE: the population density in the NE became lower than the national average since 2001 with expanded disparities to the national average, the natural growth rate of the NE remains only approximate 0.5‰ since 2011 and the TFR of the NE is only approximate 0.75.

In fact, the historical State-induced migration into the NE, on the one hand, turned the past wild marshy areas known as “Great Northern Wilderness” into the present “Great Northern Granary”, which feeds about one sixth of China’s population and composes to one fourth of China’s commodity grain with only about one tenth of China’s cultivated land; on the other hand, it gave rise to significant decrease in original wetlands whilst increase in natural hazards along with the land reclamation and the establishment of thousands of farms in this area since the 1950s.

And what’s more, in accordance with the decision of the Chinese central government to build the NE as a national strategic manufacturing base, many SOEs had been established in the NE since the 1950s. Under the central-planned economy in Maoist China, the SOEs had achieved significant performances and played an important role in national economic development and industrialization. Consequently, the NE became China’s first national heavy industrial base, served as the engine for national construction before 1978 and used to be China’s industrial showpiece. However, since 1978, along with China’s national transition from central-planned economy to market-oriented economy and the application of opening and reform policy, the NE has gradually lost its leading position in national economy. The SOEs representative for regional economy in the NE failed to adapt themselves to market signal in time instead of merely following the decisions by the State during the liberalization and privatization of the Chinese economy since 1978. As a result, the NE has increasingly lost its position as a national manufacturing base since the 1980s due to its poor performance in the arena of market-oriented economy, and the stagnation of the heavy-industry-based economy in the NE as well as its regional economic recession became more apparent since the 1990s when China deepened its national reform towards the market economy.

The decline of the NE since the 1990s demonstrates the difficulties of the region’s transition from central-planned economy to market-oriented economy due to a higher ratio of SOEs in the NE, which in fact reflects path dependence and lock-in of regional development of the NE on a central-planned economy. By the end of 2015, the NE failed to get rid of deindustrialization but the regional economic growth in the NE has been relying excessively on FAI with the percentage of total FAI to GRP higher than 80%.

The percentage of employment in secondary industry has almost continuously decreased in the NE since 1978 and has decreased much faster than the percentage of the secondary industry to the GRP. Many employees of the SOEs became laid-off with increasing unemployment, which contributed to an unstable society in the NE.

Nevertheless, the average cost of living in the NE remains lower than the national average, especially the price of food, residence, household commodities and services, transport and communications, and the relative lower resident consumption per capita of the NE is in accord with its relative lower income per capita.

Besides the low income and low consumption living pattern in the NE, ever-decreasing population is a significant challenge for regional development of the NE related to social stability. In addition, the NE have to get rid of path dependence of regional economy based on natural resource extraction with higher ratios on resource-intensive sectors such as mining and manufacturing, while the reform of the SOEs in the NE plays a crucial role during this process, since the SOEs in the NE are important actors for regional employment and contribute to regional environmental degradation and pollution.

9.1.2 Regional development of YRD

Empirical research in this study shows that the regional development path of YRD is featured by endogenous and exogenous impetus to regional development.

On the one hand, YRD has benefited from favorable national policies on opening and reform since 1978, especially for the establishment of Pudong New District in Shanghai since the 1990s and the recent China (Shanghai) Pilot Free-Trade Zone established on 29 September 2013 with preferable national policies for promoting foreign trade, investment (including FDI), export and import in YRD. Consequently, YRD has benefited from these favourable national policies in a large degree and served as one of the growth engine of China's national economy since the 1990s.

On the other hand, the endogenous impetus has sustained the economic prosperity in YRD. The regional culture of reform and innovation has played an important role in the economic boom of YRD. Even if the macro-economic background has been featured with a state of 'new normal' of slow growth since 2015, YRD remains as a leading runner in the race of economic growth in China. After several decades' reform towards market economy, regional economy in YRD has been adapted to response to market signals flexibly and in time. The present prosperity of YRD is achieved by its historical accumulation, from agriculture with perennial cultivation of rice in the past thousands of years to the 'YRD industrial clusters' evolved by endogenous township and village enterprises (TVEs) with institutional innovation on self-financing industrial zone in the 1980s.

Since 2000, YRD has been one of the most favourable destination for immigrants in China, with more than one million immigrants into YRD every year. The attractiveness of YRD on the immigrant population lies in its regional social-cultural competitiveness, including higher average wage and income, higher standard of living, convenient information change and sharing networks, leading position in China on creativity and innovation, outstanding service capacity of local governments, convenient regional transport system and more opportunities for good education especially higher education. Consequently, the population density in YRD has been more than five times of the national average since 1978. The immigrant population in YRD contributes to regional economic development while the average cost of living per capita in YRD is much higher than the national average and the NE in all kinds of consumption for daily life.

