

# Transit-Oriented Development in China

How can it be planned in complex urban systems?

## Proefschrift

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# Preface

A two-year master's study (2006-2008) and the following research experiences as a Ph.D. candidate (2009-2012) in the faculty of Technology, Policy and Management at Delft University of Technology shape this book. Before becoming a Ph.D. candidate, the master program, Engineering and Policy Analysis, taught me theories and principles with respect to public administration and decision-making, and thus helped me form a preliminary foundation of policy science. Since the Ph.D. research, at the initial stage attention was not put on formulating a definite research question, while a great deal of effort has gone into developing and publishing journal articles, a process during which I gained priceless experiences in scientific thinking and writing; I obtained valuable insights into various theories and practices associated with public management and governance; and thereby the topic of this book emerged.

The first article *A typology of strategic behavior in PPPs for expressways: lessons from China and implications for Europe* published in the European Journal of Transport and Infrastructure Research (10(1), pp 42-62), co-authored with Prof. Martin de Jong and Prof. Ernst ten Heuvelhof, provides us with ample evidence in China on various types of strategic behavior in the management of expressways under public-private partnerships (PPPs), and allows us to conclude with possible cures as effective countermeasures of strategic behavior. Still revolving around the concept of PPP, the second article *Introducing public-private partnerships for metropolitan subways in China: what is the evidence?*, appeared in the Journal of Transport Geography (18(2), pp 301-313) and co-authored with Martin de Jong, Dominic Stead, Ma Yongchi and Xi Bao, is motivated by China's rapid urbanization and motorization process and therefore shifts attention to seven major subway projects in the large Chinese cities that were constructed and developed through PPP. Soon after, given the economic crisis around the late 2008 and the rescue measures from the national government of China to invest 4 trillion public money on infrastructure construction, it has witnessed that private ownership was on the decline while state ownership was rising again after the 1978 economic reforms. Therefore, an article was written with Martin de Jong and Joop Koppenjan *The rise and fall of public-private partnerships in China: a path-dependent approach*, and was published in the Journal of Transport Geography (19(4), pp794-806) with many urban rapid rail projects as illustrative examples. This article, which presents an overall evolutionary process of the PPP adoption in China's transport sector, largely marked a complete picture of PPP in China in history and thus a close of our research on the PPP concept. Later, the opportunity to assist Prof. Martin de Jong to edit the special issue for the journal of Policy and Society 31(1) allowed me to redirect my research to issues centering around urban transport. In the special issue, I contribute two articles: one *The state of the transport infrastructures in China* (pp 1-12) where I gained a general understanding of China's transport infrastructures, urban transport in particular, rapid economic growth and fast urbanization as the twin

driving forces of urban transport development and as the sources of many urban problems like motorization and traffic congestion; another *The future of the modal split in China's greenest city: assessing options for integrating Dalian's fragmented public transport system* (pp 51-71) where I obtained insights not only on the deterioration of public transport and the extensive purchase and use of private cars in Chinese cities, but also about the decision-making process associated with public transport from the policy analyst's perspective in China.

During the empirical research of the second article in the special issue of Policy and Society, and also combined with the previous research for the journal articles, I learned that: the Chinese cities are extensively investing and building rapid rail transit projects; the Chinese cities are heavily and rapidly transforming land use patterns; and by recognizing and taking use of these two ongoing trends, many municipal governments of China have embraced the concept of Transit-Oriented Development (TOD) to deal with the urban crisis aroused by the problematic level of motorization. TOD is generally understood as an urban planning method which integrates urban land use and traffic and promotes the use of public transport. Motivated by such an observation, an article *Establishing the conditions for effective transit-oriented development in China: the case of Dalian* was developed with Martin de Jong and also published in the Journal of Transport Geography (24(September), pp 234-249). This article paved the way for my Ph.D. research and the formulation of the research topic. It creates a theoretical framework for the study of TOD where a number of TOD conditions are established and among these conditions a distinction between critical ones and important ones is made. It has a diagnosis orientation: we examine each condition with the practical situation of the Dalian city, and conclusions are drawn as to the fulfillment of these conditions as well as policy implications for areas that need improvements for effective TOD implementation.

However, I felt a great challenge when I was reminded by my professors that designing institutions for one specific policy is doomed to failure. That means, according to my interpretation, the study on TOD in such a way that aims at putting forward institutional recommendations and policy instruments that are favorable for the realization of TOD in car-dependent societies is unrealistic because those TOD-targeted institutional changes would not work out in practice given the multitude of actors and the diversity of their interests. This opinion was further confirmed and I gained a deeper understanding on this opinion when I searched out literatures on theories of complexity and self-organization. The theory of self-organization argues that cities are complex systems that are full of self-planning and that organize themselves from within. It implies that the evolution of cities is largely based on the cities' spontaneous changes; and it is practically impossible for the deliberate design of TOD to become effective in complex urban systems if the designers do not perceive the fact that complex systems seem to be unplannable. Cities can be designed, however, the design possibilities are quite limited. It is only possible to design with the right urban elements and at the right moments. Keeping this in mind, the intention of the Chinese municipal

governments to introduce TOD in the urban systems brings us to the main research question: *can TOD be planned in Chinese cities?*

To answer this question, the book is organized in the following way: in chapter 1 the state of the transport infrastructures in China is examined, the problem of urban transport is diagnosed, and the research question is posed; in chapter 2 a theoretical framework is built for understanding complex urban systems, in which a conceptual model of cities is created, which consists of a city's natural, physical, social and actor subsystems, and 36 city parameters are formulated; in chapter 3 the concept of transit-oriented development is studied and a list of TOD preconditions are established; chapter 4 introduces the case study area, the Dalian city which is one of the most open and prosperous coastal cities in China and which has officially adopted TOD, with respect to its natural, physical and social subsystems; chapters 5 through 7 investigate Dalian's actor subsystem from the policy analyst, legal and political perspectives respectively; based on the empirical data on each subsystem, in chapter 8 the city's actor-subsystem parameters are further synthesized, analyzed and typified. The typology of the parameters offers us significant meaning concerning deliberate intervention in cities; and finally in chapter 9 synthetic answers to the research questions are formulated, based on the theoretical and empirical study in the previous chapters.

Therefore, rather than providing recommendations for the Chinese municipal governments about institutional changes toward TOD, this book aims at understanding cities from the viewpoint of complex systems, searching for planning approaches that fit complex cities, and illustrating how and to what extent TOD can be planned in Chinese cities. The targeted audience of this book thus includes China's public policy-makers, the state governors and local leaders as well as their administration, experts and professionals, legislators, public officials who behind the scenes help make the governments work at different levels. Its intended audience also consists of researchers in the fields of city planning and policy science and the various thoughtful citizens who already start to think about what has happened in and around their communities and prepare to live and behave in a different way that contributes to sustainability.

Finally, I would like to close this preface with some acknowledgements. First and foremost I acknowledge my professors Martin de Jong, Ernst ten Heuvelhof, and John Groenewegen at Delft University of Technology for their supervision, conversations, constructive comments and advices, encouragements and supports which have greatly inspired my research and help me produce this book. Countless times, Martin read my draft chapters, made corrections and provided me with valuable insights and remarks; he also constantly gave me the feeling of being warmly welcome in the Netherlands and the confidence that led me to believe I could finish the work. I owe enormously to him. Ernst and John, great scientists and marvelous persons, always provided me with freedom for my research, while helping me out when I was confused; they also always

stood by whenever I needed help and support. I really appreciate their efforts to draw on my potential and to let me make progress.

I also want to thank all the people with whom I did interviews and who provided information and data for me during my empirical journey. I owe much to the Transport Research Center at Tsinghua University of China and Prof. Lu Huapu who is the center leader and who taught me his thoughtful views about urban transport in China. I also owe much to the Transport Planning Institute at Dalian Maritime University and its leader, Prof. Yang Zhongzhen, who is a famous expert in traffic engineering in China and is the real policy analyst for the Dalian government with respect to urban transport planning and design. I really appreciate that the Transport Planning Institute has hosted me for more than one month, during which I worked with their experts and engineers and observed how they carry out the analysis work, and I was offered many internal analysis reports and documents that are unavailable for external people. In particular, I like to thank an associate professor from this Institute, Yu Bin, who helped me build up the traffic simulation model of Dalian that I used in chapter 5. In addition, I owe enormously to the Ministry of Transport, the Ministry of Housing and Urban-Rural Development of China, the Liaoning Department of Transport and the Liaoning Department of Architecture located in Shenyang, and the Urban Planning Institute of Dalian as well as Dalian Bureau of Urban Design and Planning. Many public officials from the above organizations not only hosted me and accepted my interview requests, but also offered me with many internally published books, governmental reports and proceedings, as well as internally used city plans and statistics.

Last but not least come my family who stood by me the four years. You always give me love, support and encouragement. Having discussions with you always enlightens me and helps me move forwards. Finally, this book is as much your work as it is mine!

Rui Mu

Delft

# Contents

<b>PREFACE</b> .....	<b>3</b>
<b>CONTENTS</b> .....	<b>7</b>
<b>1. INTRODUCTION</b> .....	<b>11</b>
1.1. CHINA'S GROWTH AND ITS NEXUS WITH TRANSPORT .....	11
1.1.1 Economic growth.....	11
1.1.2 Urban expansion.....	13
1.1.3 The city-transport relationship.....	16
1.2. PASSENGER TRANSPORT IN CHINA .....	17
1.2.1 Traffic flows.....	17
1.2.2 Investments .....	19
1.2.3 Passenger transport modes .....	20
1.3. PROBLEM STATEMENT .....	26
1.3.1 The crisis of Chinese cities .....	26
1.3.2 Transit-oriented development as a solution.....	27
1.3.3 Cities as self-organizing systems .....	28
1.3.4 Research questions .....	29
1.4. BOOK OUTLINE.....	30
<b>2. TOWARDS A FRAMEWORK FOR UNDERSTANDING URBAN SYSTEMS ..</b>	<b>35</b>
2.1. INTRODUCTION .....	35
2.2. CITIES AS COMPLEX SYSTEMS.....	36
2.2.1 A conceptual model of cities.....	37
2.2.2 City evolution: self-organization versus deliberate intervention .....	41
2.2.3 Behavioral characteristics of urban systems.....	43
2.3. INTERVENTION VIA CITY PARAMETERS.....	45
2.4. THREE PERSPECTIVES FOR EXPLORING CITY PARAMETERS .....	49
2.4.1 Inspiration from Allison and Snellen .....	49
2.4.2 The policy analyst perspective .....	51
2.4.3 The legal perspective .....	53
2.4.4 The political perspective.....	55
2.5. CONCLUSIONS .....	57
<b>3. TRANSIT-ORIENTED DEVELOPMENT</b> .....	<b>59</b>
3.1. INTRODUCTION .....	59
3.2. TRANSIT-ORIENTED DEVELOPMENT .....	60
3.2.1 What is transit-oriented development?.....	60

3.2.2	Costs and benefits of TOD .....	63
3.2.3	Contingency of TOD .....	65
3.2.4	TOD intermodality .....	68
3.3.	WORLDWIDE EXPERIENCE WITH TOD .....	70
3.3.1	Centralized vs. decentralized planning and decision-making .....	70
3.3.2	Formal vs. informal coordination .....	71
3.3.3	Governmental vs. entrepreneurial leadership .....	72
3.3.4	Compact vs. loose land use and urban design.....	74
3.3.5	Transit vs. automobile priority .....	75
3.4.	TOD PRECONDITIONS AND CONDUCTIVE INSTITUTIONAL INCENTIVES .....	77
3.4.1	Land use.....	77
3.4.2	Urban design .....	78
3.4.3	Constraints on automobile use .....	79
3.4.4	Transit service qualities .....	80
3.4.5	Urban governance .....	81
3.4.6	Real estate market .....	82
3.5.	CONCLUSIONS .....	83
<b>4.</b>	<b>DALIAN PROFILE: THE CONTEXT OF THE CASE .....</b>	<b>89</b>
4.1.	INTRODUCTION .....	89
4.2.	DALIAN URBANIZATION IN HISTORY .....	91
4.2.1	The Russian lease period (1898-1905).....	91
4.2.2	The Japanese occupation period (1905-1945) .....	94
4.2.3	The PRC centrally-planned economy period (1945-1990).....	96
4.2.4	The early economic reform period (1990-2000).....	99
4.2.5	The economic transition period (2000-2010).....	103
4.3.	DALIAN MOTORIZATION .....	106
4.3.1	Car-friendly policies.....	106
4.3.2	Expansion of urban roads .....	107
4.3.3	Fragmented transit services .....	107
4.4.	CONCLUSIONS .....	108
<b>5.</b>	<b>A POLICY ANALYST PERSPECTIVE .....</b>	<b>113</b>
5.1.	INTRODUCTION .....	113
5.2.	THE POLICY ANALYST LANDSCAPE IN DALIAN .....	113
5.3.	THE COMPARISON OF POLICY MEASURES FOR URBAN TRANSPORT .....	115
5.3.1	Policy measure one: Imposing car restriction policies.....	116
5.3.2	Policy measure two: Reducing investments on urban expressways .....	117
5.3.3	Policy measure three: Lifting fragmentation in transit services.....	118
5.4.	MODEL .....	119
5.4.1	Model assumptions .....	120
5.4.2	Model formulation .....	121
5.4.3	Input data and algorithm .....	124

5.5. SCENARIOS .....	126
5.5.1 Scenario A: Status-Quo .....	126
5.5.2 Scenario B: Fragmented transit system .....	128
5.5.3 Scenario C: Integrated transit system .....	130
5.6. RESULTS AND ANALYSIS .....	133
5.7. CONCLUSIONS .....	135
<b>6. A LEGAL PERSPECTIVE .....</b>	<b>139</b>
6.1. INTRODUCTION .....	139
6.2. LEGAL AND ORGANIZATIONAL STRUCTURES OF PUBLIC TRANSPORT IN DALIAN ..	139
6.2.1 Legal framework .....	139
6.2.2 Statutory operating procedures .....	144
6.2.3 Organizations and roles .....	147
6.3. DEVELOPMENT REALITY OF URBAN LAND USE AND PUBLIC TRANSPORT .....	149
6.3.1 The co-planning of urban land use and rapid rail corridors .....	149
6.3.2 The development of station catchment areas .....	152
6.3.3 The discrepancy between the reality and the legal guidelines .....	157
6.4. SERVICE REALITY OF PUBLIC TRANSPORT .....	158
6.4.1 The outsource of public transport .....	158
6.4.2 The operation of public transport .....	161
6.4.3 The discrepancy between the reality and the legal guidelines .....	166
6.5. THE REALITY OF THE MODAL SPLIT .....	167
6.5.1 The deterioration of public transport modal split .....	167
6.5.2 Parking and public transport modal split .....	169
6.5.3 The discrepancy between the reality and the legal guidelines .....	171
6.6. CONCLUSIONS .....	172
<b>7. A POLITICAL PERSPECTIVE .....</b>	<b>177</b>
7.1. INTRODUCTION .....	177
7.2. CHINESE POLITICS .....	178
7.3. CHINESE URBAN POLITICS .....	184
7.3.1 The shifting urban politics .....	184
7.3.2 The cadre evaluation system in reformed China .....	186
7.3.3 The emergence of political achievement projects .....	189
7.4. DALIAN LRT-3 .....	191
7.4.1 The political context of the LRT-3 .....	191
7.4.2 Three rounds of traffic demand forecasting .....	194
7.4.3 Feasibility study and central approval .....	196
7.4.4 Ridership increases and what constitutes the success of the LRT-3 .....	197
7.5. DALIAN BRT-1 .....	200
7.5.1 The political context of the BRT-1 .....	200
7.5.2 The entire BRT plan in Dalian and its realization .....	202
7.5.3 BRT marginalized and what constitutes the failure of the BRT-1 .....	204

7.6. CONCLUSIONS .....	207
<b>8. PLANNING TOD IN COMPLEX URBAN SYSTEMS .....</b>	<b>211</b>
8.1. INTRODUCTION .....	211
8.2. RECAPPING “CITIES AS COMPLEX SYSTEMS” .....	212
8.2.1 Complexity and city evolution .....	212
8.2.2 City evolution by branching right parameters .....	213
8.3. FULFILLING TOD CONDITIONS VIA CHANGING PARAMETER SCORES .....	214
8.3.1 Dalian’s fulfillment of the TOD conditions .....	214
8.3.2 TOD conditions’ dependence on the parameters .....	216
8.4. PICKING UP THE RIGHT PARAMETERS.....	220
8.4.1 Ordering and enslaved parameters .....	220
8.4.2 Fast and slow parameters.....	222
8.4.3 A typology of parameters .....	224
8.5. BRANCHING POSSIBLE CHANGES ON PARAMETER SCORES.....	226
8.5.1 Branching “the role of municipal government” .....	226
8.5.2 Branching “the criteria of cadre evaluation” .....	229
8.5.3 Branching “the role of politicians” .....	231
8.5.4 Branching “the role of real estate developers” .....	233
8.6. CONCLUSIONS .....	235
<b>9. CONCLUSIONS AND REFLECTIONS.....</b>	<b>237</b>
9.1. INTRODUCTION .....	237
9.2. ANSWERING QUESTIONS.....	237
9.3. WHAT IF...? .....	245
9.4. RESEARCH LIMITATIONS AND FUTURE AGENDA.....	251
<b>APPENDIX A.....</b>	<b>255</b>
<b>APPENDIX B .....</b>	<b>259</b>
<b>APPENDIX C.....</b>	<b>261</b>
<b>REFERENCES.....</b>	<b>267</b>
<b>NEDERLANDSE SAMENVATTING .....</b>	<b>293</b>
<b>ABOUT THE AUTHOR.....</b>	<b>307</b>



# 1. Introduction

## 1.1. China's Growth and its Nexus with Transport

### 1.1.1 Economic growth

As it has transformed from a centrally planned economy to a more market type of economy since the late 1970s with the “opening-up” policies brought forward by Deng Xiaoping, China has experienced rapid economic development by achieving a growth rate of almost 10% per annum on average (National Bureau of Statistics of China 2009; OECD 2010). Over the past three decades, China has regarded economic growth as a national priority to improve human welfare and eradicate poverty, while GDP as a primary economic growth indicator has been extensively used to assess the success of national or regional economic policies (Wen and Chen 2008). As figure 1.1 indicates, national GDP increased from 455 to 40,326 billion RMB between 1980 and 2010. In the same period, per capita income was raised from 463 to 29,992 RMB. Among the impressive growth performance, three globalized regional economies, the Pearl River Delta, the Yangtze River Delta and the Bohai Rim Bay Area, have continued to outperform all other regions in China (figure 1.2). These three regions, which together account for only 1.6% of China's total land area, have contributed 12.3%, 27.4% and 26.3% respectively to China's national GDP in recent years on average (Tuan, Ng et al. 2009).

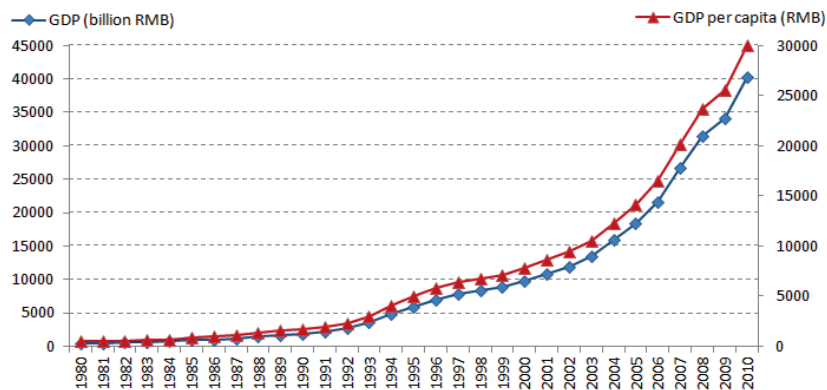


Figure 1.1 Growths of GDP and per capital income in China (1980-2010)

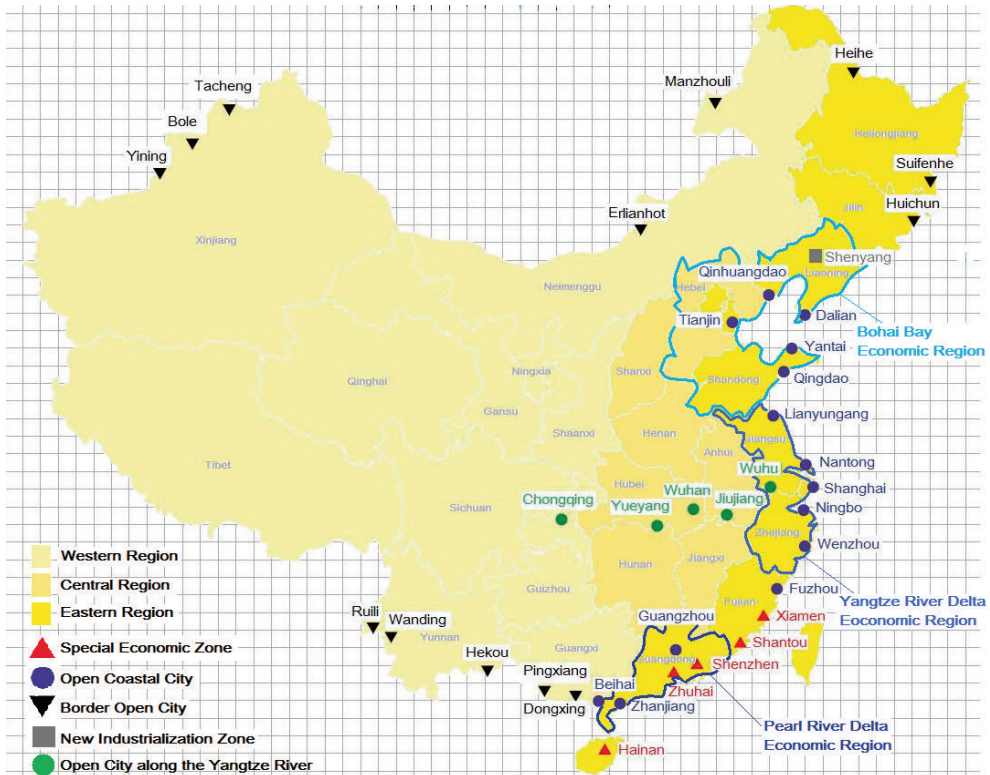


Figure 1.2 China's geography

Capital investment (including domestic investment and foreign direct investment), international trade and capital accumulation are three key determinants for China's rapid economic growth (Tuan, Ng et al. 2009; Whalley and Xin 2010). China's progressive institutional reforms have fundamentally transformed the economic system through introducing decentralization and privatization: the transfer of economic decision power from the central government to local authorities and the permission of (foreign) private investment in public infrastructures provides significant incentive for local authorities to build and expand the fix assets of their localities with a broader range of financial sources. This has resulted in large scale fixed-asset investment over the past three decades. According to official statistics, fix-asset investment relative to GDP rose from 20% in 1980 to 69% in 2010 (figure 1.3). On the other hand, the opening-up development strategy, together with preferential policies for foreign investors and outward-looking industries, has vigorously promoted China's absorption of foreign direct investment (FDI) and international trade. Since the restriction on FDI inflows into China was removed in 1979 and a new foreign investment law was enacted in 1984, China has received a large amount of FDI flows and become the largest FDI recipient among developing countries (figure 1.3). Usually, FDI inflows are realized by establishing foreign invested enterprises (FIEs) in China,

which are often joint ventures between foreign companies and Chinese enterprises. These FIEs account for about 20-40% of China's GDP in recent years and without them China's overall annual GDP growth rate could have been around 3.4% points lower (Whalley and Xin 2010). Furthermore, international trade has produced a continuously rising trade surplus since 1978 (figure 1.3).

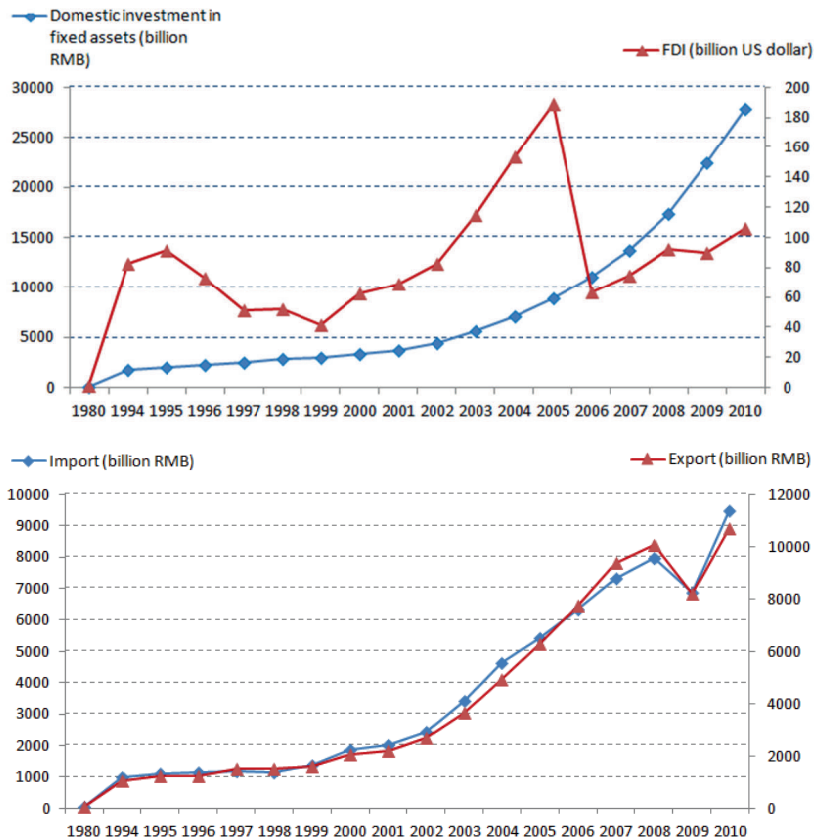


Figure 1.3 Domestic investments in fixed assets, FDI, and international trade (1980-2010)

### 1.1.2 Urban expansion

China's remarkable economic growth has been concomitant with an almost equally rapid growth in urban expansion (Zhou and Ma 2000; Lin 2001; Ho and Lin 2004; Lin 2007; Deng, Huang et al. 2008; Lichtenberg and Ding 2009). Urban expansion, on the one hand, refers to the situation of spreading spatially outwards from the city to its outskirts, and on the other hand, it refers to the process of *in situ* urbanization of rural areas, i.e. the gradual abandonment of agriculture as a way of life in favor of work in rural industries (Friedmann 2005; Yusuf and Saich 2008). On a national scale, China's urban land area increased by 817,000 ha in the period of 1990-2000 and sprawled even

faster in the period of 2001-2005 by 849,400 ha (Lin and Ho 2005; Han 2010a). And the most significant expansion often occurred in coastal city-regions (e.g. Liaoning, Shandong, Jiangsu, Zhejiang, etc.), especially in those large cities whose urban centers are surrounded by secondary cities and rural townships (Deng and Huang 2004; Wei and Zhao 2009). On a local scale, individual cities have been adding huge amounts of suburban land to their already urbanized areas. For instance, large cities such as Beijing and Guangzhou experienced growth in urban land use of 30%-50% in the past 15 years (Wu, Li et al. 2006; Yu and Ng 2007; Han 2010a). City agglomerations including the Beijing-Tianjin-Hebei region and the Pearl River Delta region expanded more than 70% in the 1990s (Li and Yeh 2004; Tan, Li et al. 2005). In addition, small cities expanded even more rapidly than the large ones. In the Beijing-Tianjin-Tangshan region the urban area of small cities increased by 80% in the same decade (Tan, Li et al. 2005).

One widely discussed reason leading to the urban expansion in China is the growth of the urban population (Liu, Zhan et al. 2005; Tan, Li et al. 2005; Wu, Li et al. 2006). From 1978 to 2010, China's urban population increased from about 172 million to 670 million and the level of urbanization rose from 18% to 50% (Han 2010a). Because of the growing difference in living standards between urban and rural areas, the pressure of urbanization is bound to increase further in the future (figure 1.4). Urban expansion is therefore taking place in order to accommodate such a population growth. Similarly, the economic growth and changes in the industrial structure naturally extend urban activities to the peripheral areas, and make rural areas industrialized. In addition, the rapid urban expansion is also a result of local government's policy for economic development. New projects such as industrial parks in the urban fringe areas reflect the intention of the local government to promote regional economic growth by constructing infrastructures and setting up ancillary facilities to improve the competitive edge of the locality and attract outside investors (Deng and Huang 2004; Wu, Xu et al. 2007).

Such urban expansion necessitates changes in land use in Chinese cities (Lin 2002; Yang and Gakenheimer 2007; Lichtenberg and Ding 2009; Wei and Zhao 2009). While expanding outward, cities do not simply replicate their old fabrics in the new areas: fundamental structural transformation takes place. Traditionally, the pre-reform urban settlement in China included state and collectively owned enterprises that contained their own housing and commercial facilities along with their production activities. With the advent of the land and housing reforms introduced in early 1980s, the fabric of urban areas has been altered in many different ways. Most evidently, many state-owned enterprises have moved their production activities to new suburbs while leaving the employees still living in the same localities to enjoy various urban amenities. And in most cases, new enterprises no longer stick to the traditional model of mixing workplace and residence. Housing supply has been subjected to market mechanisms. In addition, the centers of Chinese cities, formerly occupied by working class families, are being given over to the business offices, retail stores and the governmental sector to constitute Central Business Districts (CBD). And the households are seeking suburban

locations with lower densities, less traffic and noise, and larger, more modern housing. Furthermore, when urban expansion is limited through urban boundaries set by the Chinese central government, Chinese cities start to develop anchor-institutions and satellite communities as new development zones which are connected with inter-regional railways or expressways. Additionally, the evolution of land use in large Chinese cities is towards a multi-centered city layout in order to avoid high traffic density in the urban core.

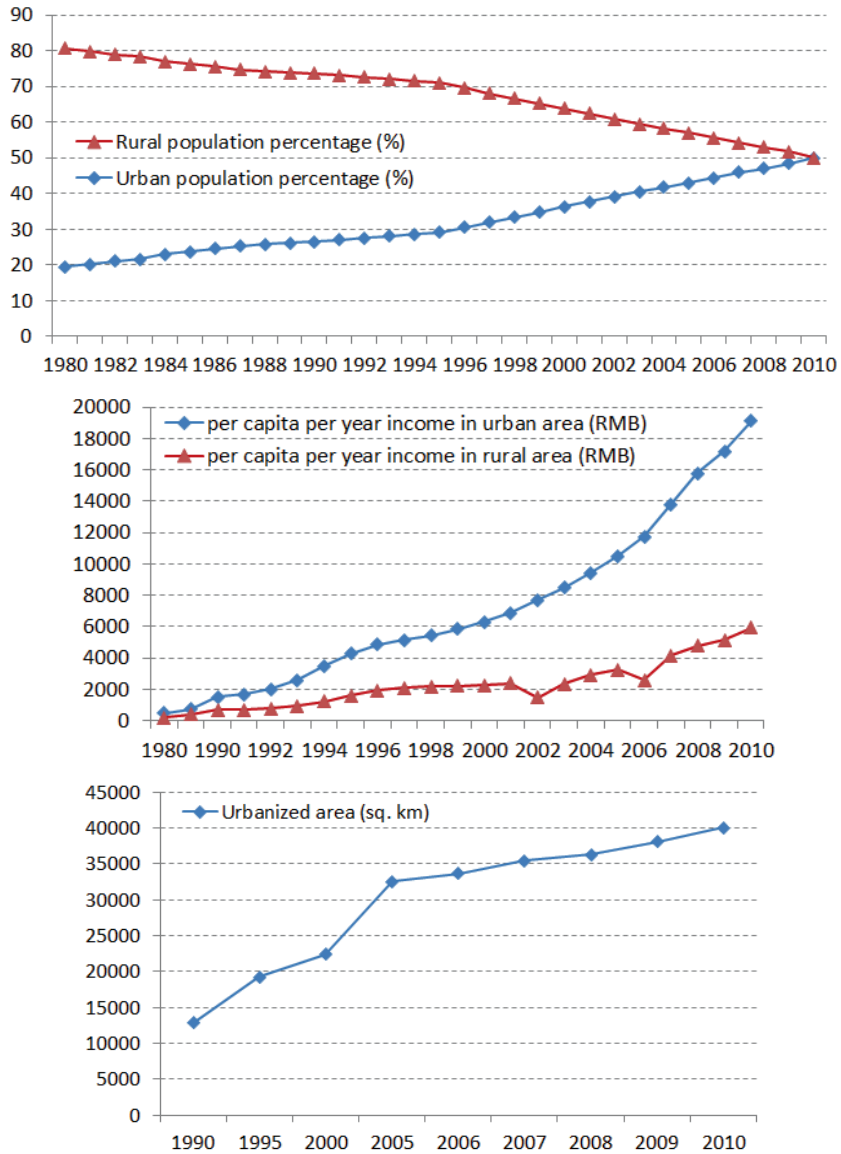


Figure 1.4 Urban-rural population, per capita income and urban area growth (1980-2010)

### 1.1.3 The city-transport relationship

From a theoretical point of view, the city-transport relationship works both ways. The transition of cities requires their transport systems to be further developed and modified. And the types of transport systems, in turn, influence the growth patterns, characteristics and environment of the cities. Thus, the serious transport problems many cities face are largely the result of planning and policies that failed to take into account the long-term relationship that exists between a city and its transportation. A common problem that affects healthy development of cities has been the tendency to design the transport system to be car-oriented (i.e. a low-capacity mode), which leads to congestion and results in unreliable, low-speed travel, higher costs, deterioration of the environment of urban areas and their attractiveness and neglect of pedestrians which makes urban areas less safe and the use of transit less convenient.

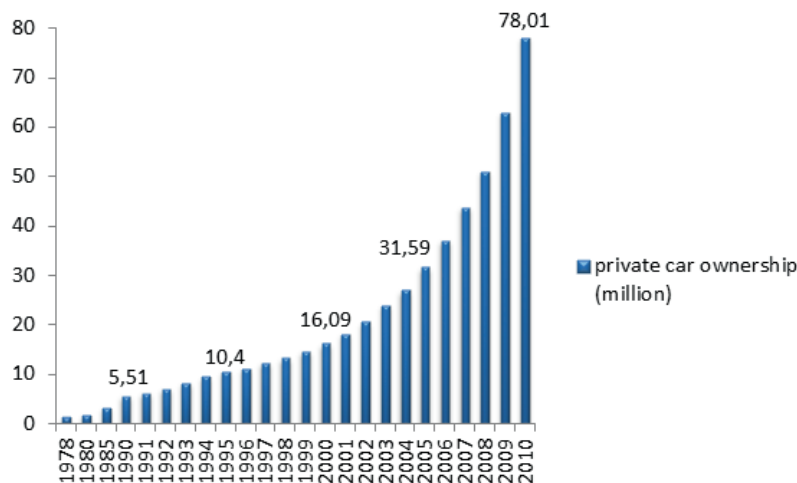


Figure 1.5 Private car ownership in China (1980-2010)

In the case of China, given the two staggering twin developments of economic growth and urban expansion, most large cities are experiencing changes in transport patterns, which include in particular the growth of long-distance trips, the upward trend of motorized mobility and the dramatic increase in urban traffic demand (Khisty 1993; Kenworthy 1995; Gakenheimer 1999; Zhao 2010). Most Chinese regions under expansion are characterized by automobile dependency. Most activities of citizens, such as shopping and commuting to work, require the use of a car as a result of the large distance between the residential zones and city centers as well as industrial and commercial areas. Moreover, rising per capita income among citizens in China and removing the restrictions imposed by the Chinese government on private car ownership have already led to a highly problematic level of motorization with huge implications for traffic congestion and increases in greenhouse gas emissions. During 1985-2010 the private car ownership in China increased from 284,900 to 78,018,300 with



an annual average growth rate of around 23% (figure 1.5) (Han and Hayashi 2008). As a result, mobility depending on automobiles in large Chinese cities has accounted for more than 60% compared with the mobility by public transit. Confronting such an increase, the Chinese government invested massively to speed up the expansion of the road network. China's total highway length increased from 0.9 to 4.0 million km between 1978 and 2010, while total expressway length increased from 0.1 to 74.1 thousand km between 1988 and 2010 to link different cities. Urban road network length and area expanded from 29 to 294 thousand km and from 0.3 to 5.2 thousand km<sup>2</sup> between 1980 and 2010, respectively. As one can imagine, China's development of urban transport systems toward automobile-dependence encourages people even more to move out of the city centers, leading to a virtually unlimited growth of suburbs and triggering diverse social and environmental problems, known as the crisis of the Chinese cities to be discussed in section 1.3.

## 1.2. Passenger Transport in China

### 1.2.1 Traffic flows

Almost all transport modes have experienced rapid growth in passenger traffic demand from 1980 to 2010 (figure 1.6). The traffic flows concentrated on railways and roads, while the trend of road transport has exceeded rail since 1995. In addition, the volume of passengers traveling by air in recent years is also increasing, given that more Chinese can now afford air travel with higher personal incomes, and under its economic boom an increasing number of foreign tourists and businessmen come to the country. In contrast, less and less people travel by ship because of the relatively low accessibility of inland waterways and long travel times. Therefore, over the past 25 years a massive modal shift occurred. As we can see in table 1.1, the share of railway transport for passengers has fallen by 29%, while the share of roads has increased roughly by 22%. In the same period, the share of air transport for passengers increased from 2% to 14.7%, and the share of waterway transport declined from 6% to 0.3%.