In fact, YRD as a sensitive region for climate change has to solve the problem of contradiction between ever-increasing population and limited resources and space

towards regional sustainable development. Along with the process of regional industrialization and urbanization, construction land has increased rapidly in YRD since 1991. In 2013, 17.83% of the total area of YRD were occupied by construction land, much higher than the NE (5.28%) and the national average (3.90%). In other words, more than one tenth (10.06% in 2013) of China's construction land is located in YRD, while the total area of YRD only equivalent to 2.20% of the national total. Due to an ever-increasing proportion of construction land, during the past decades, environmental degradation and pollution has much increased in YRD. Eco-systems in YRD have paid a great price for regional industrialization and urbanization and are under threat due to excessive human activities such as unsustainable resource use, construction, pollution and tourism.

9.1.3 The path-assets analysis of the NE and YRD

The path-assets analysis in this study distinguishes from the existent regional research characterized only with either a dynamic path analysis or a relational assets analysis. It is characterized as a synergy of both, in accordance with the relational-dynamic perspective pursued in this study.

Empirical research of the NE and YRD in this study implies that the development path of a region is influenced by various factors, among which preferential regional policies or development strategies play the most important role in regional development in China besides the region's development basis with population, employment, environment, transport and enterprises. The difference between regional development of the NE and YRD lies in their endogenous impetus, or in other words, the historical industrialization process related to regional culture. In fact, both regions have preferable regional policies from the central government and the NE even got more investment from the State in SOEs than YRD since the 1950s. However, the essential difference between the NE and YRD on their industrialization and urbanization processes is tightly related to regional culture and institutions.

The industrialization and urbanization process in the NE has been almost purely based on the national instructions from Chinese central government since the 1950s, with national investment on the construction of many SOEs, national manufacturing base for heavy industry and national agricultural production centre for commodity grain. Moreover, most of the residents in the NE are immigrants from other provinces in Maoist China due to a national decision on exploring the wild NE, and the historical large-scale migration into the NE before 1978 were almost not voluntary but forced, planned and State-induced migration. Although the NE did experience its prosperity under the central-planned economy, it presents path dependence on the central-planned economy with a status of lock-in after 1978, which becomes obvious since the 1990s. If the NE has formed some kind of reginal culture along with its industrialization and urbanization process, it could be summarized as waiting for, relying on and asking for preferable policies and investment from the State. This specific regional culture of the NE is tightly related to the establishment of the SOEs by the Chinese central government since the 1950s. However, the NE lacks of initiative and institutions to lead a development path featured in self-reliance and innovation, and that's the reason why a lot of national

investment went into the NE during the past decades but still could not sustain the revitalization of this old national manufacturing base. The most important point for regional development in the NE is not national investment or policy but endogenous culture and institutions adaptable to market economy, and that's also the key for the NE to get rid of the long-lasting path dependence on central-planned economy and lock-in.

Compared to the NE, the development path of YRD could be summarized as attempts and practices first, if applicable, implementation from the first to last. For example, the first self-financed industrial park in Kunshan (near Shanghai) in YRD was established by the local government in the 1980s without national instruction. Nevertheless, it became famous national-wide in the 1990s and served as a successful model for industrial parks in China. YRD has created several development models on regional economy in China, such as the Wenzhou Model and the Sunan Model developed from TVEs in the 1980s. Actually, at that time, YRD did not get specific national financial or policy support for regional development from the Chinese central government except several cities were included into the national decision on opening 14 coastal cities since 1984. Many preferable regional policies are benefited from self-reliance and local institutional innovation. Only if these local attempts became successful, local governments began to report to the central government and got national support afterwards. In this sense, the development path of YRD is characterised as endogenous and bottom-up, while the NE is on the contrary as exogenous and top-down.

Furthermore, the path-assets analysis of the NE and YRD implies that in a politically centralized country like China, if keeps on attempts and innovation based on local and regional resources like YRD, it is still possible to have achievements in regional development and even to create its own development model and path by catching opportunities for reform and development. Otherwise, only relying on national policy and investment without support from endogenous attempts, practices, culture and institutions adaptive to market economy like the NE, even if there were a lot of national investment and favourable policies, regional development could not sustain, and that's the most important thing for revitalization of the NE.

In fact, as mentioned previously, the development path of a region is influenced by various factors. Particularly, some factors hardly being predicted such as environmental disasters might have significant impact on the development path of the region at least in a certain period. For instance, this study looks at two serious environmental pollution accidents happened in Jilin City of the NE on 13 November 2005 and in Wuxi City of YRD on 3 June 2007, which happened at the local level but attracted attention at the national level, and the former even gave rise to international attention since cancer-causing pollutants including benzene and nitrobenzene flew along the Songhua River and came to Russia. Although two disasters did not change the regional development paths fundamentally, they do impact on the paths with more attention to environmental assets and environmental governance. As a consequence, there are both positive and negative changes in regional capability in both regions. For one thing, environmental pollution accidents deteriorate the environment and bring negative influence on regional environmental assets. For another, the environmental accidents

also lead to more consideration on regional sustainable development and governance since then and might have, in this sense, positive influence on regional development path as well as on regional capability.

Regional assets in this study refer to the multiple resources and elements inherent to or available for a region, and the empirical studies imply the following five main characteristics of regional assets:

(1) Regional assets represent a relational perspective towards understanding of regional development in a comprehensive way. In this study, regional assets include four major interactive component parts: economic assets, social-cultural assets, environmental assets and political-institutional assets.

(2) Regional assets can be either tangible or intangible. For example, the area of natural reserve in a region or the amount of government revenue is tangible, while knowledge management or potential for future economic benefits of a region is intangible.

(3) Some of the regional assets are regional-specific (such as preferential policies towards specific region or economic zones) while others are not (such as the general global or national macroeconomic situation a region is embedded in, national industrial policies and national environmental policies).

(4) Some factors influencing the regional development path serve as regional assets as well. For instance, political incentives or decisions on specific regions at the national level is also an element of the political-institutional assets of a region.

(5) The influence of regional assets to regional development might be, in some degree, positive or negative. For example, in the case studies of the NE and YRD, serious environmental pollution accidents or environmental disasters caused tremendous economic and social losses in each region, and from this point of view, they might be negative for regional development. Nevertheless, these accidents also resulted in increasing public awareness of environmental protection and public participation in environmental governance, and from this point it might have a positive effect on regional development as well.

Based on the empirical case studies, this study considers that the path-assets analysis as a comprehensive method of analysing regional development is applicable in practical scientific regional analysis and could be taken as a planning instrument as well. This study conducts the multi-dimensional path-assets analysis with both quantitative and qualitative analysis: a quantitative analysis on 48 indicators of regional assets (18 indicators for the economic dimension, 20 indicators for the social-cultural dimension and 10 indicators for the environmental dimension, see also: Table 2.5 and Figure 3.4) as part of the empirical research of case studies based on official statistical data besides a qualitative analysis for the political-institutional dimension based on some expert interviews. Concerning that it might be quite difficult to list and to analyse all kinds of regional assets in detail in practical research especially for a comprehensive regional study, this study mainly lays emphasis on the changes of the regional assets since 1978. Moreover, sometimes a broader time period might be needed for specific studies

besides the given time period. For instance, as to the NE in this study, it is necessary to look to its development process before 1978 from the establishment of the PRC in 1949, since the NE had experienced its prosperity under the central-planned economy between the 1950s and 1970s but suffers from path dependence on the central-planned economy with a status of lock-in after 1978. In this sense, the most important thing in empirical research is not to focus on how many indicators are analysed but to find out the reasons for certain problems or dilemma and try to give appropriate explanations, which is particularly essential for a qualified analysis such as the political-institutional path-assets analysis.

The path-assets analysis in this study concludes that regional development cannot be sustained by relying on national policy and investment alone, but requires endogenous impetus and innovation based on regional assets, and hence regional governance and planning can be effective tools for the management and the strengthening of regional capability.

9.1.4 Regional development and governance in China

For the qualitative political-institutional path-assets analysis of the NE and YRD based on expert interviews, this study mainly lays emphasis on regional governance and planning in China with focus on the political-institutional dynamics for multilevel environmental governance.

At the regional level, the governance process is operationalised by both national decisions and local activities in China. The political-institutional path-assets analysis indicates that understanding the nature of the complex process of governance in China requires a thorough understanding of national policy, local politics and their interacting ways (Lo 2015).

This study analysed two serious environmental pollution accidents happened in the NE and YRD at the local level but attracted attention at the national level. In both cases, local governments tried to hide the fact of water pollution, neglect environmental laws and regulations, ignore public participation in the environmental governance process, cover up the truth from local as well as national media and keep citizens out of the information about pollution accidents, which reflects the institutional defect in the environmental governance in China. Although public awareness on environmental protection has increased a lot in the past decades, it is still quite difficult to influence political decision by the governments due to weak enforcement of laws in China. In fact, the activities of environmental activists, NGOs and groups remain under control by Chinese governments, which makes it rather difficult for real environmental protection without a sufficiency of democracy.

The reaction to environmental pollution accidents in the NE and YRD reflects the deficiency of China’s environmental governance system. The state-led development pattern as well as dominance of the administration makes governments play a particularly important role in the governance process in China, and could be considered as a determinant for the performance of governance in China. In fact, the accountability of governments is often blamed by citizens as well as the public, especially at the local

level. In face of an environmental pollution accident, local authorities “either do not want to be bothered by complaints of illnesses, or are being bribed by operators to remain inactive” (Dodson 2011). The most significant weakness of China’s environmental governance system is the insufficient institutional framework for policy coordination (Richerzhagen and Scholz 2008). Presently the function of the central government on regional management remains loose and dispersive in China, and the most important as well as the most difficult point is coordination, including vertical coordination between the national, regional and local level and horizontal coordination among different governmental departments at the same administration level.