Table 1.1 Transitions of market shares of different transport modes (1980-2010)

Market shares of transport modes (calculated through passenger-kilometer statistics)	Year	Railway	Road	Waterway	Aviation
	1980	60%	32%	6%	2%
	2010	31%	54%	0.3%	14.7%

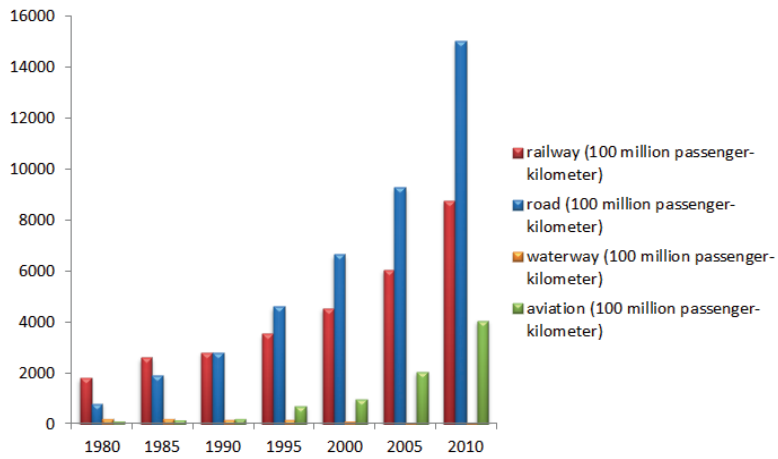


Figure 1.6 Passenger traffic flows (1980-2010)

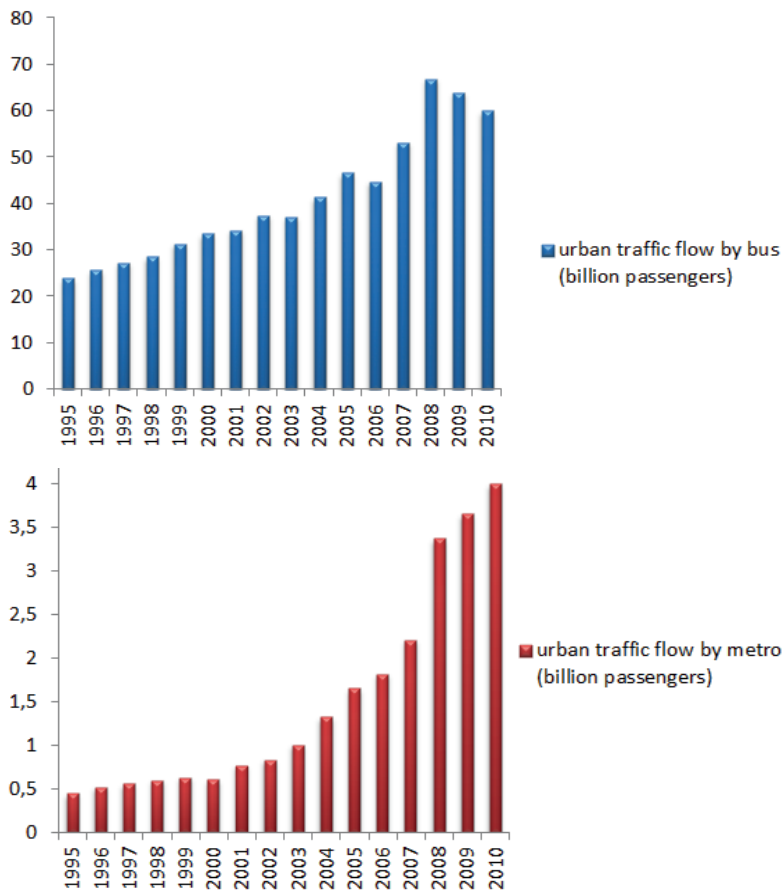


Figure 1.7 Urban traffic flows by bus and metro (1995-2010)



Apart from the long-distance inter-city transport, figure 1.7 shows that the absolute numbers of passengers traveling by urban bus system and urban metro system also experienced steady growth in the past decade. Passenger numbers traveling by bus increased from 25.6 billion people in 1996 to 63.1 billion in 2010, while in the same period passengers using the metro system for trips grew from 0.2 to 5.6 billion people. But since 2000 urban subways and light rails received massive investments and the total metro length in the whole country reached 1,471 kilometers in 2010, the growth rate of passenger flows by metro has exceeded that of buses.

## 1.2.2 Investments

The status of investment in transport infrastructures in China from 2001 to 2010 is shown in table 1.2, and we can see that the scale of the investment went up massively from 243.2 billion RMB in 2001 to 2,561 billion RMB in 2010. Grouped by mode, a majority of the investment was spent on road and railway constructions while only a small part was invested on urban, air and waterway transport. If grouped by different sources of financing, roughly 20-30% of the total investment was from the fiscal budget of the central government, and the remaining part came from local governments that may use their local fiscal budget, obtain loans from banks, or otherwise attract private capital. If differentiating the investment by ownership, we can see that more than 90% of the investment was from public sources; only around 4-6% was private and a very tiny part from collective sources.

Table 1.2 Investments in transport infrastructures (2001-2010)

Investment (billion RMB)	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Investment in transport infrastructures	243.2	262.5	461.8	671.1	846.1	1070.8	1221.1	1455.4	2152.8	2561.0
Grouped by mode:										
Railway	28.3%	27.4%	13.3%	12.6%	15.0%	18.4%	20.4%	28.0%	30.9%	29.8%
Road	59.7%	63.2%	68.5%	69.5%	66.0%	60.5%	56.7%	50.9%	49.1%	49.8%
Urban Transport	n.a.	n.a.	7.8%	5.8%	6.2%	7.5%	8.8%	8.8%	9.4%	8.8%
Airports & Air Transport	8.3%	7.5%	3.9%	4.1%	3.6%	4.3%	5.0%	4.1%	2.8%	3.5%
Ports & Waterways	3.7%	1.9%	6.5%	8.0%	9.2%	9.3%	9.1%	8.2%	7.8%	8.1%
Grouped by source:										
Central Gov.	n.a.	n.a.	n.a.	18.3%	19.7%	21%	24.5%	30.4%	31.1%	30.2%
Local Gov.	n.a.	n.a.	n.a.	81.7%	80.3%	79.0%	75.5%	69.6%	68.9%	69.8%
Grouped by ownership:										
State	n.a.	n.a.	n.a.	94.7%	93.0%	92.3%	91.6%	91.2%	92.7%	92.0%
Collective	n.a.	n.a.	n.a.	0.6%	0.9%	2.2%	2.3%	2.2%	2.1%	2.3%
Private	n.a.	n.a.	n.a.	4.7%	6.1%	5.5%	6.1%	6.6%	5.2%	5.7%

### 1.2.3 Passenger transport modes

This sub-section presents an overview of different modes of passenger transport in China in terms of their mode-specific advantages and disadvantages, network capacities, projects in development plans and policy emphasis in modal sectors. Because of the negligible passenger ridership of waterway transport nowadays, we do not take it into account. And at the end of this sub-section table 1.3 gives a summary and a comparison of the developments in these modes.

#### *Roads*

Since the mid-1980s, China has invested massively in road infrastructure. The resulting expansion of the road network, has contributed greatly to, and has also been strongly stimulated by, China's continuing economic development and the reduction of rural poverty (Fan and Chan-Kang 2008). Among the transport modes, road transport has seen significant growth in both passenger and freight volumes. Passenger numbers grew from 2.22 billion in 1980 to 30.52 billion in 2010, while freight volume increased from 3.82 billion tons to 32.41 billion over the same period. And the road sector experienced fast network expansion with receiving the largest amount of investments compared with other modes of transport. By the end of 2010, the total length of the road network was about 4,008,200 kilometers, of which 74,100 kilometers are expressways, compared with a figure of 1,698,000 kilometers in total and 19,437 kilometers for expressways in 2001. However, relative to the breadth and length of China's geographical area and its large population size, its road network still ranks among the sparsest in the world in terms of density and coverage. Focusing only on expressways, the fast construction and expansion originated from the first approved "National Trunk Road System Plan" in the late 1990s. The plan was originally designed for a 35,000-kilometer network including 5 north-south expressways and 7 east-west expressways. And the estimated cost was 1,200 billion RMB. By the end of 2004, 97% of the planned projects, roughly 34,288 kilometers, were completed. However, driven by the ever increasing traffic demand for road as a consequence of the rapid growing trend of motorization, the Chinese central government expanded the existing plan into a "7918 Expressway Network Plan" in late 2004, to build 7 Beijing radials, 9 north-south expressways and 18 east-west expressways, totaling 85,000 kilometers (figure 1.8). The completion date is scheduled in 2020 and the total estimated cost is 2 trillion RMB. Currently, more than 74,100 kilometers have been completed.



Figure 1.8 7918 expressway network plan

### *Railways*

Railways are essential to China's economic development and social cohesion, and railway transport is still the most commonly used and dominant mode for the movement of both passengers and freight in large volumes and long distances. Passenger volume by rail increased from 0.92 billion in 1980 to 1.68 billion in 2010 and freight volume also grew from 1.11 billion tons to 3.64 billion over the same period. The growth in both passenger and freight volumes was accelerated by enormous improvements in railway infrastructure. The length of railways in operation has increased from some 49,900 kilometers in 1980 to about 91,200 kilometers in 2010. This expansion of the railway network speeded up in recent years because of the approval of the "Mid- and Long-term Railway Network Plan" in 2004 (figure 1.9). Projects in the plan are expected to be completed in 2020 when the total length of railways in operation would reach roughly 100,000 kilometers. In addition to network expansion, the main goals of this plan are to construct 12,000 kilometer high-speed passenger rails as well as to upgrade 50% of the existing lines to double-tracked and electrified lines. Until the end of 2010, China has built around 8,000 kilometer high-speed lines that are

equipped with new controlling and signaling systems, and with the help of foreign technology China has developed high-speed trains with a maximum operating speed of 486 km/h. Further, in this plan 16,000 kilometer new lines are planned in Western China.



Figure 1.9 Mid- and long-term railway network plan

### *Airports*

The global air transport has been undergoing waves of change in the last 30 years as a result of deregulation, liberalization and commercialization. Over the same period, air transport in China has also been undergoing significant transformation following the “opening-up” policies since 1980. In 1980, passengers and freight handled at the country’s airports were only 3.43 million passengers and 0.089 million tons, while the figure in 2010 has risen to 267.69 million and 4.99 million, respectively. Such rapid growth in air traffic volumes of passengers and freight have been partially a result of the increase in citizen income, leading to an increase in affordability of air passenger transport, and the trend toward globalization, in the context of which China has become a major manufacturing center. There has been growing demand for air cargo services as well. China’s airport infrastructure has been remarkably improved and

expanded. Between 1990 and 2010, the Chinese governments at all levels invested 389.59 billion RMB on constructing and upgrading airports. By 2010 China has built 175 civil airports with a density of 1.53 per 100,000 square kilometers. Figure 1.10 shows the airport distribution. There are 31 international airports, of which 26 are of a minimum 1800m-long runway and a capability of handling a B747 aircraft of 52-60m wingspan for takeoff, as well as more than 121 airports that could accommodate B737s. All municipalities, provincial capitals and autonomous regions, coastal and major tourist cities had modern airports. In addition, some borderlines, minority regions and areas with poor ground transport infrastructures also have airports.



Figure 1.10 Airport distribution in China

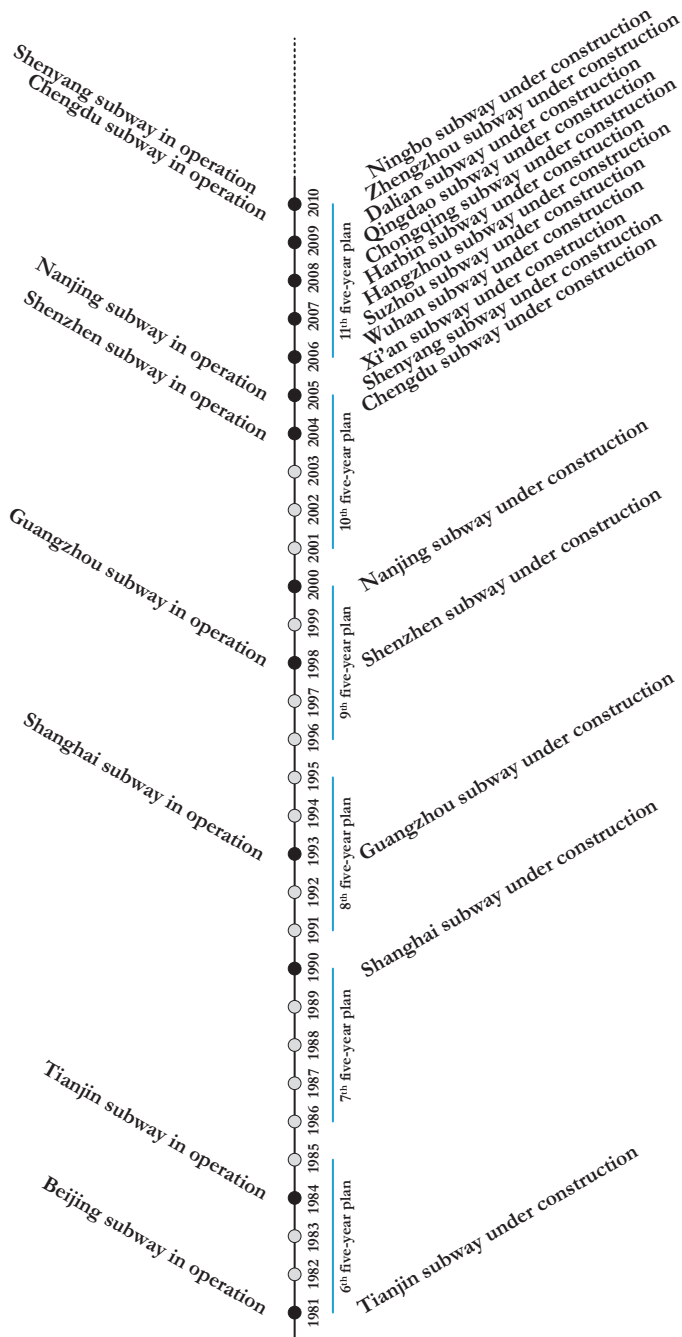


Figure 1.11 Chronological subway constructions in Chinese cities

Table 1.3 Comparisons among different transport modes

Modes	Mode advantages and disadvantages	Network capacities	Planned projects	Policy emphases in modal sectors
<b>Road</b>	<ul style="list-style-type: none"> <li>Convenient; flexible; private; short distance or middle distance viable.</li> <li>Environmental pollution; less safe and expensive than alternatives; potential delays and cost increases due to congestion; only small volumes.</li> </ul>	4,008,200 km (2010) <ul style="list-style-type: none"> <li>74,100 km expressways (2010)</li> </ul>	7918 Expressway Network Plan (2004-2020): 85,000 km expressways	<ul style="list-style-type: none"> <li>Expand road network;</li> <li>Priority expressway development;</li> <li>Technical upgrade of provincial roads to national roads.</li> </ul>
<b>Railway</b>	<ul style="list-style-type: none"> <li>Fast; safe; more environmentally friendly; long distance viable; no contribution to congestion; large volumes; relatively cheap.</li> <li>Fixed routes; inflexible timetables.</li> </ul>	91,200 km (2010) <ul style="list-style-type: none"> <li>32,700 km electrified lines (2010)</li> </ul>	Mid- and Long-Term Railway Network Plan (2004-2020): 100,000 km in total; 12,000 km high-speed passenger-dedicated lines; 50,000 km lines either be double tracked or be electrified	<ul style="list-style-type: none"> <li>Expand railway network;</li> <li>Separate passenger lines from freight lines;</li> <li>Develop high-speed passenger dedicated rails;</li> <li>Develop electrified rails.</li> </ul>
<b>Airway and airport</b>	<ul style="list-style-type: none"> <li>Fast; long distance viable; safe.</li> <li>Expensive; environmental pollution; small volumes; unsuitable for some certain goods; airport taxes; inflexible routes and timetables.</li> </ul>	175 civil airports (2010)	National Civil Airport Layout Plan (2005-2020): 97 new civil airports	<ul style="list-style-type: none"> <li>Improve airport capacity.</li> </ul>
<b>Urban (rapid) bus/rail transit</b>	<ul style="list-style-type: none"> <li>More environmentally friendly; little contribution to congestion; large volumes; safe.</li> <li>Fixed routes; inflexible schedules.</li> </ul>	488,812 km bus lines and 1,471 km metro lines at the national level (2010)	Urban transit plans differ among cities	<ul style="list-style-type: none"> <li>Develop rapid bus transit;</li> <li>Expand urban subway network.</li> </ul>



### *Urban (rapid) bus and rail transit*

Urban transit systems have played an increasingly important role in meeting citizens' transport needs within urban areas as cities grow in China. And among the strategies being pursued to head off rising traffic congestion and worsening environmental conditions have been huge investment in urban rail systems in Chinese metropolises. Compared to 1980 when urban rail lines could rarely be found in Chinese cities, the total length of urban rail systems in 2010 had reached 1,471 km (figure 1.11). And bus transit lines have also been extended from 5,979 km in 1995 to 488,812 km in 2010. In addition, the urban trips by Chinese citizens have also increased from some 3.7 billion in 1995 to around 70 billion in 2010. Such an increase in urban traffic demand, therefore, justifies high-capacity urban rail investments. Urban rail systems are currently found in 8 mainland Chinese cities. Plans call for extending and upgrading existing rail systems and building new ones in 15 other Chinese cities. Bus Rapid Transit (BRT) systems are also being built or expanded in Beijing, Tianjin, Dalian, Shenyang, Chengdu, Xi'an and Kunming. The cities of Tianjin and Dalian also operate streetcars on city center streets.

## **1.3. Problem Statement**

### **1.3.1 The crisis of Chinese cities**

The growth of private car ownership in China, which has provided more options for residents to select their housing, places of work, business, entertainment and other activities, has led to the progressive dispersal of cities and to excessive motorized travel volumes, which generate substantial negative impact on the urban environment. Severe congestion problems in Chinese cities especially in large ones can be evidenced by very low average automobile speed and high percentages of driving time idly spent and accelerations and decelerations (Hook and Replogle 1996; Kutzbach 2009; Yan and Crookes 2010). In the context of climate change, the increase in motorized mobility, including those of expressway and air transport, not only in China but also in other developing countries, causes serious environmental problems. According to the data available, the annual growth rate in CO<sub>2</sub> emissions by the transport sector in developing countries is projected at 3.4% (IEA 2006; Zhao 2010). In China's motorization age, the transport sector's use of petroleum increased from 24.6% in 2001 to 29.8% in 2005 of total use, and it is estimated to reach 47% in 2030 (Wang, Cai et al. 2007; Han and Hayashi 2008; Yan and Crookes 2009; Yan and Crookes 2010; Zhao 2010). This situation is most apparent in large Chinese cities (Chan and Yao 2008). Taking Beijing as an example, the number of private cars in Beijing had approached 4 million in 2009 and will continue to rise at an annual rate of 15% in coming years. From 2000-2005, trips by private cars increased by 6.6% while trips by public transport only increased by 3.3%. The transport sector in Beijing accounted for 15% of total urban



energy consumption and air pollution due to road transport was 23% of total air pollution, close behind pollution levels from industrial production (Huang 2009). In addition to the negative environmental impact, the auto-dependent travel also leads to higher numbers of traffic accidents. The statistics show that in 2007 the death toll as a consequence of road traffic was at 81,649 people, approximately ten times that in countries like Germany, Australia, Japan and France. And in the same year the “million vehicle mortality” of China was 5.1, 6 times higher than in developed countries (Jiang and Han 2009).

### **1.3.2 Transit-oriented development as a solution**

Obviously, China’s staggering developments in economic growth and urban expansion have far-reaching impact as well as challenges on its transport sector. Impacts include the ever increasing traffic demands from individual users and the business sector, the constant road network construction and expansion which needs large amount of land and funding, the increasingly auto-dependent travel behavior, congestion, energy depletion and emission levels. Challenges, however, include the issues concerning how the transport sector should respond to those trends in order to facilitate a sustainable economic development and a healthy urban growth. To achieve this goal, Transit-Oriented Development (TOD) emerges as one possible solution, with supporters claiming that it can help to reshape the quality and form of urban growth towards enhanced accessibility and mobility, pedestrian friendliness, lower emissions, less use of space, and potentially higher degree of human interaction (Curtis, Renne et al. 2009). More detailed TOD theories will be discussed in chapter 3, including a broader understanding of the TOD concept, cost and benefit structures of TOD, and the contingency and intermodality as intrinsic attributes of TOD, in order to explain if TOD would be the solution and in what circumstances, in what ways, TOD can be adopted. Overall, TOD can direct urban growth (i.e. new towns with high density and mixed land use) along the already planned or existing transit lines/corridors. By doing so, traffic flows between new developed areas and old city centers could be connected by transit services. In addition, it aims at shifting a car-dependent and spread-out urban form toward a built environment that is revitalized with high-density and mixed land use, pedestrian friendly and with easy access and high-quality transit services. In this way, daily activities of most people, such as living, working, shopping and recreation, can be confined within the transit-served neighborhoods in combination with some degree of walking. Furthermore, it requires strategies to restrict automobile ownership and usage, and concurrently it focuses on improving transit service levels and making transit riding more attractive to passengers.