The main problem of environmental governance in China is “the mis-match of the speed of change driven by global market forces in the business sector and the relatively slow pace of institutional change to cope with the unwanted and damaging by-products of rapid economic growth” (Xue *et al* 2006: 51). It is represented by powerful governments versus weak public participation in the environmental governance process with weak enforcement of laws (including corruption) due to insufficient institutional capacity.

Based on the path-assets analysis in the empirical research of this study, the present situation of regional development in China shows many unsustainable characteristics, such as relatively high relying on investment from either governments or foreign companies with more attention to the growth of GDP, relatively low investment in environmental projects with increasingly serious environmental pollution and degradation. There are many reasons for the current problematic state, for example, for one thing, China’s current performance evaluation system for government officials gives considerable weight to the growth of GDP (Burns and Zhou 2010; Sarfraz *et al* 2014). Accordingly, government officials at the local and provincial level are more interested in increasing investment in manufacturing or other sectors with relatively higher rewards on the growth rate of GDP in contrast to investment in environmental protection, since the economic indicators are more important for governmental officials and achieving the goal of economic growth provides opportunities to get promotion to higher positions with more power and higher salary in a relatively shorter period of time. For another, the present punishment for firms on environmental pollution does not fit their crime and is not severe at all (Table 6.8, Table 6.9 and Table 6.10). Consequently, the polluting firms are less interested in the investment in pollution treatment projects but more willing to pay the fine, since as to the polluting firms in China, the fine costs much less than the investment in pollution treatment projects. As a result, current regional development in China features with specific unsustainable aspects (Zhang and Wen 2008; Cao *et al* 2015).

Presently environmental pollution as a serious problem of regional governance in China needs inter-provincial coordination strategies provided by regional planning towards regional sustainability. Regional planning with Chinese characteristics represents the development of planning theories and practices in China in the past decades. In China, regional plans approved by the central government as a component of the national FYPs are basically in accord with the dynamic five-year planning cycle of the FYPs. Consequently it is possible to correct the inadequacy of regional plans in time and to make adaptions according to the planning objectives. In a word, regional planning plays

an important role in spatial governance and serves as a guideline for regional development in China. In light of the instrumentality of regional planning in China mentioned above, considering regional development as important components of national development, regional plans actually serve as guidelines for national development in China, which is in accord with regional plans as important basis for national policies related to the development of specific regions (NDRC 2015).

Regional plans have served as a design towards regional sustainability in the past decade and become a way of conflict management for coordinated regional development. Aimed to solve the unsustainable problems in the process of regional development in China such as redundant construction and lack of public services, the coordinated regional development as "the development of China's regional status" serves "an important guarantee" to "promote the sustained and healthy development of the national economy prerequisite to maintain social and political stability" (Yu and Chen 2014: 225). Under this background, even if the contents of regional plans are regional-specific, regional plans have the same ultimate goal of coordinated regional development. In China, regional planning serves as a key instrument for the state to coordinate regional development in the national FYPs, which is connected with regional policies as well as national development strategies. On account of the governance essence as well as strategic and comprehensive characteristics of regional planning, a regional plan may serve as an effective tool towards regional sustainable development by improvement of regional capabilities, and the key is the implementation of the regional plan.

Presently regional planning in China is still compiled in a top-down way with relatively lack of direct and spontaneous public participation, but with a kind of state-organized participation for the vertical coordination within the DRC system between the national, provincial and local level and for the horizontal integration between different provinces and cities. Governments at all administration levels are the most significant actors during the state-organized participation, and scholars and planners as members of the consulting committee providing suggestions on sustainable development for the government are also important actors.

Among the main findings of the case studies on regional planning in the NE and YRD in 8.2.3, the following two findings are of the most importance: for one thing, in both case studies, regional planning as well as a coordinative regional institution contributes to sustainable regional development, though with regional-specific difference; for another, in both case studies, the regional planning process remains government-predominant without public participation, which is quite common in China.

In addition, regional planning projects in the NE and YRD have two main problems, which are also common problems for regional planning in China. On the one hand, economic dimension is attached with most of the consideration in accordance with the interest of the provincial or local governments, while the social-cultural, environmental and political-institutional dimensions are not paid sufficient attention to. On the other hand, most of the attention is attached to the comparative advantages of a city or a region based on present states with policy recommendations on future strategic

orientations, not to the efficient long-term management of the dynamic development process of the region towards sustainable development. This study regards it important to consider the social-cultural, environmental and political-institutional dimensions besides the economic dimension in order to fully explain current development situations and to give suggestions to the government or the policy-makers for future decision.

In general, regional planning practice in China is still a government-predominant process, with NDRC as the most important coordinator. Consequently, regional planning in China is compiled in a top-down way and lack of public participation. Nevertheless, considering that China is a country with vast territory and large population, it is difficult to apply participatory methods in the macroscopic planning processes. Therefore, lack of public participation in the planning process does not obviously prevent the effective implementation of regional plans in China. On the contrary, China's one-party political system makes it even more effective on the planning compilation and implementation without long-time consultation and persuasion, both for the vertical coordination within the DRC system between national, provincial and local level and for the horizontal integration between different provinces or cities, which could be understood as a kind of "state-organized participation".

As a final point, as for the approach of analyzing regional capability put forward in this study, building or improving regional capability could serve as a general objective of regional planning in China from now on. In fact, making a regional plan based on the path-assets analysis of regional capability developed in this study also contributes to get precise information on the status of regional development as well as its advantages and disadvantages, which is not only in accordance with the previous widely-used planning approaches such as the SWOT analysis in the planning process, but also provides a relational-dynamic perspective with additional focus on regional assets as well as the regional development path. Moreover, the development or improvement of regional capability could ameliorate regional governance by the implementation of the regional plan and might set up a new model of regional governance with focus on regional capability. In a word, regional capability as a concept is central to regional analysis, applicable to regional planning and governance and vital for regional sustainable development.

9.2 Reflections on regional capability as a theoretical approach of regional analysis

9.2.1 Regional capability: its origin, definition and characteristics

This study intends to present a conceptual framework of regional capability as a new analytic framework for a capability-based analysis of regional development. Before giving a definition of regional capability, this study investigates two existent firm-based concepts of regional capabilities (Heidenreich 2004, 2005) and dynamic capabilities (Teece *et al* 1997), and finds that Heidenreich's concept attaches much weight to the institutions and relations shaping the cooperation in firm-networks, which reflects a relational perspective; while the concept of dynamic capabilities lays emphasis on the flexibility as well as adaptability of a firm, which represents a dynamic perspective.

In this study, regional capability is defined as the total ability of a region being capable to develop itself with its possession of regional assets under any circumstances including adaptability to contingency. Distinguished from the firm-based concepts mentioned above, the concept of regional capability in this work is based on a region as a whole and could be taken as an approach to regional analysis.

Moreover, this study argues that regional capability is shaped by a region's assets and its development path, and consequently regional development is constrained by the region's assets and development path. The formation and change of regional capability is a dynamic process with two key aspects: the access to regional assets and the adaptability to contingency, and both aspects are essential for the understanding of regional development. Consequently, regional capability reflects the context of regional development at one point in the time sequence by the possession of a variety of regional assets with a relational perspective, while simultaneously presents the function of regional assets through a certain development path of a region with the process of time with a dynamic view (Table 2.4).

9.2.2 A rethink of regional capability as a theoretical approach for regional analysis: its applicability, limitation and contribution

The path-assets analysis of the NE and YRD in the empirical work of this study has *de facto* assessed the applicability of the concept of regional capability for regional analysis as an instrument to comprehend the dynamics of regional development by analysing a broad range of regional assets with a regional-specific development path.

In this study, regional capability is designed as the center of regional analysis interrelated with regional development, regional governance and planning and regional sustainability (Figure 9.1 and Figure 2.6). The path-assets analysis as an approach for analyzing regional capability not only offers a comprehensive understanding of regional development, but also provides regional-specific information on regional governance and planning (Figure 9.1). And what's more, regional capability interrelates regional development with regional governance and planning towards a common goal of regional sustainability (Figure 9.1 and Figure 2.6).

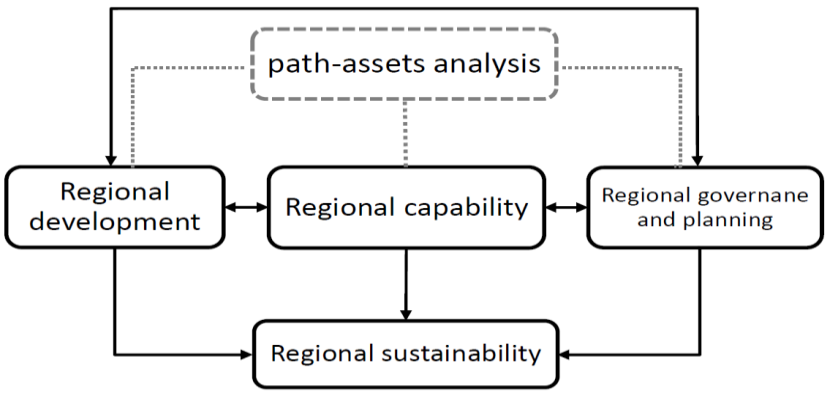

Figure 9.1 Regional capability: a theoretical approach for regional analysis

The concept of regional capability needs to be further explored and improved both in theory and in practice. Firstly, this study provides a preliminary analytical framework of