The TOD concept was first proposed by an American architect Calthorpe (1993) and therefore many American cities such as San Francisco and Atlanta have adopted the TOD planning principles over the past 20 years. Later on, it gained much attention from Europe. Various good practices with TOD adoption have been reported in

Stockholm, Copenhagen, Munich, Zurich, and Karlsruhe (Bernick and Cervero 1997; Cervero 1998; Dittmar and Ohland 2004; Curtis, Renne et al. 2009). Most recently, some Asian governments like South Korea, Hong Kong, Taiwan, mainland China, Japan and Singapore, have begun to use this concept as their primary urban planning methods (Cervero and Day 2008; Loo, Chen et al. 2010; Sung and Oh 2011). As can be seen, it is a good tradition for Asian countries to systematically gather knowledge from western experience and subsequently implement the most useful lessons at home. And the adoption of TOD in China is no exception to this rule. Nowadays, many Chinese cities with growing numbers and scales of large, rapid transit projects have seen opportunities for creating sustainable city forms through integrating land development and transit investments. The local governments of Beijing, Shanghai, Hangzhou, Nanjing, Wuhan, Chengdu, Shenzhen, Guangzhou and Dalian are turning to the concept of TOD as a solution to promote public transport and thus to reduce car-dependency.

### **1.3.3 Cities as self-organizing systems**

TOD as a solution to the crisis of the Chinese cities actually presents a real challenge and inconceivable difficulties to the municipal governments not only because an effective TOD requires the fulfillment of a number of preconditions, but also because cities nowadays are very complex systems and they self-organize (Forrester 1969; Allen and Sanglier 1981; Allen 1996; Portugali 2000; Batty 2005). The concept of planning and steering still is the cornerstone of the Chinese governments' dealing with cities. Nevertheless, the planner's dilemma or the local government's perplexity is becoming more and more visible: cities seem unplannable. Among the western scholars, disillusionment came by the early 1970s (Berry 1964; Alexander 1966; Derthick 1972; Pressman and Wildavsky 1973/1984; Gottmann 1974; Lucy 1975). However, until recently only a few Chinese scholars have found that cities are self-organizing systems, have welcomed the new theory and made it the cornerstone of their research (Chen 2006). In spite of this, the Chinese governments have not yet adopted this mode of thought. It became evident for the scholars that "the rational comprehensive planning" in China is an irrational assumption, that the planning is a political and essentially "non-scientific" and "non-technical" process; it became apparent that both the planners and the policy-makers cannot tame the urban environment, nor the natural environment, nor the social and actor environment, nor the physical environment; it also became obvious that the development of science and technology can send satellites to outer space but cannot address many urban problems such as traffic congestion, inadequate drainage, sewage disposal, urban pollution, unsafe drinking water, unemployment and poverty. The failure of urban planning to solve urban problems and to control cities by means of comprehensive plans, however, does not mean that we should oppose any forms of planning. Our interpretation regarding the above is that the failure is caused by misappreciation of the nature of cities as self-organizing

systems in urban planning theory (Portugali 2000). Some degree of planning, or say artificial intervention, in selected domains, is necessary and sometimes unavoidable for self-organizing cities but should base on something else. Therefore, rather than eliminating planning for urban systems, to develop new forms of urban planning is more advisable, imminent and should start from the perception of cities as self-organizing systems.

### 1.3.4 Research questions

Based on what we have discussed in the preceding sections, the main research question of this book reads:

## *Can TOD be planned in Chinese cities?*

To answer the main research question, a series of both theoretical and empirical sub-questions need to be solved in sequence.

The theoretical study aims at answering the research questions:

- (1) *How can cities be understood? Can a conceptual framework be sketched to depict cities? If yes, what parameters fall into such a conceptual model? And how to explore the scores of the city parameters in practice?*
- (2) *What is TOD? What are the good and bad experiences with TOD around the world? What are the preconditions for successful TOD according to the worldwide experience and the academic literature?*

Through answering these theoretical questions, a theoretical framework is construed for the purpose of conducting our empirical study. In the empirical research, the selected case area is Dalian, which is an eastern coastal city in China under the administration of the Liaoning province and a city of millions. That we choose Dalian as our case study is for the following reasons. Dalian is a city that is now undergoing significant infrastructure investment, especially for large transport projects. And it is one of the pilot cities in China in officially proposing and developing the TOD concept. The local government is very active in improving urban transport planning and management, and they have put political and economic priority on developing a more reliable and sustainable urban transport system. In addition, Dalian has a good tradition in using public transit, and this can be evidenced by a very favorable modal split in comparison to any other Chinese city. Therefore, Dalian can be regarded as a critical case and a city that is the most appropriate candidate to adopt the TOD concept. If it does not work there, it would also have a hard time getting effectively implemented in any other city in China. Apart from that, Dalian is a city where we

have data accessibility, or close personal relationship with the experts and policy-makers in the field of urban transport engineering, planning and management.

In light of this, our empirical study aims at investigating the research questions consisting of:

- (3) *What do the current scores of the city parameters look like in the Chinese city of Dalian that has officially adopted TOD and historically has the modal split most favorable for public transport in all of China?*
- (4) *What lessons can be drawn from Dalian's parameter scores? Can we develop a new approach with respect to planning TOD in complex urban systems?*

## 1.4. Book Outline

The structure of the book is as follows:

1. *The state of the transport infrastructures in China is examined, the problem of urban transport is diagnosed, and the research question is posed.* A short tour d'horizon of the transport infrastructures in China points out that many impressive developments have taken place in the previous three decades, driven by rapid economic growth and urbanization, but many challenges appear in urban areas in terms of the centrifugal movement of people and jobs, growing traffic demand, longer trip distance, the strong desire of people to own and use cars, declining public transport in the modal split, as well as persistent congestion, and environmental and safety hazards. When facing these challenges, many local governments that are extensively carrying out land transformation programs and making substantial investment in urban rail projects, recognize the opportunity of placing the cities on a more sustainable development pathway by introducing TOD. However, it is questionable whether this new policy is able to work out in the Chinese urban context, considering that nowadays the Chinese cities are self-organizing systems. Therefore, our research question reads: *Can TOD be planned in Chinese cities?* (Chapter 1)
2. *A theoretical framework is built for understanding urban systems.* In order to answer the research question, one has to be able to understand what a city consists of, and how a city is ordered and structured. In chapter 2, a conceptual model of cities is built. In the conceptual model, we view cities as complex systems which are composed by natural, physical, social and actor subsystems, and which change over time through constant interactions among the system components. Although we do not abandon the opinion that city evolution is a self-organizing process driven by countless individual decisions, we do assert that artificial design also plays a significant role in influencing urban development, and in most circumstances it is necessary for designers, planners and policy-makers not merely

to wait and see, but to take proactive actions to intervene in the system for a better or more desirable performance. However, the counterintuitive and unpredictable characteristics of systems behavior give rise to enormous challenges for deliberate intervention. Nonetheless, it is possible to intervene by investigating and understanding system parameters which are the foundations defining an urban system and which are important elements to take into consideration for the comprehension and evaluation of an urban situation. In light of this, following our conceptual model, we identify a list of city parameters in the natural, physical, social and actor subsystems. These parameters do not cover every aspect of a city; they focus on urban transport; they are not mutually exclusive; they influence each other; they collectively define the state of a city; and they can be influenced to varying degrees. As for the parameters in the natural, physical and social subsystems, we generally take them as given, and we focus on the parameters in the actor subsystem not only because they radiate and largely affect the natural, physical and social parameters but also because they define the roles of actors and shape the underlying incentives for actors to deploy intervening actions and strategies. To examine the actor-subsystem parameters in an urban context, we adopt three perspectives, the policy analyst perspective, the legal perspective, and the political perspective, which provide us with additional angles to cover the parameters to the largest extent and thus to completely unfold a city's actor subsystem. (Chapter 2)

3. *The concept of Transit-Oriented Development is studied.* To answer the research question, one not only has to understand how cities operate, but also to thoroughly study the Transit-Oriented Development concept the local governments intend to introduce in the urban systems. In chapter 3, the definitions of TOD community and TOD city are explored. In addition, the costs and benefits associated with the development of TOD are examined; different kinds of transit modes are compared; the circumstances of fitting the appropriate transit modes into different sized cities are analyzed; and the importance of intermodality in developing TOD is highlighted. Furthermore, good and bad experiences with adopting TOD in worldwide metropolises are investigated and contrasting lessons are drawn. Accordingly, these experiences imply a number of preconditions that underlie an effective TOD. Examples include high levels of diversity and density in land use; a pedestrian friendly, beautiful and vibrant urban environment; the presence of effective strategies on restricting car use; giving transit priority and improving transit service qualities; a good urban governance; and a healthy real estate market environment. (Chapter 3)
4. *The case study area, the Dalian city which is one of the most open and prospers coastal cities in China and which has officially adopted TOD, is introduced with respect to its natural, physical and social subsystems.* In chapter 4, it examines the natural, physical and social parameters of Dalian through looking into the urbanization process of Dalian in history and the rapid motorization process in recent years. The historical

transformation process in terms of urban design, land use and mobility pattern in urban Dalian leads to the conclusion that Dalian once had a good record in public transit use and many TOD preconditions showed favorable scores in Dalian. However, in recent years mass transit began to compete with the private automobile, and its market share of urban travel has been rapidly eroding in Dalian. Dalian's good record in using public transport is thus deteriorating. It is undeniably due to the urbanization process taking place in the past twenty years that induced low-density, low-diversity land developments and more long-distance trips. It also relates to the willingness on the part of public authorities to curb and strictly regulate cars in the public space and the enhancement of the coordination among and professional management of the various companies involved in public transport. Therefore, Dalian is losing its good tradition in using public transport, and something needs to be done if Dalian intends to implement the TOD policy and thus still wants to remain as an environmentally-friendly city and a comfortable living habitat. This leads to our empirical research questions to be studied in chapters 5 through 7: *Generally, what does the actor subsystem look like in Dalian? Specifically, who are the policy analysts in Dalian, what analysis have they made to promote TOD? (Chapter 5); what does the legal and organizational framework look like in Dalian concerning urban transport? Is the development reality consistent with what is articulated in the legal procedures? (Chapter 6); and what does the political environment look like in China? How do the local politicians exercise power-play? And how does the power-play influence mega transport projects in urban areas? (Chapter 7).* (Chapter 4)

5. *The actor system of Dalian is explored from the policy analyst perspective.* The policy analyst perspective enables us to investigate the question "what are the policy analysts doing in assessing the options for improving urban transport system in Dalian that helps TOD?". The contribution of this perspective to our explanations and predictions of public transport administration in Dalian is considerable because this lens reduces the legal and political complications of policy process in the government to the simplification of a rational and model-based decision-making style. It starts with introducing who the policy analysts are in Dalian and what analysis with respect to urban transport they have made. There were three policy measures (restricting car use, reducing investment on urban fast roads, and lifting fragmentation in transit services) under comparison, and eventually the policy analysts chose the measure of "lifting the fragmentation in the transit system". Therefore, as the policy analysts always do, a mathematical model is built to test the effectiveness of reducing fragmentation in improving transit service. And the results show that the modal split after system integration is going to tilt more strongly towards transit, while for service quality levels for users cannot expect much improvement. These modeling results have significant implications for the future public transport administration in Dalian. (Chapter 5)
6. *The actor system of Dalian is explored from the legal perspective.* In this perspective, we attempt to study the issue "does the development reality of public transport in



Dalian reflect the legal guidelines and procedures?”. To answer this question, the legal and organizational structures of urban transport in Dalian are examined. It shows that the legal framework and the statutory operating procedures concerning the management of urban transport have been largely in place and aimed at promoting sustainable urbanization by coordinating land use and transport, energy saving and environmental protection. However, the reality exhibits a mixed picture: some organizational implementation such as the coordinated planning of land use and transport has worked along the lines that the legal procedures prescribe; but other practices, including the quality levels of public transport service provision and the efforts for conserving the high market share of public transport, have shown unfavorable scores. The discrepancies are caused by the absence of an effective supervision mechanism in the Chinese legal system. More efforts by the central government should be made for checking local authorities’ obedience to the legal guidelines. (Chapter 6)

7. *The actor system of Dalian is explored from the political perspective.* Chapters 5 and 6 have focused on the actor system of Dalian from the policy analyst and the legal perspectives. Chapter 7 will focus on the third perspective: the political power-play. First of all, the Chinese political system is introduced by teasing out the two intertwining hierarchies, the government and the party, in order to understand where the true decision-making power lies. When zooming in on the Chinese urban politics, we found that China’s power devolution and fiscal reforms have given the leading officials of the local governments unprecedented freedom in spending public money. China’s political centralization, however, especially in its control over personnel management in the political hierarchies, almost automatically encourages the officials at local levels to take decisions and actions that are centrally inclined, which adds weight to the officials’ political achievement records. Under such an urban political environment, the emergence of political achievement projects is quite likely. In this chapter, we examine two mega public transport projects in Dalian which are regarded as prestige projects. It is interesting to find that the fruits of these projects are bitter in most circumstances considering the fact that they serve political purposes and thus lacking deliberate scientific evidence, but the results may also be sweet considering the large amount of resources and money are mobilized for the projects by the powerful politicians. Thereby, we investigate the reasons that make a difference in the political achievement projects. (Chapter 7)
8. *The city’s actor-subsystem parameters are further synthesized, analyzed and typified based on Dalian’s empirical data in the preceding chapters. A planning approach is thus found for complex urban systems.* First, we recap the theoretical assumption of “cities as complex systems”, from which we know that urban evolution is mainly driven by spontaneous changes and the possibilities of deliberate intervention are quite limited. Design is only possible if the planners could identify the right parameters and intervene at right moments. Keeping this in mind, we analyzed current scores

of the city parameters in Dalian and we found that the parameters operate in two dimensions. One is an ordering-enslaved relation where some parameters enslave others and thus have decisive power in forming the urban structure. Two, there is a fast-slow property where some parameters take longer than others to change their statuses. These two dimensions produce four types of parameters (ordering-fast, ordering-slow, enslaved-fast, and enslaved-slow). This parameter typology has significant implications for the search of a new urban planning approach. According to our findings, we propose that the ordering-fast parameters, which have the most dominant and prompt influential power in shaping urban configuration, are the right parameters to pick up to influence. The planners will put attention on changing their scores, so that their changes can branch out and give rise to changes on other parameter scores. (Chapter 8)

9. *A synthetic answer to the research question is formulated, based on all theoretical and empirical study in the previous chapters.* In the concluding chapter, first we systematically answer the sub-questions through synthesizing our findings both at theoretical and empirical levels. To answer the main question, this book claims that there is no direct answer to that, nor simple or common formula for charting a path for the Chinese cities toward becoming transit-oriented metropolises. However, the lessons and findings about cities that we never realized before provide helpful signposts and dispel a number of lingering confusions about the relation between transit and the city. To plan TOD, the planners should aim at the right parameters, and initiate possible changes on their scores so that changes on other parameter scores will follow. Second, based on the recommendations proposed on the right parameters we sketch a vision of Dalian: what the city would look like if those changes on the parameter scores are indeed achieved. And finally we present our research limitations and future research agenda. (Chapter 9)



## 2. Towards a Framework for Understanding Urban Systems

### 2.1. Introduction

Worldwide debates on urban development in metropolitan areas typically are grounded in the assumption that trade-offs must be made between economic development and environmental protection in general, and when it comes to urban transport, between car-dependent development and transit-oriented development in particular. It is often assumed that economic growth causes environmental degradation and that environmental protection detracts from economic growth. The thinking that environment and economy are dichotomous has led many scholars to point out that it is impossible to imagine a city that is undergoing rapid economic growth to be environmentally friendly (Brock and Taylor 2005; Xepapadeas 2005). The implications, then, are either the developed countries have to markedly reduce consumption and the developing countries have to hold back from wealth, or the environment is destroyed. In urban transport issues, cities have to choose between a clean environment by forcing people to use public transport and prosperity by allowing people to freely purchase and use cars. However, the above debate neglects the reality that cities are complex systems where urban development is the synergy among numerous components and actors. This means that we cannot simply impose a policy in the urban system that seems to be able to solve an urban difficulty or to alter an urban situation. What we can do is understand how cities are structured, what interrelationships exist, and how cities evolve. Therefore, this chapter aims to build a theoretical framework for understanding complex urban systems. It starts with the construction of a conceptual model of cities; the contrasting views on urban evolution, self-organization versus deliberate intervention; and the behavioral characteristics of complex systems which make the decision-making on urban development a challenging effort to generate intervening actions (section 2.2). According to the conceptual model, in section 2.3 we identify 36 city parameters, through which urban actors can intervene in the system to varying degrees. In section 2.4, three perspectives of decision-making are presented for the purpose of exploring the parameters belonging to the city's actor system. And finally, in section 2.5 conclusions are drawn as to how we will use the theoretical framework in the empirical study.

## 2.2. Cities as Complex Systems

*“Merely to think about and get somewhere, one of the main things to know is what kind of problem cities pose...”*

...

*Cities happen to be problems in organized complexity, like the life science. They present situations in which half a dozen or several dozen quantities are all varying simultaneously and in subtly interconnected ways...The variables are many but they are not helter skelter; they are interrelated into an organic whole.”*

- Jane Jacobs, *The Death and Life of Great American Cities* (Jacobs 1961), p433

*“The phrase ‘complex system’ refers to a high-order, multi-loop, non-linear feedback structure. All social systems belong to this class. The management of a corporation has all characteristics of a complex system. Similarly, an urban area, a national government, economic processes all are complex systems.”*

- Jay W. Forrester, *Urban Dynamics* (Forrester 1969), p107

*“Cities are about ‘connecting people’. The various processes that bring people together to produce and exchange goods and ideas that take place in cities define a multitude of networks that enable populations to deliver materials and information to support such endeavors...The (physical and social) networks tend to mutually reinforce one another as they develop.”*

- Michael Batty, *Building a Science of Cities* (Batty 2012), p511

Half a century or more ago, the rapidly expanding sciences of complexity and the systems approach provided momentum in developing formal ideas about what a city consists of and how a city is ordered and structured. Cities, since then, have been considered as “complex systems” which have a multitude of interacting entities and actors (or subsystems; structures; networks), usually forever changing and collectively determining the evolution of cities. In this section, a conceptual model of cities is depicted, showing the various interrelated (natural, physical, social and actor) systems in urban areas. When it comes to the issue of change, we argue that although it is upheld that cities evolve mainly from the bottom up as the products of millions of individual and group decisions, it is undeniable that grand design, that is, top down planning and decision-making, also plays a significant role in influencing urban evolution, considering that countless urban projects, plans, programs and decisions are carried out in reality. But, due to the behavioral characteristics of complex systems, decision-making for solving an urban difficulty becomes challenging and complex, and thus requires decision-makers to be more prudent and deliberative.

### 2.2.1 A conceptual model of cities

The complexity originates not only in the fact that a city is an aggregation of large sets of components, but also in the fact that as those components are brought together by feedback loops and interact with one another, synergies emerge. In addition, those components change over time as a result of their responsive behavior during interactions, and such changes are firmly embedded in past developments. These dynamic and path-dependent features also add additional complexities to an urban area and make behavior of the urban system as a whole emergent and unpredictable. Therefore, in order to explain the complexity of cities, we have to identify and depict what components cities are composed of, and how they are related with one another in a conceptual model. We went through a large number of articles and research papers on the topic of “cities and complexity”, “complex urban systems”, and “urban dynamics” (Jacobs 1961; Berry 1964; Forrester 1969; Allen 1996; Castells 1996; Christensen 1999; Batty 2005; Healey 2007), and based our framework on the literature review and authors’ judgment and an analysis in a number of brainstorming sessions where we conceptualized, reconceptualized, ordered, reordered and then finally established the conceptual model of an urban area (figure 2.1). Therefore, the various components, systems and structures shown in the figure are the results of our own synthesis.

We distinguish four relevant constituent systems, the natural system, the physical system, the social system and the actor system, which are connected and holistically shape an urban area. The natural system consists of resources a city is naturally endowed with (e.g. land, forest, river, energy, etc.) and natural conditions of a certain urban area (e.g. natural geography, geomorphology, geology, etc.). An urban area is associated with the natural system because these natural resources and conditions give a city the fundamental attributes and properties. Cities differ in their physical layouts, their economic and industrial makeup, their social and demographic characteristics as we will introduce in the following paragraphs. These differences can be traced back to regional variations in the local resources and conditions on which growth was based during the early development of the urban pattern. For instance, a coastal port city and an inland city often differ substantially in their economic and industrial structures; a large city and a small city vary remarkably in their transport planning principles and land use strategies; a city with abundant coal resources often has the coal industry as the pillar of the local economy; and a city on the seismic zone usually has a different building structure and strength than those with lower earthquake risks.

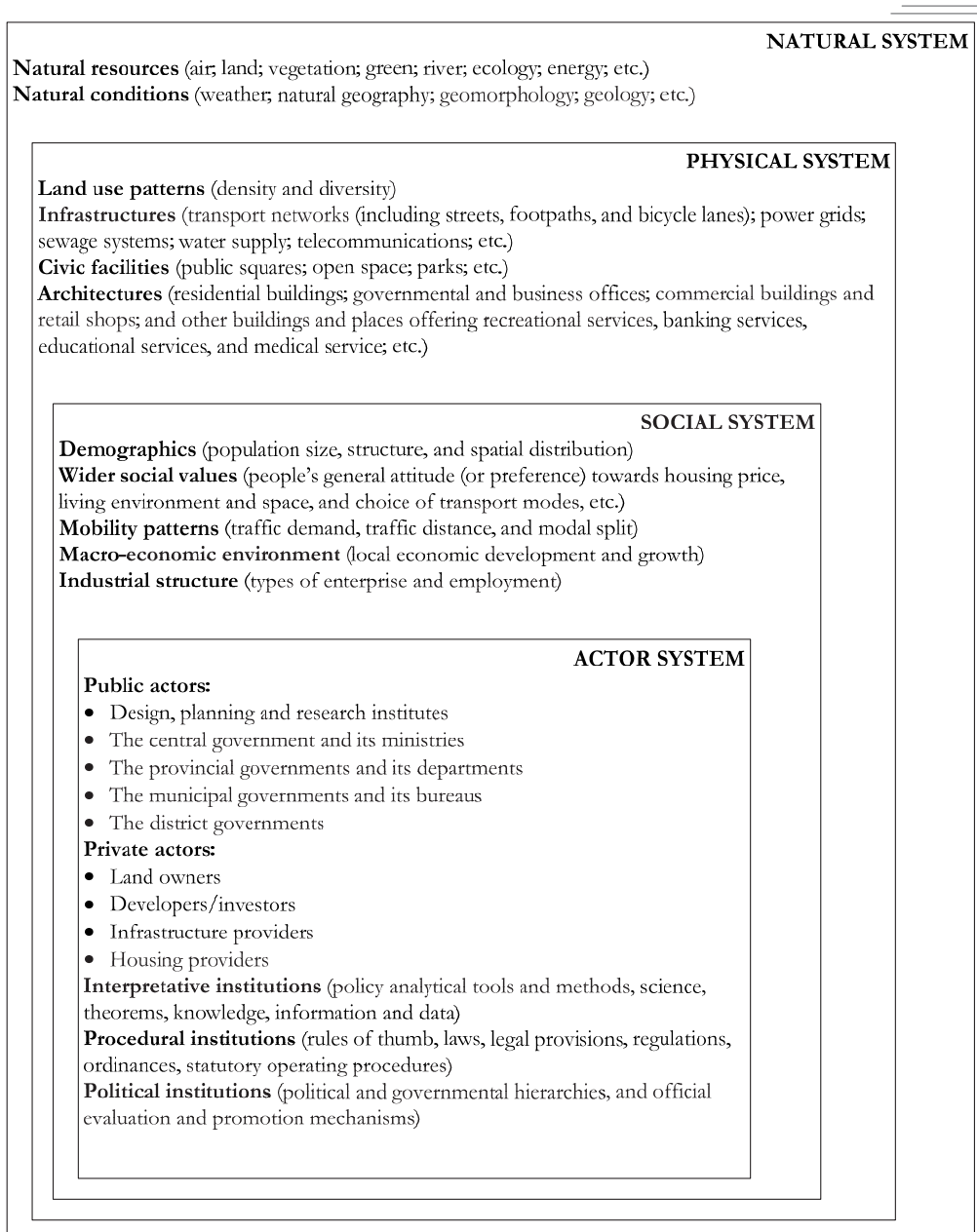


Figure 2.1 A conceptual model of cities

The physical system is composed of a large number of individual objects. These objects constitute a city. And the spatial distribution of these objects determines the city's land use pattern. Physically, a city is composed of a variety of infrastructures, civic facilities and architectures. Infrastructure systems include the fixed assets like the transportation

networks, vehicles, power plants, water and gas pipes, cables, etc. and the control systems and software required to operate and monitor the systems. These infrastructures are the basic physical structures needed for the operation of a city, or the services and facilities necessary for an economy to run. Apart from the infrastructures, a city consists of civic facilities such as public squares and parks, which provide citizens with open space for play, chat, and holiday celebrations and which make the city lovely and livable. In addition, a city is also constituted by architectures with different functions: residential buildings, governmental and business offices, commercial outlets and retail shops, etc. These objects not only feature simple linear dependencies but also diverse non-synchronous dependencies. Each object interacts with its surroundings, and if one object is not functioning well, this may result in far-reaching repercussions on the entire urban system. For example, the blockade of a street may lead to a problematic access to transport stations; poor city amenities may cause urban buildings to decay faster; and the breakdown of the control system may interrupt the supply of energy to citizens.

The social system of a city refers to its demographics, wider social values, macro-economic environment, industrial structure and when it focuses on urban transport issues, mobility patterns in particular. Demographics encompass the issues of population size, structure, and spatial and temporal distribution of the population. Wider social values, in addition, are embedded in a society's culture and are generally-held preferences about goals worthwhile pursuing and embody what most citizens consider to be good, beneficial and desirable. Specifically, in an urban area, for instance, they are related to people's attitudes and preferences of living in the central city or in the suburb, choosing a large house or dwelling in a small house, as well as using public transport or driving a car for daily commuting. These values affect the mobility pattern of an urban area in terms of traffic demand, travel distance and modal split. Furthermore, the social system is strongly related to a city's macro-economic environment. Normally using GDP as an indicator, people can understand how the whole local economy functions and what the levels of personal income and living standards are. The level of prosperity of the local people influences their values with respect to pursuing higher living standards, such as living in larger and low-density houses and owning cars. Finally, the industrial structure constitutes another component of the social system. It is made up of numerous enterprises and manufacturing factories under different ownership. It becomes the main source of local revenue, a key sector of production, and thus an important driver of the local economy. And it also employs a major part of the local population.

The actor system contains a number of organizational groups, who deploy activities in an urban area, acting and thus affecting the formation of a city and the direction of urban development. In the conceptual model, public versus private actors are distinguished. Public actors include the public-funded research institutes that have professional knowledge and skills in analyzing urban issues and in drawing up urban plans. In addition, the public actors also consist of the governments and their functional

organs at different hierarchical levels. These government authorities and agencies are the regulators of a city, and a number of politicians such as the local leaders and other public officials reside in these governmental organizations. Private actors, on the other hand, involve various property owners such as the land owners, investors such as large joint-ventures and banks, infrastructure providers and real estate developers and housing providers.

These actors are often found in a network where they are connected through different types of institutions and they interact for the realization of their goals. First, people interpret and make sense of the world around them on the basis of rules and conceptual schemes. Scientific and other knowledge, including conceptions, theorems, and evaluation criteria towards things, and some customary perspectives and perceptions of the reality can be seen as interpretative institutions that shape human understanding and interpretation of the world. When it comes to solving an urban problem, each actor has its own notion or perception of the problem but this is not always tightly structured, or not all of them have converted their implicit or explicit vision on the problem into a model which could serve as a basis for analyzing and searching for solutions. The interpretative institutions therefore play their function in structuring the thought processes of the actors who analyze policy issues in an urban area, because the problems at hand have been interpreted within some framework or model of specific interrelated concepts. Evaluation indicators could also be formulated within the framework as to make comparisons among alternatives. Given a practical urban difficulty, the interpretative institutions will define which concepts should be embraced from a variety of concepts, which criteria should be given priority, and which model (and numerical input data) are expected to be applied for taking decisions and actions.

Second, from the general definition of institutions, the major role of institutions in a society is to simplify complexity and to reduce uncertainty by establishing a stable (but not necessarily efficient) structure for human behavior. For instance, the city regulators might be unable to cope with an infinite number of alternatives, given their cognitive limitations, the unavailability of complete information, and the inadequacy of time and resources. Consequently, rules are developed to guide and facilitate the interaction process among various actors by pointing out clearly the possible, permitted ways/procedures of doing things. The rules are regarded as procedural institutions which can be laws, legal provisions, regulations, ordinances and statutory operating procedures. These legal procedures significantly reduce the uncertainty and complexity created by the problem, and even if the problem-solving capacity of the actors is limited, an acceptable solution can be found by following the existing procedures.

Finally, apart from institutions being interpretative and procedural rules for actor interaction, there are such institutions that distribute authorities and allocate resources. These institutions are known as political institutions which are actually distributional instruments laden with power implications. As a result, the political institutions will

impose unequal implications for resource allocation and clearly many rules are specifically intended to distribute resources to particular kinds of actors. Consequently, actors with different endowments of resources and authorities are motivated to pursue the creation of different kinds of rules. In some cases, the power of one group relative to another may be so great that dominant actors are able to design rules that closely correspond to their preferences. In light of this, we should not assume that the institutions existing at a given moment are always favorable because they reflect the views and wishes of the actors who brought them about, i.e. they are the decision-making outcomes of those who had the power to introduce such rules, intentionally or unintentionally, in the past. Therefore, dynamic tensions and pressures are built in: those who benefit from existing institutional arrangements may have an objective preference for continuity but ensuring such continuity requires the ongoing mobilization of political support as well as active efforts to resolve institutional ambiguities in their favor. Those who lose from current arrangements may not comply with them and try to alter them according to their preferences. Therefore, the decision-making environment where political institutions with serious power implications are rife leads to the typical power-play behavior of politicians.

### **2.2.2 City evolution: self-organization versus deliberate intervention**

Cities evolve over time and space. This is an uncontested point of view, but contrasting views exist concerning city evolution driven by self-organization or by actors' deliberate intervention (Chadwick 1971; Bourne 1974; Allen and Sanglier 1981; Portugali 2000).

The idea that a dynamic system is able to increase the inherent order of a system by itself has profound impact on people's interpretation of city evolution. It is believed that a spontaneous order generated through allowing various integral components of cities to self-organize is the most efficient way of shaping interactions that any design could achieve because this spontaneous order is superior to any order the human mind can design due to the specifics of the information and knowledge required (Hayek 1949). Portugali (2000), for example, also stresses that cities mainly evolve from the bottom up as the products of countless individual and group decisions with only occasional top down grand design and planning actions. From this viewpoint, cities are more like biological than mechanical systems: the survival of the fit and of unstructured, unanticipated and undirected evolutionary development leads to the strongest mobilization of knowledge and resources and thus the most desirable form of urban areas (Marmefelt 2009). In light of this, the city seems largely untameable. And the city evolution comes across as an uncontrollable and unplannable process which offers few openings for designers and planners for deliberate intervention and adaptation. Planners who want to artificially interfere the evolutionary process are seen



as wrongful. Alexander's *"A city is not a tree"* (1966) further confirms such a proposition: a city is a semi-lattice structure while people's decision-making mind is a tree structure which can never generate semi-lattice structured cities; and thus there is always some essential ingredient missing from "artificial cities" (i.e. cities that are deliberately created by designers and planners), when compared to "natural cities" (i.e. cities which arise more or less spontaneously over a long period of time).

In contrast to the self-organizing cities whose development is independent of scientific predictions and planning rules, and where designers, scientists and planners sit and watch the life in general and urbanism in particular, the "artificial intervention" viewpoint argues that it is not enough for the urban designers and planners just to wait and see. On the contrary, in the process of urban evolution, an urban designer or a city planner, at certain moments, is able to gently steer the way that various urban entities and actors interact, store information, and adapt (Gottmann 1974; Lucy 1975). Obviously, such artificial power is limited, but it can be enhanced by accumulated knowledge and experience gained from generation to generation (Allen and Sanglier 1981; Allen, Engelen et al. 1986). In this context, our image of the city shifts from an untamed environment to a controllable and plannable entity, just waiting for us to scientifically analyze it and reveal its regularities and orders. Policy-makers purposively tune the "rules of the game" in order to increase the number of options or to alter the content of the original repository of choices (Klijn and Koppenjan 2006; van Buuren and Klijn 2006). This can be evidenced in everyday reality: public and private actors plan new projects in urban areas, enact new policies and set up new ways of conducting tasks; they launch urban programs such as public housing provision; urban renewals; and various organizational restructuring and rearrangement; they often establish new strategies for revitalizing industries and making the economy more viable; and they draft urban master plans. Apparently, in real situations, either public or private actors cannot even carry out any economic activities with the uncertainty stemming from total spontaneity. Therefore, although a spontaneous order does not leave openings to actors, those openings are experienced by the actors as a real need (Brousseau and Raynaud 2011). So, if we completely adhere to the idea that city evolution is only a spontaneous order or a self-organizing process, then we will misunderstand much of the reality.

In essence, both views on city evolution provide useful insights for us. We accept the idea that cities can self-organize to some extent, but cities are not always well-behaved, and thus it is highly likely that there would be certain "fit" and promising concepts being left after the selection due to their original failure to get locked-in (Toulmin 1972; de Jong 1999). As a result, deliberate intervention through imposing artificial decisions and actions, such as urban design programs, plans, procedures and policies, is needed to minimize the loss of promising concepts in the urban evolution process and to generate a wide range of options and choices that form the basis for selection. Therefore, it is not enough for the policy-makers of the city to behave like an audience and only to "wait and see". Intervention is required in certain urban elements at certain moments.

To generate intervening actions, decisions have to be made. However, the decision-making process on urban change is challenging and in many circumstances also complex for several reasons we are going to discuss in the following sub-section.

### **2.2.3 Behavioral characteristics of urban systems**

Complex urban systems have many important behavioral characteristics that we have to understand if we aim to deliberately design systems with “better” behavior. Complex urban systems (i) are counterintuitive; (ii) are insensitive to changes in many system parameters; (iii) contain influential points often in unexpected places; (iv) counteract for externally applied corrective efforts such as policy changes; and (v) often react to a policy change with contrary short-term and long-term effects (Forrester 1969). It is these characteristics that make intervention a challenging and also complex effort (Alfasi and Portugali 2007).

The counterintuitive characteristic of urban systems makes the intervention for better urban development difficult and complex because very often one finds that the urban policies that have been adopted for correcting an urban difficulty are actually intensifying it rather than producing a solution. Illustrative examples can be found in Forrester’s *“Urban Dynamics”* (1969) where urban programs for improving the decaying situation of central cities were examined. One program was the creation of jobs by busing the unemployed to suburban jobs; a second was a training program to increase skills of the low-income group; a third was financial aid to urban renewal activities from federal subsidies; and the fourth was construction of low-cost housing. However, the outcomes of all these programs proved to be ineffective in their long-range effect on the low-income population, and even harmful to the economic health of the city. Another example is the road widening project that aims to solve the road congestion problem but comes out with worse traffic jams. The ineffectiveness of the policies for coping with urban difficulties does not mean there is no need for grand design or an artificial plan. On the contrary, system designers and decision-makers have to be aware of such devious system behavior and plan in a more prudent and deliberative way, with the collection of as much relevant information as possible and the careful comparison of various action alternatives.

As for the second to the fourth characteristics, urban systems often counteract to most policy changes the policy-makers select in an effort to alter behavior. That is why sometimes we cannot observe significant effects from imposing a sound policy in an urban area. In fact, the effect has been largely offset when the policy passes through a number of system levels and components. Additionally, not all system parameters are sensitive to policy changes. If the decision-makers take policy changes on the insensitive parameters, then no effect is observable. For instance, efforts to reduce hunger by greater food production will generally fail unless there are simultaneous counterforces sufficiently large to prevent the population rising to match the new level

of food availability (Forrester 1971). The same logic also applies to the restriction of automobile purchase and usage. At the detailed level of urban transport, so many factors impinge on travel behavior and modal choice that an active program of automobile control will be largely defeated by relaxation of controls that previously existed. However, there are indeed a few system parameters that have a high sensitivity to changes. If a policy at one of these points is changed, pressures radiate throughout the system and behavior everywhere seems different. Birth control is an example of this point (Weidlich 1999). The parameters that can cause structural changes at the system level are usually not self-evident. This thus puts significant challenges to the system analysts and decision-makers who must be careful in discovering and examining system parameters and dynamics.

As to the fifth characteristic, complex urban systems usually exhibit fundamental conflict between the short-term and the long-term consequences of a policy change. That means a policy which produces improvement in the short run is quite possibly which degrades the system in the long run. In urban issues, the short-term can be several years or a decade, while long-term might range from fifty years to a century. Programs and policies which generate benefits for urban development in the long run may initially depress the urban situation. These “worse-before-better” sequences are treacherous because people usually first recognize short-term effects that are more visible and compelling. But a series of short-term measures can eventually burden an urban system with long-term costs. Many examples exist: industrialization has raised the standard of living but now leads to pollution; improvements in medicine and sanitation facilities improved health and reduced death rate, but lead to pressures of rising population and an aging society; an increase in agriculture crop and food output in the short-term leads to erosion in vast land areas and to salt contamination. The short-term versus long-term conflict is particularly troublesome to the political leader faced with reviving an urban system. And the decision-making associated with urban development becomes more complex and challenging as political achievement pressure and political power combine to favor short-term policy measures (Portugali 2008).

To sum up, in this section a conceptual model is developed to understand urban systems. Cities are complex systems where substantial components and structures, as well as numerous people, groups and organizations are connected, interact, learn and adapt. Our understanding of city evolution is transformed from “cities evolve spontaneously from the bottom up” to “cities change through top down designs”, where the unplannable and untameable features in the dynamics of cities are replaced by the notions of artificial design and deliberate intervention in the development of cities. We then look at the behavioral characteristics of complex systems that give rise to the challenging and complex nature of intervention in urban areas if people expect to change cities towards better or more desirable behavior. Nonetheless, it does not mean we should give up. On the contrary, it is possible for us to intervene by investigating and understanding system parameters which are the foundations defining an urban system and which are important elements to take into consideration for the

comprehension or evaluation of an urban situation. In light of this, according to the conceptual model, in the next section, we identify a list of city parameters in the natural, physical, social and actor subsystems. These parameters do not cover every aspect of a city; they focus on urban transport; they are not mutually exclusive; they influence each other; they collectively define the state of a city; and they can be influenced to varying degrees.

## 2.3. Intervention via City Parameters

What parameters define a city? Based on the conceptual model that is developed in the preceding section, we identify a list of city parameters in table 2.1. This is not a complete list covering every aspect of an urban system, but it focuses on urban transport. To generate the list of parameters, numerous academic works on urban studies and government documents that record and analyze the experiences and lessons of urban development, transport planning and management worldwide are investigated. Representative literature from which these parameters can be distilled include: Lake (1983); Cervero (1998); Vuchic (1999); Crawford (2000); Dittmar and Ohland (2004); Wright (2005); Batty (2008); Kaplan, Wheeler et al. (2008); Newman and Jennings (2008). Among these parameters, urban area and geological conditions are contained in a city's natural system; land use density, diversity, capacity and coverage of various transport modes, architecture aesthetics, public space, pedestrian friendliness are classified as physical parameters of a city; population size and growth rate, GDP, personal disposable income, car ownership, traffic demand, travel distance and modal split are classified as social parameters of a city; and the existence of actors, the roles of the actor groups, the importance of policy analysis and analytical information, the importance of legal procedures, concentration of city-planning tasks as well as concentration of transport-planning and operation tasks, the level of competition in government procurement, the acceptance of power-play and the importance of personal networks are typical parameters in the actor system of an urban area.