regional capability with an empirical analysis on a set of 48 indicators. With attention to a rich array of regional assets providing a ground for regional development, it is important to find out the key assets for shaping the development path of a region, whereas these key assets might be variable according to different research areas and concrete research emphases. For example, if only focuses on the region of NE, national investment and preferable regional policies from the Chinese central government play quite an important role in the regional development process of the NE (see 9.1.1); when taking both the NE and YRD into consideration, though national investment and preferable regional policies are still important for both regions, the essential difference between the NE and YRD on their industrialization and urbanization processes is tightly related to regional culture and institutions. Due to a lack of endogenous culture and institutions adaptable to market economy, presently the NE still could not get rid of the long-lasting path dependence on central-planned economy and lock-in (see 9.1.3). Secondly, it remains difficult to describe or to measure regional capability precisely both theoretically and practically in light of the development path of a region influenced by a broad range of factors. Thirdly, although the relational-dynamic perspective seems to be applicable to the empirical research on regional capability in this study, it is still worthy to reconsider if it could fully explore the dynamics of regional capability between regional assets and the regional development path.

9.3 Methodological application of the concept of regional capability

This study focuses on regional capability and regional analysis. In fact, the concept of regional capability and its analytical framework is not only limited to regional analysis, but could also be expanded to a broader field of spatial analysis with a six-step methodology for spatial analysis based on capability analysis (9.3.1). Moreover, there are possibilities to adopt the model to different spatial scales both theoretically (9.3.2) and practically (9.3.3).

9.3.1 A six-step methodology for spatial analysis based on capability analysis

A preliminary consideration on the expansion of the concept of regional capability is a six-step methodology for spatial analysis based on capability analysis:

(1) Define the spatial scale for analysis: transnational, national, regional or local. For instance, it could be the EU, ASEAN, the Tibet Plateau, a country (e.g. China or Germany), a region (e.g. Berlin-Brandenburg or Eastern China), a city-region (e.g. YRD city-region), a city (e.g. Shanghai or Berlin), a town, a county, a village or a part of them (e.g. a district or part of a city such as Berlin Kreuzberg).

(2) Apply a multilevel analysis to concrete area selected in step (1). This might be not a “must-do” step but a “could-do” step according to specific research topic. When following this step, there should be a highlight on a specific spatial dimension. For instance, if the research topic is the influence of air pollution to economic development in China, the national level should be the focus of the study. In addition, considering that air pollution happened with different extent in the provinces and municipalities, provincial level might be the next spatial dimension to present concrete spatial differentiation of air pollution: for example, Beijing and Hebei might

be the provinces and municipalities with the most influence; on the contrary, Hainan might be the province with the least influence.

(3) Define the time period for the path-assets analysis, which depends on the available resources or data beside the research topic or interest.

(4) Define the dimensions for assets based on the research objective of a specific project. Although four dimensions (the economic, social-cultural, environmental and political-institutional dimension) have been applied in this study for a comprehensive analysis, it is possible to focus on one or more from them according to concrete research topic. For example, if the research topic is the influence of air pollution to economic development in China, the emphasis could be laid on the economic dimension.

(5) Define concrete assets according to selected dimensions in step (4) and select indicators for the analysis based on the availability of data and resources. Following with the example in step (4), if the economic dimension is selected for the study on the influence of air pollution to economic development in China, try to list all the indicators related to this dimension, then the availability of data and resources is an important consideration on the selection of the indicators.

(6) Implement the capability analysis based on the path-assets analysis under a relational-dynamic perspective: analyse the indicators selected in step (5) during the time period defined in step (3).

The research method applied in this study could broaden its application by this six-step methodology for spatial analysis based on capability analysis summarized above. Its concrete methodological application is investigated from both a scientific view in 9.3.2 and a practical view in 9.3.3.

9.3.2 Methodological application of the six-step methodology: a scientific view

The six-step methodology for spatial analysis summarized above in 9.3.1 could be taken as an interdisciplinary approach with specific consideration on a capability-based spatial analysis featured with a path-assets analysis under a relational-dynamic perspective. It is designed for spatial analysis in geographical sciences (regional studies, development studies, human geography, economic geography, etc.) and is also applicable to interdisciplinary studies on relevant topics such as governance and planning.

In terms of spatial scale, this six-step methodology is appropriate to almost all the scales for spatial analysis such as a village, a town, a district of a city, a city, a province, a country, a transnational or transcontinental area, or even the globe. Based on a preliminary consideration, this methodology should be appropriate for analysis at the mesoscale and macroscale. Nevertheless, the capability-centred concept of the methodology is compatible with other firm-based concepts in economic geography such as regional capabilities (Heidenreich 2004, 2005) and dynamic capabilities (Teece *et al* 1997). In addition, this capability-centred concept might also be applied at the household level with some adaptions: it might offer a dynamic perspective into the livelihood analysis besides the focus on the assets as well as the access to the assets.