These parameters are not mutually exclusive, and there are causal effects between some of the parameters. For instance, the role of land owners in the actor system has significant effects on land use density and diversity in the physical system; similarly, the role of real estate developers has impact on housing affordability in the social system; and land use density and diversity have remarkable influence on traffic demand and travel distance in the social system of a city.

In addition, when we look into these parameters, we find that they vary in terms of impact and influenceability. For the former, it means that the parameters may hold different degrees of power in determining the urban structure. As for the latter, it measures the degree to which the parameters can be influenced. Although it is only

possible for us to know which parameters are of high/low impact and high/low influenceability after we obtain and analyze the empirical evidence, here we are able to give some preliminary examination and supposition. For instance, some parameters, such as geological conditions, population size, the importance of policy analysis and analytical information, and the level of acceptance of power-play, have a low likelihood of being influenced, either because they depend on many uncertain factors and situations, or because they are so deeply imbedded in culture and belief that it would take a hundred years to change them. As for parameters like capacity and coverage of transport networks, public space, and car ownership, they can be influenced to a medium extent, because their situations can be altered if people take certain actions but these actions might be constrained by some factors. For instance, people can enlarge transport infrastructure coverage simply by expanding the networks, but such expansion depends on the availability of funds and land. However, there are parameters with high potential to be influenced. For instance, architecture aesthetics and pedestrian friendliness can be influenced by retaining city traditions and organizing new physical buildings into a coherent pattern with general beautiful and attractive appearance, and by paying greater attention to the maintenance of the street network to ensure that it is well connected and equipped with amenities.

In our study, we apply this model in such a way that its natural, physical and social subsystems are taken as given, while we focus on the actor-network subsystem. We do so for the reason that parameters from natural, physical and social subsystems change slowly and that parameters from the actor-network subsystem change fast and they are the parameters policy analysts, legalists and decision-makers can really work with. Although we realize changes in natural, physical and social subsystems also have impact, for instance, population aging has impact on urban traffic patterns; technological changes have impact on the intelligence of transport networks; changes on societal values have impact on automobile ownership and usage, we put our efforts on actor-network subsystem because we tend to change the system now, rather than waiting for the technological evolution, social value changes or the aging of the population. Besides, we do so for the reason that the actor-network parameters, which define the roles of actors and shape the underlying incentives for actors to take intervening actions and strategies, largely affect the natural, physical and social parameters.

Given this, people can expect numerical scores of the natural, physical and social parameters. For instance, parameters like the total area, the land use density, the population size, the car ownership and the modal split of an urban area will be scored with quantitative data. Regarding the actor-subsystem parameters, however, people can expect nominal scores. This type of measure often reflects the current situation of a parameter, such as a qualitative description on the criteria of the cadre evaluation. To practically examine the actor-subsystem parameters in an urban context, in the next section we introduce three perspectives, the policy analyst perspective, the legal

perspective, and the political perspective, which provide us with additional angles to cover the parameters and to lay bare a city's actor system.

Table 2.1 36 city parameters

PARAMETERS	WHAT DO THEY MEASURE?
<b>Parameters in the natural system</b>	
1. Total area	How large is the city?
2. Land area for urban construction	How large is the land area in which urban construction activities can be carried out, other than the mountainous areas and the agricultural land areas?
3. Geological conditions (e.g. rock, clay, or silt)	How possible is it for the city to utilize and to develop underground space, such as the construction of underground metro systems?
<b>Parameters in the physical system</b>	
4. Land use density	How intensive is the land used? High density land use can increase urban vitality and provide closer physical proximity of transit stations, protecting against the urban sprawl characteristic of car-oriented city planning.
5. Land use diversity	To what extent are different functions mixed? High diversity land use can create a greater variety of daily services catering for the diverse needs of residents of a neighborhood (e.g. retail shops, schools, restaurants, hospitals, banks, etc.).
6. Capacity and coverage of the transport networks	How large are the capacities and the coverage of the transport networks?
6a. capacity and coverage of roads;	
6b. capacity and coverage of regular buses;	
6c. capacity and coverage of urban rapid rails (e.g. light-rails, metros);	
6d. capacity of port;	
6e. capacity of airport.	
7. Architecture aesthetics	How attractive is the urban landscape?
8. Public space	How livable is the city's public environment?
9. Pedestrian friendliness	How friendly is the street network for pedestrians?
<b>Parameters in the social system</b>	
10. Population size and growth rate	How large is the population of the city? And how fast it grows?
11. Population density	How large is the number of people inhabiting in a certain area?
12. GDP	How much does the economic system generate?
13. Personal/household disposable income	How affluent are the people in the city?
14. Housing affordability	How expensive are the houses in the city? And to what degree can both rich and poor afford their houses?

15. Car ownership	How high is the level of motorization?
16. Traffic demand	How large is the demand for traffic in an urban area?
17. Travel distance	How long does a person have to travel on average per day for daily activities such as house-job commuting or house-school commuting?
18. Modal split	How high is the market share of each transport mode?
<b>Parameters in the actor system</b>	
19. The role of policy analysts	How strong is the role of the policy analysts in urban planning and decision-making?
20. The role of the central government	How strong is the role of the central government in urban planning and decision-making?
21. The role of provincial governments	How strong is the role of the provincial governments in influencing local policies and governmental actions?
22. The role of municipal governments	How strong is the hold that the municipal governments have been given administratively and fiscally in urban development?
23. The role of district governments	How strong is the role of the district governments in influencing local policies and governmental actions?
24. The role of politicians	How strong is the role of politicians in steering urban planning and decision-making?
25. The role of land owners	How large is the role of land owners in urban planning and construction?
26. The role of investors (e.g. banks)	How large is the role of investors in urban construction and development?
27. The role of transport infrastructure providers	How large is the role of transport infrastructure providers in influencing service qualities and thus mobility patterns?
28. The role of real estate developers/housing providers	How large is the role of real estate developers in shaping the housing market and in investing the urban sustainable and transit-oriented projects?
29. The importance of policy analysis and analytical information	How large is the influence of policy analysis in policy-making process of cities? And how large is the role of analytical information in generating/supporting good policy analysis?
30. The importance of legal procedures	How large is the influence of formal legal procedures in urban planning and decision-making? How strictly are they followed?
31. The concentration of city-planning tasks	To what extent are the city planning tasks divided?
32. The concentration of urban transport planning and operation tasks	To what extent are the urban transport planning and operation tasks bundled?
33. The level of competition in contractor selection for transport service delivery	To what extent is the contractor for transport service delivery selected through open and competitive tender?
34. The criteria of cadre evaluation	What criteria are used to evaluate public officials? And how large is the influence of the cadre evaluation criteria in determining the behavior of politicians?
35. The level of acceptance of power-play	To what extent is political power-play accepted by the wider social groups?
36. The importance of personal networks	How large is the influence of personal networks in pushing forward urban programs and driving policy-making?



## 2.4. Three Perspectives for Exploring City Parameters

### 2.4.1 Inspiration from Allison and Snellen

Modern public administrations and policy-making processes are characterized by a multitude of actors and plurality of values. In view of this, scholars of policy sciences have been searching lenses of seeing public policy-making and establishing models for public administration. To explore the empirical scores of the actor network parameters, we look for what lenses are in place and how we could apply them, or use them in an adaptive way. We base ourselves on the lenses provided by Allison (1971) and Snellen (2002).

Allison (1971) defines three different decision-making models to analyze a famous event in 1962: the Cuban missile crisis. Model I is "*The Rational Actor*", the traditional way of looking at a governmental policy or action. It assumes that one man at the top ultimately makes the decision on the basis of a rational calculation of the costs and benefits to be expected from a proposed policy. Reasoned debates and substantial calculations, as well as comparisons over a spectrum of options are primary. Model II, "*Organizational Process*", assumes that governmental behavior can be understood less as deliberate choices and more as outputs of large organizations functioning according to pre-existing routines, i.e. standard operating procedures and the distinctive organizational logic, culture and capacities, which is jargon of saying the bureaucracy runs everything regardless of what the top man (for example, the president or the premier) wants. Decision-makers simply follow the rules in place to make an acceptable and satisfying decision. Innovation is rare in this case because decision-makers are merely rule-followers and do not challenge the current routines even though the routines are non-optimal. Model III, "*Governmental Politics*", stands in contrast to Model I by involving more actors in the game. It emphasizes the tug and pull of personal politics in the organization. In this model, the struggle for power among contending political actors and making value trade-offs through consultation and negotiation supersedes other considerations. In explaining what kinds of bargaining among which players yield the critical decisions and actions, Allison focused attention on certain concepts: the players whose interests and actions impact the issue in question, the factors that shape players' perceptions and stands, the "action channel" for aggregating competing preferences and their power and bargaining skills.

Snellen (2002) formulates a four-rationality model of public administration and policy-making. One is "*The Professional Rationality*", which means that if a government wishes to realize its policy objectives it must have appropriate theories, knowledge and technical sciences at its disposal. These sciences are developed by professional and scientific institutes, and play an important role since they provide policy-making with

the foundations for calculation, comparison and reasoning. The increasing involvement of science in policy is presented as professionalization and rationalization of public policies. Second is *“The Economic Rationality”*. In this rationality, public policy should stem from the fact that social needs should be fulfilled in an efficient way and social resources should be allocated in the most cost-effective way. According to this interpretation, we could understand this rationality as the social rationality, meaning that public policies effectively and efficiently meet the needs of the wider society. It distinguishes macro-economic rationality and micro-economic rationality. The former measures the wide social economic environment, while the latter measures inter-organizational and inter-personal relations. The third is *“The Legal Rationality”*. The essential elements which constitute legal rationality are equality before the law, legal security and protection from arbitrary action. It means that the construction of the legal procedures must justify a claim to equal treatment; the legal procedures must develop by ordering (new) social phenomena into relevant legal categories; and government policies and actions must be consistent with legal procedures. Finally, *“The Political Rationality”* views public policies as a result of political struggle. Policy struggle is rational because it prevents the inter-personal violent strife; it replaces dictatorship; it makes a society that looks peaceful; and it succeeds in establishing unequal distributions in situations of equal claims. Here, some policy problems are indeed solved, but others are not necessarily solved. Politicians are able to put the problems aside, or to solve them only symbolically.

Table 2.2 A comparison between lenses of public administration and decision-making

Allison	Snellen	Mu
“The Rational Actor”	“The Professional Rationality”	“The Policy Analyst Perspective”
“Organizational Process”	“The Economic Rationality” - Macro-economic - Micro-economic	
	“The Legal Rationality”	“The Legal Perspective”
“Governmental Politics”	“The Political Rationality”	“The Political Perspective”

A comparison between Allison and Snellen (table 2.2) implies that there are similarities and differences of their lenses of looking at public policy-making. To a largest extent, “The Rational Actor” model and “The Professional Rationality” model are the same, both emphasizing that a good policy comes from a careful scientific calculation and comparison. The “Governmental Politics” model and “the Political Rationality” model are also largely the same. Both stress policy struggle and power-play in the policy-making process. Regarding Snellen’s “The Legal Rationality” model, Allison does not have it. Regarding Allison’s “Organizational Process”, Snellen has it in a wider way. The micro-economic aspect of “The Economic Rationality” that focuses on inter-organizational relations coincides with what Allison refers to the “Organizational Process”, that is, the organizational routines.

Allison and Snellen's theoretical lenses provide broader implications for the essence of decision and public administration, and offer us with different perspectives in unraveling the actor parameters of an urban system in particular. When we attempt to apply these models, however, we found that data is lacking concerning the routines of various organizational actors, not only because some formal operating procedures and routines are not open to external researchers in China, but also because there are many informal routines guiding the decision-making process. Figuring out those informal routines normally requires the external researchers to be personally involved in each of the organizations, observe and experience informal interaction patterns. Because we cannot do the participatory observation and we do not know the routines, we do not apply the micro-economic aspect of Snellen's "The Economic Rationality", nor Allison's "Organizational Process". As for the macro-economic aspect which demonstrates figures and facts about the wider society, we have them in the social subsystems of our conceptual model of cities.

Therefore, we have three models to apply. We name them "The Policy Analyst Perspective", "The Legal Perspective", and "The Political Perspective" (table 2.2). This section thus introduces these three perspectives that are adopted for exploring actor network parameters and understanding the actor subsystem of a city.

#### **2.4.2 The policy analyst perspective**

The first perspective, The Policy Analyst, deals with classical decision-making. In the traditional sense, the policy analysts refer to technologists, scientists and engineers. A policy analyst often plays a role in serving as a decision-aide to one or more decision-makers, but is not the decision-maker. Policy analysis here means any type of analysis that generates and presents information and knowledge in such a way as to improve the basis for decision-makers to exercise their judgment (Dunn 2008). In policy analysis, the "analysis" is used in a general sense: it implies the use of intuition and judgment and encompasses not only the examination of policy by decomposition into its components but also the design and synthesis of new alternatives. The activities of policy analysts may range from research to illumination and from design to recommendations (Walker 2009). Some policy analyses are qualitative, involving nothing more than hard and careful thinking by adopting conceptual models for the purpose of obtaining insight into the causal relations existed within a policy problem, whereas others require extensive data gathering and elaborate calculation employing sophisticated mathematical and computational processes. Both types of policy analyses, however, try to develop objective knowledge to assist decision-makers in choosing a good course of action based on multiple and competing criteria from among a variety of alternatives under uncertain conditions (Quade 1975). The major premises are that: the world is to a large extent empirically knowable and often measurable; and knowledge used for policy-making must be capable of withstanding scientific scrutiny.

The role of knowledge in decision is a positive one, i.e. a greater insight into causes, effects, nature, and scale produces better policy.

More or less in parallel to the development of policy analysis as a discipline during the 1960s and 1970s, however, policy scientists have been criticizing policy analysts for being too narrowly focused on means-end rationality, and pointing out the key roles of other factors (e.g. political, procedural, personal relations, and strategic behavior) in policy processes. Therefore, in addition to the scientific use of mathematical methods and assessment tools, policy scientists view policy analysis as a process of political bargaining, exchanging arguments, actor analysis and solving conflicts. In response to these challenges, policy analysts have come up with a variety of new approaches, such as participatory and interactive styles of policy analysis (Thissen and Twaalfhoven 2001; Mayer, van Daalen et al. 2004). Here, to emphasize the distinction with the other two perspectives, we stick to the classical/traditional view of policy analysis which normally amounts to a series of steps, from problem formulation to execution:

- **STEP 1 PROBLEM:** Formulating the problem;
- **STEP 2 GOALS AND OBJECTIVES:** Specifying objectives and deciding criteria;
- **STEP 3 ALTERNATIVES:** Identifying alternatives;
- **STEP 4 MODELLING:** Building models;
- **STEP 5 DATA:** Collecting data;
- **STEP 6 CONSEQUENCES AND CHOICE:** Analyzing and comparing alternatives in terms of consequences (e.g. advantages and disadvantages; or costs and benefits) and choosing the alternative whose consequences rank highest in terms of the specified objectives.

Step 1 sets contents and boundaries for the following steps 2-6. What policy analysts do in this step involves identifying the questions involved in a policy issue, fixing the context within which the questions are to be analyzed and the policy decisions will have to function, clarifying (resource) constraints on possible courses of action, identifying the people who will be affected by the policy decisions, and deciding on the initial approach. In step 2, policy objectives and criteria that can be used to measure the fulfillment of the objectives are determined by the policy analyst. It requires that a complete and unbiased set of different objectives of all of the related actors (not only those of the client) should be taken into account from the very beginning. And it presumes that if the objectives of the decision-makers and other actors have been met, then the problem should be solved. In step 3, the policy analyst identifies alternative solutions. The current situation could become the “base case” in order to determine how much improvement can be expected from other alternatives. It is important to note that options should be excluded if they seem impractical or run contrary to past practice. Once the alternative options have been determined, each one has to be examined with the likely consequences of its implementation. This is usually done by the policy analyst in step 4 through building models because trying each option in the

real world is impractical, expensive and dangerous. Hence it is important to remember that models are not reality, only approximations of reality. Building models often means using theories of operations research or systems engineering. It is the job of the policy analyst to make simplifications on the one hand, and to make sure that no reasonable solutions are excluded on the other. After building models, policy analysts, or modelers, need to collect data in step 5. Following our initial assumptions, the world is to a large extent knowable and thus it is accessible to all information that is thought to be needed for the problem's solution. However, there is a need for analysts to understand what the data mean and to assess their accuracy. Cleaning and validating the data, although taking a great deal of time and resources, are of utmost importance to detect errors before any analysis can be conducted and will prevent the drawing of erroneous conclusions. Step 6 is the final stage where analysts synthesize each alternative's strengths and weaknesses and present them to the decision-makers. And the decision-maker selects one policy option among several alternatives which can fulfill the specified objectives in step 2 to the maximum.

### **2.4.3 The legal perspective**

For some purposes, public policies can be usefully summarized as decisions chosen by decision-makers to whom policy analysts offer comprehensive analysis and comparative policy alternatives. The policy analysts are completely informed, and the decision-makers are value/utility maximizing. However, this simplification conceals the fact that many legal rules and statutory operating procedures have been in place prior to any analytical efforts, and these pre-existing legal procedures articulate what actions should be carried out by whom. Because few important policy issues fall exclusively within the domain of a single organization, when faced with a policy problem, a multitude of organizations are involved. Therefore, the responsibility is divided, and each organization attends to a special set of problems and acts relatively independently. The necessity for decentralization consequently requires coordination and consensus building, and it is usually the government leaders sitting at top of these organizations that can disturb, but not substantially control, and coordinate the behavior of these organizations. Therefore, public policies, or say, governmental actions, can be understood, according to our second perspective, as outputs of various organizational actors functioning according to their legal roles and following the legal standards and procedures. We call it the legal perspective. Decision-makers, from this perspective, rarely engage in maximization because it does not require all possible actions to be made available for comparison, it does not require computing the consequences of actions with precision, and it does not require deriving a single utility ranking from multidimensional goals. What it requires is that actors generate decisions and carry out actions by following the pre-existing legal procedures. In many circumstances it is not necessary for the legal framework to be perfect or efficient, but stable enough for the actors to reach an acceptable course of action.

However, the assumption that a direct causal link exists between the legal procedures and the observed realities is questionable as implementation studies emerged in the 1970s with growing concerns regarding the incongruence between the realities and the legal expectations (Derthick 1972; Pressman and Wildavsky 1973/1984; Bardach 1977). Before that, it had been taken for granted that legal provisions and central mandates were clear and organizations were thought to behave according to the rules and to implement policies in line with the intentions of central decision-makers. The implementation studies can be divided into two streams. The first stream originates from Pressman and Wildavsky's *"Implementation"* (1973/1984), in which the central government enacts legal provisions, regulations and policies; the local governments are expected to follow these central intentions; and then the implementation research is left with the task of analyzing the difficulties and discrepancies in achieving these central objectives. In this view, the legal perspective focuses on the establishment of adequate legal procedures to ensure that policies are executed as accurately as possible. To this end, there needs to be a structure of clear organizational responsibilities and hierarchical control to supervise and coordinate the actions of the implementing organizations. The second stream, which is in line with Allison's concept of organizational routines, emphasizes that implementation consists of the everyday problem-solving routines and strategies of "street-level bureaucrats". In addition to Allison, several studies show that organizational outcomes do not always sufficiently relate to what the legal frameworks prescribe (Lipsky 1971; Lipsky 1980; Hjern and Hull 1982). Scholars belonging to this stream suggest studying what is actually happening at the recipient level and to analyse the routines that determine action on the ground.