In essence, this six-step methodology for spatial analysis put forward in this study draws on other capability-centred concepts and is complementary to the existent theories, concepts and methods of spatial analysis in economic geography.

9.3.3 Methodological application of the six-step methodology in practice

According to the concrete research emphasis, there might be great difference in methodological application of the six-step methodology in practice. If the research aims for a comprehensive understanding of the research area like this study, theoretically it might be better to select all of the four dimensions in step (4) and to select the assets in step (5) as many as possible and then analyse them in step (6). However, step (5) and step (6) are subject to the practical availability of data to a certain extent. Even if an indicator has been selected in step (5), lack of data might become a challenge to the selection, which will further influence the path-assets analysis in the following step (6). Equally important is the qualification as well as quantification of indicators for the path-assets analysis. And what's more, in addition to available data source, other available resources such as schedule, qualified stuff and financial resources for the project are also important aspects that might influence the methodological application in practice in a large degree. Nevertheless, a path-assets analysis based on a relational-dynamic perspective in step (6) is central to the capability-based spatial analysis in practice, which helps to recognize the whole development path of the research area in a given time period.

For urban and regional planners, this six-step methodology is complementary to the existent planning methods such as SWOT analysis and scenario analysis by providing a comprehensive understanding of the practical planning area. In addition, the visualization of the path-assets analysis in step (6) as well as the presentation of the planning project could be realized with the implementation of a geographic information system (GIS), which could be used as an interactive platform not only for decision-makers but also for exhibitions or museums with intention on public education and communication.

9.4 Promoting regional capability towards regional sustainability in practice: future recommendations for the government on regional governance and planning in China

In line with the features and problems mentioned previously in 9.1.4, there are three future recommendations for regional governance and planning in China: increasing public participation (9.4.1), reforming China's current performance evaluation system for government officials at the provincial and local level (9.4.2) and establishing a specific regional coordination institution to bear full responsibility for the implementation of regional plans and for regional coordination and cooperation (9.4.3).

9.4.1 Increasing public participation in the governance and planning process

Public participation should be encouraged in the regional governance process besides the current focus on the central-local relation, namely the relation between the central government and the local as well as the provincial government. Although GONGOs as a

kind of government-organized participation play a part in provincial and local governance in China, there is still expectation of genuine NGOs to express the opinion of the public in order to achieve a harmonious society by 2020.

Environmental governance in China requires diffusion of public information on the costs of environmental degradation and the rule of law (Richerzhagen and Scholz 2008), while the political system in China does not provide an institutional channel for general public to exercise a strong influence on the process of formulating environmental policies (Ross 1988; Sinkule and Ortolano 1995). Henceforce, China might still need to improve in the following aspects to strengthen its regional capability [255]: (1) strengthening of legal institutions and the independence of the courts and improving governments' capacity to enforce environmental laws and regulations; (2) transparent monitoring and reporting of data as well as improving public access to environmental information; (3) promoting corporate social and environmental responsibility with penalties for non-complies as well as incentives for complies to arise awareness of environmental protection; (4) strengthening of civil society and enhancing NGO capacity; (5) conducting environmental education, research and training.

As to planning, though lack of direct and spontaneous public participation in the planning process does not obviously prevent the effective implementation of regional plans in China, and even the one-party system makes it more effective on the planning compilation and implementation without long-time consultation and persuasion, increasing public participation in the planning process is still necessary in the long run. Looking back on my working experience as an urban and regional planner, I could hardly find enough evidence on public participation in the planning process. In other words, in China, there is only limited and indirect public participation in the urban and regional planning process, and it is still at the beginning stage. To listen to the voice of the general public and know their opinions will benefit the planning, the public as well as the government in the end, with better solution to certain problems and with more effective planning implementation.

9.4.2 Reforming the performance evaluation system for government officials

It is necessary to reform China's current performance evaluation system for government officials at the provincial and local level, since provincial and local governments are the dominant actors in the process of regional governance in China and the decisions and actions of government officials at the provincial and local level are important to regional and local governance. As mentioned previously in 9.1.4, China's current performance evaluation system is not orientated towards sustainable development but towards the quantity of achievements during the tenure of the government official. The future reform on the orientation of performance evaluation system should be moved to real concern about environmental protection and sustainable development at the provincial and local level in accordance with the implementation of regional plans, and the punishment should fit the crime. In the past decades, governmental officials almost have never feared of environmental damage or pollution, since they won't lose their position at all,

[255] Expert interview with Prof. Dr. Miranda Schreurs (22 April 2013).