As we have explained in the preceding sub-section, it is impossible for us to investigate the routines, or the behavior of the street-level bureaucrats of each involved organization, we stick to the first stream, that is, examining the legal procedures on the one hand and exploring the realities on the other hand so that we are able to identify the discrepancies and to analyze the reasons. Therefore, the practical adoption of the legal perspective can be summarized by the following steps:

- **STEP 1 LEGAL PROCEDURES:** Examining the pre-existing legal rules and statutory operating procedures;
- **STEP 2 ORGANIZATIONAL STRUCTURES:** Examining the existence of organizations and their legal roles and responsibilities;
- **STEP 3 INTER-ORGANIZATIONAL COORDINATION:** Partial decisions generated from each organization need to be centrally coordinated to eradicate overlaps and conflicts, and a consensus should be reached among the organizations before a policy is put into practice;
- **STEP 4 ORGANIZATIONAL IMPLEMENTATION REALITIES:** Identifying the realities of the organizational implementation;
- **STEP 5 LEGAL INCONGRUENCE:** Comparing the discrepancies between the legal procedures and the realities.



#### 2.4.4 The political perspective

The second perspective's simulation of government action as organizations implementing central policy intentions extends our understanding on a decision-making process. We realize that there is an apparent incompatibility between the interpretation of the first perspective and that of the second. The analyst perspective approaches public policies and governmental actions as strategic and rational choices, while the legal perspective accounts that many crucial details of policy formulation and implementation are actually carried out by various organizations from following the legal procedures. However, the analytical ability of the first perspective should not stop us from going into a further level of investigation. The principal government leaders of the organizations that take responsibilities for solving some specific, factored aspects of the problem are not a unified, integral, or consistent group. Rather, they differ markedly in their perceptions of the problem, their estimations of the consequences of various alternatives, and their preferred solutions. Therefore, each individual in this group is a player in a political game with both competitive and cooperative behavior. And this also implies that there is no unitary actor but rather many actors are involved (van de Riet 2003; ten Heuvelhof and de Bruijn 2008). Bargaining, negotiating, compromising, or even "wheeling and dealing" among individual politicians constitute the core of decision-making. Public policies can thus be understood, according to our third perspective, as results of these political games. And its central premise is that the actors act at least partly in their own self-interest, and they are very sensitive to the implications of alternative policy options upon their goals and interests (Allison 1971; Pettigrew 1973).

From the political perspective, as a result, a decision-making process is an arena where political deals are formed among the players against a policy problem, or say, value trade-offs are shaped through bargaining, negotiation and compromise. In this process, stalemates and breakthroughs may exist because individual players who have conflicting interests and diverse perceptions towards a specific policy issue compete to satisfy their own interests (Klijn 2001). Problem definition, data collection and evaluation criteria are weapons used to manipulate decision outcomes towards personal ends (Scharpf 1997). A decision, therefore, is the aggregate response of the relevant players to a problem they perceive (Crozier and Friedberg 1980) and this response reflects the relative power of the participants, their different understanding of the problem at hand, their strategies for protecting their values and political interests, and consequently it is actually a political resultant with value trade-offs (Page 1985). To use this perspective to reveal a decision-making process, one does not focus on a number of pre-structured or sequential phases (i.e. problem formulation, development of alternative solutions, selection, implementation and evaluation), but rather, investigates the following questions:



- **WHAT DOES THE POLITICAL ENVIRONMENT LOOK LIKE?:** Investigating the national and local political environment;
- **WHO PLAYS?:** Identifying the players whose interests and actions have an important effect on the government's decisions and actions. Usually, individuals become players because they possess important positions that are hooked onto the major channels for generating actions;
- **WHAT DETERMINES EACH PLAYER'S STAND?:** Identifying the factors influencing each player's stand, for example, the organization's orientation and priority of the player, the goals and interests, and the deadline faced by the player;
- **WHAT DETERMINES EACH PLAYER'S IMPACT ON RESULTS?:** Investigating the factors that endow each player with influential power, for example, bargaining advantages coming from formal authority and responsibility (stemming from positions), actual control over some necessary resources, expertise and possessing useful information, as well as persuasiveness that affect other players' objectives;
- **WHAT DOES THE GAME LOOK LIKE?:** That is, how are players' positions, influential power and moves combined to yield governmental decisions and actions?

As this perspective unfolds, it becomes clear that we have placed considerable emphasis on the self-interest motives in explaining the decision-making behavior of public officials. Then one question emerges: how are public interests served? Although we cannot deny the fact that it would be possible for some of these decisions to be consistent with public objectives, most of the policies resulting from political struggle, in terms of solving public problems, are extremely doubtful. At least in part public interests are replaced with private ones. Or, the direct link between problem and solution is broken, i.e. the search for a solution is not triggered by a problem at all. For instance, it is questionable whether public money is spent in a proper way; or whether the approval for a specific transport project and the allocation of funding to that is the need to accommodate the increase in traffic flow.

To summarize, we have presented three decision-making perspectives with alternative conceptual angles, each consisting of a cluster of assumptions and different analytical lenses that probe a decision-making process differently. The first perspective's explanatory power derives primarily from the construction of a calculation that makes plausible the decisions taken. The essential element in this perspective is its reasoning. The second perspective inclines to dig deeper in the evidence about decision behavior according to legal procedures. And the third perspective analyzes decision-making by looking at the interaction process between actors who possess diverse interests and goals. Such variance among interpretations, therefore, demonstrates each perspective's tendency to produce explanations to different parameters.

## 2.5. Conclusions

Chapter 2 has provided a framework on how to interpret cities and how to deal with complex urban problems in a dynamic environment. If we view cities as complex systems, it is not wise for us to simply imagine that we can alter the behavior of millions of system components or change the system behavior as a whole by implementing a policy change, without systematically examining the interrelationships of various natural, physical, social and actor structures in urban development. Again, in complex urban systems, it is not wise for us to steer the system without understanding the status of the city parameters. That is because urban change has a quality which is often counterintuitive, built around a few sensitive parameters in unexpected places, and tricky usually exhibiting the “worse-before-better” sequences. All these features put significant challenges on decision-makers who must be prudent in examining the interrelated system parameters and deliberative in formulating policies and actions. Before we adopt this theoretical framework in the empirical urban studies, in the following chapter 3 we will study the concept of TOD because to answer the research question posed in chapter 1, one not only has to understand how cities operate, but also the TOD policy the local governments intend to introduce in the urban systems. After thoroughly investigating the TOD concept in the next chapter, we apply this framework for understanding urban systems in our empirical chapters 4-7: in chapter 4 we will introduce our case study area, the Dalian city which is one of the most open and prospers coastal cities in China and which has officially adopted TOD, with respect to its parameters belonging to the natural, physical and social subsystems. In chapters 5 through 7 we will thoroughly explore the parameters of the actor subsystem of the case area respectively from the policy analyst, the legal, and the political perspectives; and then we will find it back in chapter 8 the typology of the parameters and their implications for the planning rules of self-organizing cities.



## 3. Transit-Oriented Development

### 3.1. Introduction

The world is increasingly becoming an urban place. About 65% of the world's population is forecasted to live in urban areas by the year 2025 (Schell and Ulijaszek 1999; Li, Liu et al. 2009). And it is expected that by 2050 nearly 70% of the world's population will live in cities (United Nations 2007), in particular in large metropolises of developing countries (Zhao 2010). As we have discussed in chapter 1 in the section on city-transport relationships, urbanization promotes rapid economic development, but at the same time, leads to many social and environmental problems, such as concentration of the population and housing storages, dispersed land use for industrial purposes and loss of arable land, an increase in motorized, long-distance trips and traffic congestion, oil dependence and air pollution, as well as reduced livability and unsatisfactory quality of life. Such urban sprawl, in terms of both urban-rural migration and urban boundary shifts has sparked considerable debate about alternative, potentially "more sustainable" urban development. And we can regard such a shift toward sustainability as a solution which is rational according to policy analysts. Actually, many previous studies have revealed that a large share of these problems stem from the inefficiencies of urban transportation systems and the failure of town planning in effectively coordinating urban land use patterns with suitable transport modes (Vuchic 1999). As a result, the most commonly adopted policy measures since the early 1990s focus on limiting transport demand such as restraints on automobile usage by imposing road pricing, fuel tax and parking control on the one hand, and growing transportation supply, including road construction, rail investment, applying advanced technologies and provision of park-and-ride facilities on the other (Cervero 1998; Loo, Chen et al. 2010). However, the effectiveness of these policy measures that focus on transportation issues can be limited, as there are still other factors influencing people's travel behavior and urban traffic generation. Among the factors, land use planning and urban design present the most significant ones. A compact, mixed, pedestrian friendly built form with aesthetic architecture and open space is also believed to be an essential component of sustainable urban development. Accordingly, a number of strategies of development, such as smart growth (Miller and Hoel 2002; Gabriel, Faria et al. 2006; Turner 2007), transit-joint development (Transportation Research Board 2002), transit-adjacent development (Dittmar and Ohland 2004; Renne 2009a), neo-traditional development (Nasar 2003) or transit-focused development (Porter 1998), have been proposed. Although the meanings of these terms are not

exactly the same, they share some common elements, such as the promotion of compact, mixed land use close to transit, inducing more transit ridership and helping mitigate the problems associated with high automobile dependency. These strategies are broadly covered under the concept of Transit-Oriented Development (TOD) in this study. Hence, in this chapter we first introduce the concept of TOD and its cost and benefit structures, contingency and intermodality in section 3.2. Then we will investigate the worldwide experience with adopting TOD in section 3.3. And by drawing lessons from international evidence, a series of preconditions for TOD are generated in section 3.4, together with some implications for the required institutional incentives conducting TOD implementation.

## **3.2. Transit-Oriented Development**

### **3.2.1 What is transit-oriented development?**

Debates surrounding the definition of transit-oriented development (TOD) are extensive and multifaceted. And the definitions for different nations and organizations also highlight distinctive emphases in accordance with their own interests and objectives. Generally speaking, TOD is interpreted as an urban development strategy that prevents urban sprawl by integrating spatial planning (i.e. land use composition) with transport functions (Calthorpe and Fulton 2001). In addition, TOD is understood as a local transport planning principle which seeks to maximize access to public and non-motorized transportation with centrally located rail or bus stations surrounded by relative high-density construction, mixed land use and a pedestrian friendly built environment (Dittmar and Ohland 2004). It argues that the pursuit of TOD, either through new construction or through redevelopment, offers opportunities to revitalize neighborhoods and thereby to increase the vitality of cities (Bernick and Cervero 1997; Curtis, Renne et al. 2009). Most importantly, it is also believed that TOD can help mitigate the problems associated with high automobile dependency (Loo, Chen et al. 2010). In other words, TOD is a model to promote transit through integrating traffic with land use – i.e. concentrating moderately a mix of land use around transit stations. Therefore, the transit-oriented locations represent a mobility environment where public transport is a much more respectable alternative to automobile travel, and enough travelers opt for transit riding in spite of continued automobile dominance (Cervero 1998).

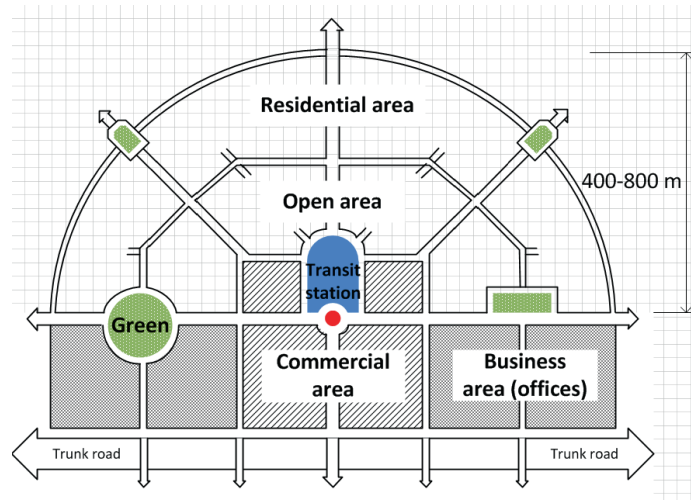


Figure 3.1 A sketch map of TOD neighborhood

In line with the general perception of TOD, researchers are increasingly recognizing that TOD can take a variety of forms (Atkinson-Palombo and Kuby 2011). First, TOD can be designed and built at neighborhood levels (Calthorpe 1993; Dittmar and Poticha 2004). As figure 3.1 presents, *a TOD neighborhood* means creating a small-scale pedestrian-friendly built environment that is within a radius of 400-800 meters (the distance considered to be an appropriate scale for pedestrians), in which the centrally located rail or bus stations are surrounded by relatively high-density and mixed commercial and residential developments. Such a standard definition of a TOD neighborhood, however, tends to force a one-size-fits-all transit-oriented design onto the different types of neighborhoods. Actually, the planning and development strategies that might be appropriate in downtown neighborhoods are certainly different from those that might be effective in suburban contexts. In recent years, as global and regional economic dynamics have shifted a significant proportion of jobs from central cities to the suburbs of large metropolises, downtowns are emerging as civic and cultural centers rather than hubs of employment. This fundamental change has enormous implications for designing a TOD neighborhood. For downtown neighborhoods, normally, 60%-80% of the land is designed for commercial and entertainment uses relative to business and residential developments. And such places are often served by several types of transit and are typically primary points of intermodal transfer. However, for those neighborhoods that are on the extension of the downtowns, much of the land (around 70%) is occupied by residential houses, while a small proportion of land is designated to commercial and business use. In these neighborhoods, livability is important and daily services and facilities like restaurants, schools, shops, hospitals and parks should be well integrated with the residential areas. Houses should be affordable, streets should be attractive and transit services should be accessible and frequent. When it comes to designing suburban neighborhoods which

have grown to accommodate economic and industrial development zones and become into centers of employment, a lot of land (around 80%) needs to be developed into industrial purposes. And such job centers need to be connected with residential areas through appropriate (rapid) transit services.

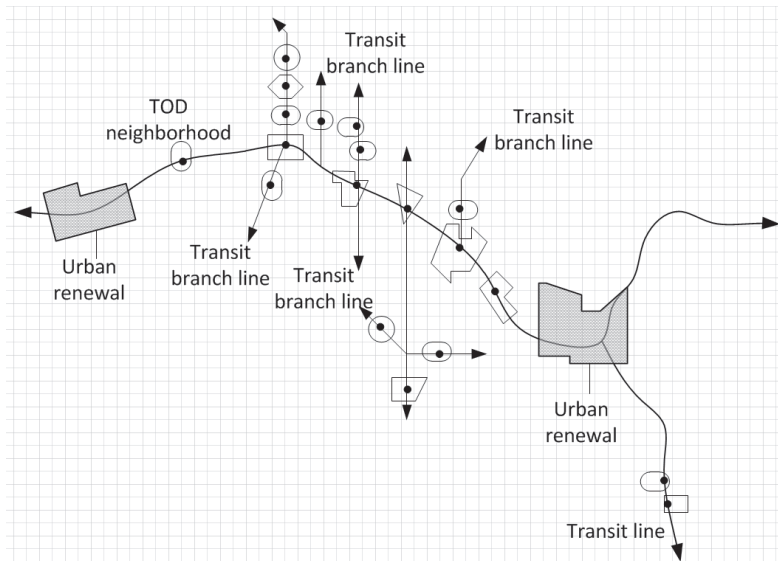


Figure 3.2 A sketch map of TOD metropolis

Additionally, TOD can be developed at the metropolitan level (figure 3.2). A *TOD metropolis* refers to the urban area that is composed by numerous neighborhoods mutually connected by transit lines (Dittmar and Ohland 2004; Cervero and Day 2008). TOD metropolises may form in different ways (Cervero 1998). For instance, there are transit-oriented metropolises (e.g. Stockholm, Copenhagen, Tokyo and Singapore) that invest in rail systems in advance to guide urban growth for purposes of achieving larger social objectives such as preserving open space and producing affordable housing in rail-served neighborhoods. The clustering of development at each neighborhood (i.e. the nodes) along the transit line, and the resulting confinement of trips along the transit axes are what makes the arrangement highly efficient from a mobility standpoint. Also, some cities (e.g. Karlsruhe in Germany and Adelaide in Australia) that have already experienced urban sprawl and where low-density patterns of growth have emerged have sought to construct or reconfigure transit infrastructures and apply new technologies to best serve this environment. In this case, origins and destinations distribute nearly evenly throughout a city landscape, which produces almost random patterns of trips and makes the design for transit route a big challenge. Additionally, there are cities (e.g. Munich, Ottawa and Curitiba) that have guided urban growth along mainline transit corridors and later adjusted their feeder transit services to efficiently serve their spread-out suburbs. In such cases, the trunkline transit



services need to be well coordinated and integrated with feeder transit (e.g. light-rails and conventional buses) in the suburbs.

### 3.2.2 Costs and benefits of TOD

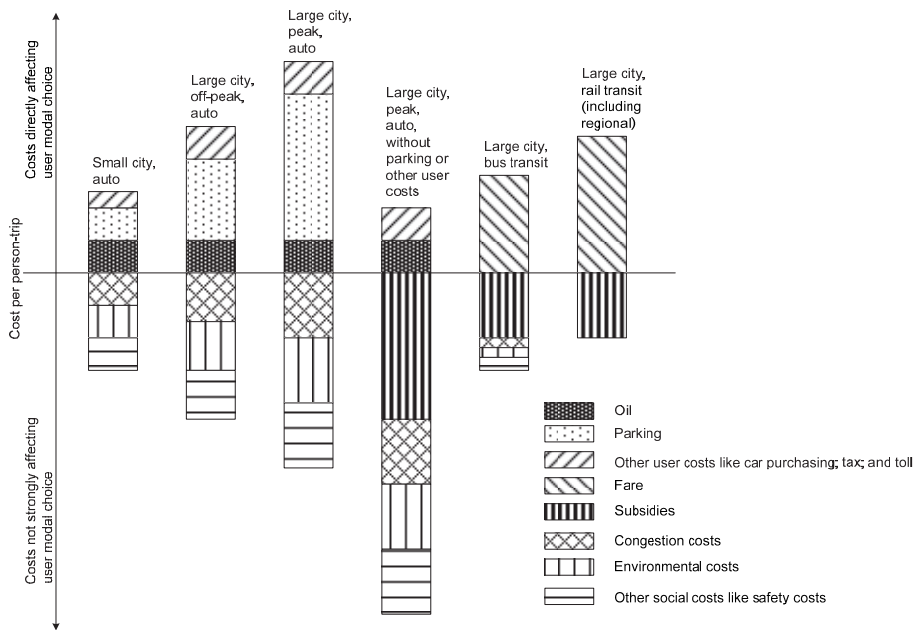


Figure 3.3 Cost structure of TOD (source: Vuchic (1999))

For further analysis of transit-oriented development, the structure of costs and benefits of travel by transit in contrast to automobile needs to be clarified. The costs are illustrated in figure 3.3, where costs are generally classified as *user costs* (e.g. costs for oil, parking, car purchase and sometimes for tax and toll), *subsidies*, and *social costs* (e.g. congestion costs, environmental costs and safety costs). The user costs, which are plotted above the horizontal line, are the costs most directly affecting the modal choice of passengers, while the subsidies and social costs, which are sketched below the horizontal line, tend not to be considered strongly by passenger in choosing modes of travel. The figure clearly shows that for individual passengers the costs of off-peak car travel are not much higher than that of transit riding, and in some occasions (e.g. in small cities or parking is free) traveling by car can be even cheaper than transit riding, not to mention the relative privacy, flexibility and comfort of car travel. However, the social costs of traveling by car are much higher than that of transit riding, especially in large cities. Moreover, the most serious case which is shown in the fourth bar is that automobile users do not need to pay for parking (because parking is subsidized by employers, residential developers or merchants of shopping malls). In this case, costs paid by travelers are very low, while the total costs paid by the whole society are very

high. To correct this, transport policies and regulations on automobile usage should be designed to shift some cost components from below the line to above the line. This will be discussed in more detail in section 3.4. Transit costs, as can be seen in the last two bars, only include the fare as direct user costs, whereas subsidies consist mainly of governmental compensations for the loss of transit operation. The congestion, environmental and safety costs per person-trip are much lower than the corresponding costs of car travel.