at most change their working places. Even if they did lost their current position due to their crime right away, they would be designated another position somewhere else and they can still stay and work in the government system. If this situation is not changed fundamentally, local sustainable development remains hardly to achieve, which makes regional sustainability in fact only an empty talk. According to China's Environmental Protection Law (2014), the State adopts environmental protection target accountability and performance evaluation system since 2015, and local governments shall incorporate the fulfillment of environmental protection target as an appraisal criteria into the performance evaluation of local EPBs and their responsible persons. Future reform on China's performance evaluation system should integrate the implementation of regional plans and environmental protection goals. A provincial or local governmental official should achieve the environmental protection goals and at the same time implement the regional plans. In that case, the reciprocity between polluting enterprises and government officials could also be changed, and consequently industrial pollution could be gradually reduced. If sustainable development could be taken as the most important goal at all administration levels in China, the implementation of regional plans would become effective rather than non-compliance.

9.4.3 Establishing a specific regional coordination institution at the national level

Presently not only the function of the central government on regional management remains loose and dispersive in China, but also the implementation of regional plans is consistent with the non-compliance and low level of enforcement of laws in the country. As a consequence, the implementation of regional plans remains more or less problematic, and it is essential to establish a specific regional coordination institution at the national level. According to Zhang (2009), this new regional coordination institution could be established as an institution of the State Council, or as an institution directly under the State Council, or as an institution with the NDRC on behalf of the State Council for management. In fact, coordination and cooperation at the provincial and local level between provinces and cities towards the common goal of sustainable development is the key for promoting regional capability towards regional sustainability. If an institution could bear full responsibility for the implementation of regional plans and for coordination and cooperation at the regional level between provinces, there would be effective communication and coordination among the provinces instead of the non-compliance of the regional plan.

9.5 Open questions and further research directions

This study tries to develop an analytical framework of regional capability for regional analysis and to apply it in empirical research with quantitative and qualitative analysis. Nevertheless, it is important to recognize the limitations of this study besides the points mentioned previously in 9.2.2. Both the qualitative and quantitative analysis of regional capability needs to be strengthened in theory and in practice. The quantitative analysis of this study is mainly restricted to official statistical data as well as papers, books, news or reports, and the qualitative analysis of this study is mainly based on interviews. Considering that this study is designed to focus at the regional level, other studies with focus at the local level in each region might complement this study with first-hand data.

Aimed to build a harmonious society by 2020, the Chinese government has been promoting the Scientific Development Concept as a national strategy since 2007, which calls for putting people first in the development and aims at comprehensive, coordinated and sustainable development. As to regional development, this strategy is in accord with the concept of sustainable development, attaching more attention to people rather than the economic growth rate. Regional capability as a theoretical framework for regional analysis provides a new insight into the area of academic inquiry under this new strategy at the regional level. How to analyze regional capability with more focus on people? How to develop economy with nature in harmony to swoop the present bottleneck of the 'new normal' after a period of high-speed economic growth? How to generate a sustainable development path at the regional level in order to implement sustainable development at the national level? What new institutional arrangements could be made according to this new strategy? What should regional planning contribute to this new concept? These open questions might become further research directions. Although the political intentions of the governments dominate the governance process in China, there is still room for plenty of potential in regional governance, especially in the field of environmental governance, such as real amelioration in legislation and enforcement of environmental laws, environmental education, public awareness on environmental protection, public participation in the governance process and effective implementation of environmental and regional plans.

Although there are still a lot of problems in China accompanied with its economic development, in particular many serious environmental problems aroused international attention, it is gratifying to see that China has taken its first step towards sustainable development with preliminary achievements. In accordance with various efforts by the Chinese government on developing its economy in a more sustainable way, some scholars show their optimistic attitude during the expert interviews in this study. For example, as to energy policy and reaction to climate change, China has been doing a lot with carbon reduction, energy efficiency policy and renewable energy policy since 2005, which is exactly the so-called "climate policy" in the western world[256].

Although it remains quite difficult for a study to solve all kinds of problems in the process of regional development, at least this study tries to provide a new way of thinking ─ to explain regional development with focus on regional capability, and the empirical research tests its applicability in practice. This study intends to inspire other new thinking in the fields of geography, regional analysis and planning and advocates for inter-disciplinary learning. If regional planning focus on how to improve regional capability and how to govern the development path of a region, could it be better than the current state? In fact, regional planning in China since the 2000s covers most of the following aspects: background of regional development, present situation, advantages, disadvantages and potentials of the region, overall regional development strategies and concrete section strategies (e.g., industry, space, environment, transportation, energy, education and culture) in accordance with the overall strategies and supportive policies by the Chinese central government. Therefore, since regional capability has relations with all these factors mentioned above, why not focus on regional capability?

[256] Expert interview with Dr. Eric Martinot (3 May 2013).

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Curriculum Vitae

For reasons of data protection, the curriculum vitae is not included in the online version