On the other side of the coin, the benefits of transit relative to automobile can be evidenced by the modal split comparisons (table 3.1) given by Merlin (1996) in his *“Urban Transport”*. Bus transit and rail transit can assume 25 and 1440 times more passengers respectively than car does during peak hours. And if calculated per passenger, the static spaces (i.e. area occupied by vehicle when it stops) required by bus and rail transits are only 1/26.7 and 1/8 of those by car, and the dynamic spaces (i.e. area occupied by vehicle when it moves) for bus and rail transits are respectively 1/4 and 1/8 of those needed by car. Therefore, a neighborhood or a city that is designed under TOD principles is believed to be able to move more passengers (i.e. to satisfy more passenger transport demands and thus to increase mobility) particularly in peak hours with less spatial requirement. Consequently, it implies that the traffic congestion problem, the safety problem, the energy-depletion problem and the environmental problem, as well as the problems of increasing land use for cars are likely to be effectively resolved. For this reason, cities would become better places to live, work and play and citizens would have a higher quality of life. (Babalik-Sutcliffe 2002; Policy Link 2008; Renne 2009b)

Table 3.1 Benefit structure of TOD (source: Merlin (1996))

Modes	Ridership during peak hours	Static space occupied (m <sup>2</sup> )	Static space occupied per passenger (m <sup>2</sup> )	Dynamic space occupied (m <sup>2</sup> *h)	Dynamic space occupied per passenger (m <sup>2</sup> *h)
Walking	1	0	0.3	0.4	0.4
Bicycling	1	1.5	1.5	1.5	1.5
Car	1.25	10	8.0	3.0	2.4
Bus Transit	30	30	1.0	9.0	0.3
Rail Transit	1800	540	0.3	1200	0.67

Therefore, TOD is not a one-fit-all solution. The problems that TOD solves mainly concern the reduction on the social costs of urban transport, such as the congestion costs, environmental costs and safety costs, since it requires less space for urban mobility and it can assume much more passengers than automobiles during peak hours. In off-peak hours, TOD cannot offer more significant benefits for individual passengers in contrast to automobiles. And in small cities the total travel costs by car is lower than that by public transit. Therefore, TOD is much more suitable in large cities with

problematic levels of congestion, especially during peak hours. If TOD is applied in small cities or cities where traffic demands are low, then TOD will bring the so called “opportunity costs” (i.e. the lost benefits of the forgone choices) both to car users (e.g. privacy, flexibility and comfort of car travel) and to the society at large (e.g. large amount of public money, governmental subsidies required for the operation and maintenance of public transit).

### 3.2.3 Contingency of TOD

To achieve the above mentioned TOD benefits for cities, it is essential to recognize the importance that different cities varying in topography, physical form, population size and density should match with suitable transit services that may also differ in terms of system performance (e.g. capacity, speed, reliability and safety), investment requirement, passenger attraction and potential impacts on urban form as well as city livability. In this sub-section, therefore, we examine the characteristics of different transit modes and see how they can be fitted into cities of different sizes.

An overview of characteristics of the commonly used transit modes are presented in table 3.2, classified as three categories of the *street transit*, the *semirapid transit* and the *rapid transit* (Vuchic 2007). The street transit designates modes, including paratransit, regular bus, trolley bus and streetcar, operated on streets with mixed traffic. Its investment requirement is relatively low, but the performance (e.g. reliability) depends on traffic congestion and the speed is lower than the speed of traffic flow due to the time lost at passenger stops. In addition, it contributes considerably to air pollution because of the use of the internal-combustion engine and the dependence on oil, and as a result its impact on urban form and city livability is weak. By contrast, the semirapid transit consists of such modes as rapid bus transit and light rail transit which are operated on separated lines on the street. The reliability, safety and speed of these modes are high because they are isolated from other traffic and thus unaffected by road congestion. However, their investment requirement is relatively high and the rapid bus transit still heavily adds to air pollution. In spite of that, they are attractive for passengers and have a positive impact on the urban landscape and livability. The rapid transit, however, operates exclusively on specially designed elevated bridge or tunnels that are fully without grade crossings and any legal access by other vehicles or persons. The investment is thus huge. Yet, the transit capacity is large and the system performance is more efficient with very high levels of reliability, safety and speed. Additionally, these transit modes are controlled by automation operation systems, which make the services more intelligent from a technological point of view. Furthermore, they are very attractive to passengers and have a low contribution to air pollution. With respect to their relation with city livability, it is often argued that rapid transit modes have a “magnet effect” and will attract mixed land use around transit stations. This will significantly reduce long-distance trips in urban areas and in the long run reshape the urban form.

Table 3.2 Characteristics of transit modes (Source: Vuchic (2007))

Transit Modes	Street Transit		Semirapid Transit		Rapid Transit
	<i>Paratransit (PT)</i>	<i>Streetcar/</i>	<i>Rapid bus</i>	<i>Light rail</i>	<i>Rapid rail</i>
	<i>Regular bus (RB)</i>	<i>Tram (SCT)</i>	<i>transit</i>	<i>transit</i>	<i>transit/</i>
	<i>Trolley bus (TB)</i>		<i>(RBT)</i>	<i>(LRT)</i>	<i>Metro</i>
					<i>(RRT)</i>
Support	Road	Rail	Road	Rail	Rail
Guidance	Steered	Guided	Steered	Guided	Guided
Propulsion	ICE	Electric	ICE	Electric	Electric
Control	Driver/ Visual	Driver/ Visual	Driver/ Visual	Driver/ Signal	Signal/ ATO
Cars per TU	1	1-3	1	1-4	4-10
TU capacity (spaces)	80-125	100-300	80-180	100-720	720-2500
Speed (km/h)	30-40	30-40	40-60	40-60	60-90
Headway (min.)	10-30	10-15	10-15	10-15	5-15
Stop spacing (meters)	80-300	80-300	200-600	250-1000	1000-2000
General performance	Moderate	Moderate	High	High	Very high
Investment cost	Low	Moderate	High	High	Very high
Passenger attraction	Moderate	Moderate	High	High	Very high
Air pollution and noise	Considerable	Low	Considerable	Low	Low
Potential impact on urban form	Weak	Weak	Strong	Strong	Very strong

Notes:

*Support* means the vertical contact between vehicle and riding surface;

*Guidance* refers to the means of controlling the direction of the vehicle;

*Propulsion* refers to the type of traction or acceleration/deceleration forces;

*Control* means the way of regulating and signaling the travel of all vehicles in a transit system;

*Transit unit (TU)* refers to a set of vehicles traveling together;

*ICE* is the abbreviation for internal-combustion engine;

*ATO* is the abbreviation for automation train operation.

In addition to the public transport modes, there is private transportation, including walking, bicycle and private car. These private modes of transport are not excluded from TOD not only because TOD is not equated with a region where public transit almost entirely replaces the private automobile or even captures the majority of motorized trips, but also because the use of the public transit modes must be combined with some degree of walking or bicycling. In some circumstances, it also requires driving a car to access the public transit, which is known as the “park-and-ride” system. These private transport modes give travelers the greatest freedom of movement with respect to time and route. In addition, walking and bicycling represent the basic modes of travel that are the most efficient, economic and environmentally friendly means of transport for short-distance trips. Moreover, pedestrian and bicycling traffic is a

fundamental component of livable cities because most people would agree that a basic feature of livable cities is the ability to walk or to ride a bike in pleasant surroundings that are protected from automobiles.

Bearing in mind these characteristics of public and private transport modes, it is obvious that their relative roles and significance should differ in various urban settings. Extensive research has been done on how to fit different transport modes into cities of different sizes (Vuchic 1999; Vuchic 2005; Vuchic 2007). For small cities and urban areas where the congestion problem is less severe than in large cities, it has been recognized that private transportation including walking, bicycling and cars may be adequate and efficient if streets are well designed, land use is carefully planned and traffic regulations are applied. The need for huge infrastructure investment is, therefore, low. And the requirement for service availability to all population groups, however, necessitates some transit services. As figure 3.4 shows, within a relatively small town which is well constructed with roads, transit services provided by regular buses, trolleybuses or streetcars are not competitive with auto travel with respect to speed, reliability and comfort because transit vehicles run together with cars, but they are delayed by having to stop for passengers. However, as city size increases, traffic problems such as growing traffic demand, congestion and negative environmental impact intensify. Consequently, the need for higher-capacity transport services with better system performance increases, and huge investment costs are required. Therefore, in medium-size cities and large metropolises, transit modes such as rapid bus, light rail, and metro should play the dominant role in carrying major passenger flows. In such cases, transit ridership can be improved by high-quality (e.g. frequent, reliable, safe and comfortable) transit services. In addition to good transit service, cities in these circumstances must have extensive pedestrian facilities and well-designed bicycle amenities as transit accessories.

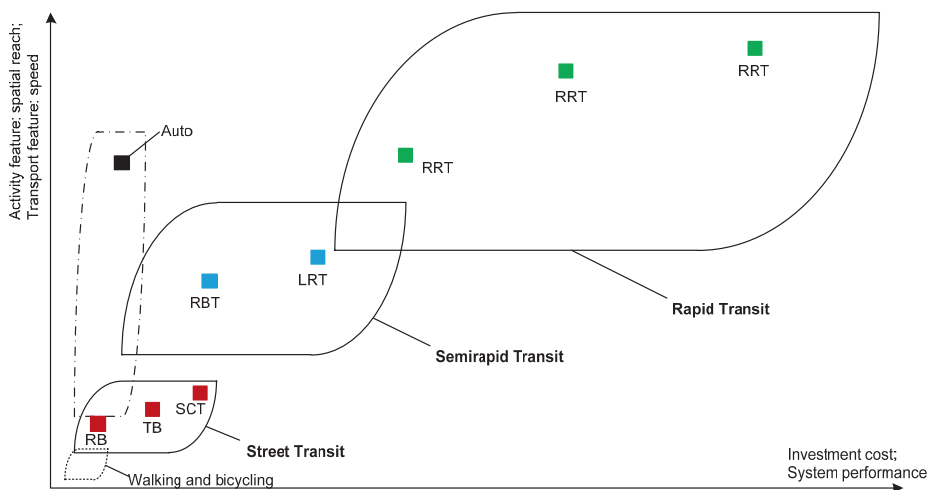


Figure 3.4 Contingency of TOD (source: Vuchic (1999))

Therefore, the effectiveness and economic efficiency of transport systems largely depends on the utilization of the most appropriate transport modes with different “spatial reaching-system performance packages”. In other words, it would be incorrect to argue that there exists a single best mode. For each set of conditions, such as city size, transit mode capacity and speed as well as available funds, all transport modes, not excluding automobiles, need to be evenly developed in the context of TOD and different transit services need to be well integrated for easier intermodal transfers.

### **3.2.4 TOD intermodality**

Although recognizing the overall benefits of TOD and the relative strengths of each mode, travelers may be tired of, and step away from transit riding due to the difficulties of intermodal transfer. The difficulties may be induced by physical disconnection between transit modes and operational incompatibility between service providers (US Transportation Research Board 1996; Denant-Boemont 1999; Mulley and Nelson 1999; Hine and Scott 2000; Panayides 2002; Hull 2008; Schöller-Schwedes 2010). Therefore, to increase passenger attraction and to achieve a high level of transit ridership, intermodality is an essential component of TOD, especially when a city has experienced urban sprawl and a unimodal system is insufficient to move people from origin to destination. Accordingly, intermodality here means physical and operational integration between transit modes.

*Physical integration* means that the network layouts of various transit modes are designed in such a way that passenger transfers are safe, fast, convenient and even seamless. As figure 3.5 shows, the physical integration can be achieved through designing the metro station below the elevated light-rail station (or even the airport terminal building), combined with regular buses, trolley buses, taxis and streetcars at the ground level. And the different layers of transport modes can be connected by elevators. In addition to such kind of vertical integration, these transit modes can also be integrated only at the ground level in a continuous way. That means, the stations of metros, buses and streetcars are adjacent or beside each other and are connected by short-distance walking paths (Blow 2005). However, not limited to these, physical integration also encompasses two important intermodal designs. One is the hierarchical forms of transit services, meaning that by carefully integrating services - high-capacity mainline services, intermediate connectors and community-scale feeders - many origin-destination combinations can be efficiently served (Cervero 1998). And another is the park-and-ride services, referring to the situation that parking facilities are equipped near transit stations (see figure 3.5) in order to adapt transit provisions to the sprawled lay of the land (Parkhurst 1995; Horner and Groves 2007; Kepaptsoglou, Karlaftis et al. 2010; Meek, Ison et al. 2010).

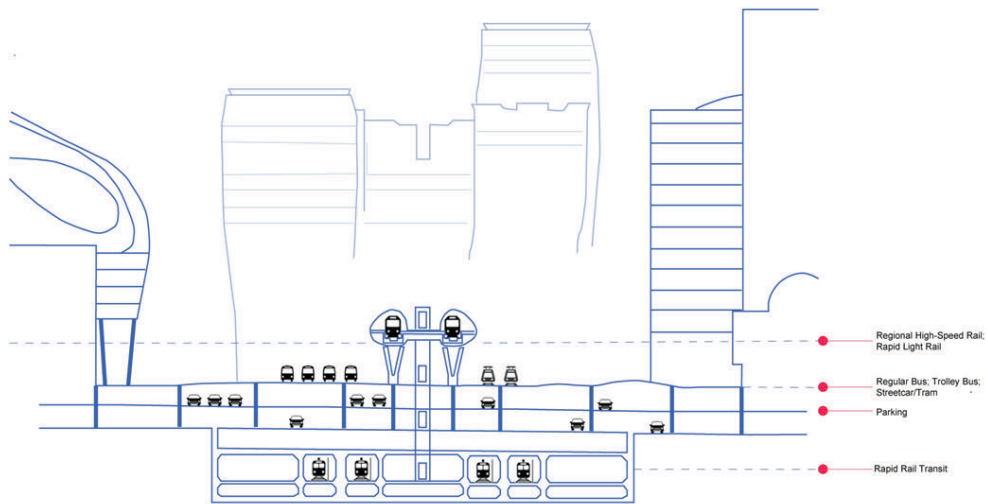


Figure 3.5 TOD intermodality

*Operational integration* means that different transit modes are coordinated by routes and timetables that are designed for the most efficient and convenient transfers at stations or terminals. In operationally integrated services, it would be the best that fares are paid only once for each trip, regardless of the modes used. Technical and operational innovations, such as the introduction of “smart cards” and “transit passes”, have improved the convenience of fare payment, which has a significant impact on the attraction of travel by transit. Smart cards are credit or charge cards that can be used for all kinds of transit, or even more effectively, for all travel charges like oil, toll and parking (Chip Talk 2002; Pelletier, Trépanier et al. 2011). And transit passes are another kind of fare payment that can be effectuated weekly, monthly and in some cities even annually. For those daily passengers such as employees who have paid for the passes through a monthly payroll at a discount rate, transit travel does not involve a direct payment any more, which also contributes significantly to convenience of transit travel (Vuchic 1999). Besides the innovative fare collection methods, technical innovations, primarily including Information and Communications Technology (ICT) and Intelligent Transportation System (ITS) in the transport sector, play crucial roles in operating real-time traffic flows and controlling intermodal relations (Hoose 2010). ITS carries a number of features that can benefit transit. In addition to the safety devices and increased reliability of traffic flow, ITS can trace precisely transit vehicles, which facilitates the operation of control centers of different transit modes, especially when delays occur and feeder transit is followed (Taniguchi and Shimamoto 2004; Juan, Wu et al. 2006; He, Zeng et al. 2010; Kulmala 2010).



### **3.3. Worldwide Experience with TOD**

Currently, transit-oriented development is warmly embraced by metropolises around the world as a strategy for sustainable urban development and transportation management. Undeniably, the experiences with TOD vary across countries according to national legal frameworks and public administration practices. However, regardless which countries are advanced TOD adopters (e.g. Denmark, Sweden, Singapore and Japan) or latecomers (e.g. China, United States and South Korea), and although most TOD projects vastly differ in terms of size and scope, worldwide experience according to literature indicate that the TOD projects, either undergoing setbacks or even failures or enjoying success, share similar reasons. Hereafter a summary of the global experiences with TOD drawn from numerous case studies carried out by various international organizations is presented.

#### **3.3.1 Centralized vs. decentralized planning and decision-making**

Global experience shows that the extent of centralization or decentralization is an essential question for planning and decision-making in a TOD development. At one extreme is a centralized structure with a single decision-maker. This is characteristic of TOD plans and decisions imposed and administrated by dictatorial forms of government, where no initiative and decision-making power on land use and transport issues is left to citizen involvement. At the other extreme, we find complete decentralization, where decentralization may either refer to political decentralization that aims to give citizens more power in urban and transport planning as well as TOD-related policy-making, or refer to administrative decentralization that seeks to transfer powers and responsibilities of planning, financing and management of public transport infrastructures from the central government to regional governments or local governments (Jaakson 1972).

There are cities that are regarded as successful TOD adopters and represent the centralized and decentralized planning and decision-making models for TOD respectively. Singapore, for instance, applies centralized planning to transform the city-state into a transit metropolis (Ng 1999). Singapore's one-party rule has provided the potential unity and stability necessary for the emergence of a highly centralized strategic planning process (Soh and Yuen 2006). And the Singapore government won popular support for the centralized planning for TOD through relocation of most residents from crowded, poorly served slum housing into modern, high-rise housing units which were later added with retail, cultural and service facilities, as well as feeder roads and expressways (Abrams, Kobe et al. 1980; Gosling 1990). Copenhagen, on the other hand, is a typical case of developing TOD through a highly decentralized institutional landscape. Land use planning and transport services are shaped by a multitude of agencies and authorities, operating at different tiers of government that

often compete for the same limited resources. However, there exist adequate checks and balances, and politics of gentle persuasion to ensure that the plan and decisions are well coordinated. In addition to the successful cases, there are also unsuccessful ones. China, where transit infrastructures are politically centralized but administratively decentralized, has witnessed rapid expansion in subway networks in large metropolises due to the ease of project approval and the widen financing sources, but several subway projects in Nanjing, Beijing, Shanghai, Shenzhen and Hangzhou were found to have managerial and technical flaws, which put these projects aside for years or even led to a collapse during construction (Ma, de Jong et al. 2012).

Therefore, both centralized and decentralized governance have their own strengths and weaknesses in planning and decision-making for TOD. The advantages of more centralized approach to TOD are that reforms, approvals of land use and constructions of transport projects are more likely and achievable in spite of the existence of wide gaps between current administrative practice and the citizens' expectation and satisfaction. However, the disadvantages lie in the fact that many irresponsible and unaccountable public officials with decentralized power squander public money in land use and transport projects that cost too much for construction while adding few benefits to citizens, or even sometimes remain as unfinished projects. In terms of a decentralized approach to TOD, although it is more democratic and reflects the expectation of the public to a larger extent, the absence of consensus, conflict goals, competition over resources and different perceptions on what TOD should accomplish could halt the progress of TOD development. Furthermore, a decentralized approach requires a much higher level of coordination among involved actors.

### **3.3.2 Formal vs. informal coordination**

Worldwide experience highlights that TOD operates in a multi-actor context where well-established coordination methods are crucial to make joint efforts among agencies and authorities with diverse goals, perceptions, resources and skills for the purpose of achieving physical and operational integration and furthering intermodality. And international evidence shows that coordination accompanying TOD development can be achieved in either formal or informal ways. Formal coordination includes markets, hierarchy and networks. In market coordination, actor interaction is largely based on free decisions, not imposed by any external player. And the medium of coordination is purely contractual arrangement. In hierarchical coordination, actor interactions largely depend on institutional frameworks imposed by some external authority. These frameworks contain a legitimized set of rules, regulations and some monitoring to direct the actions of players (Alexander 1995). And in network coordination, interdependencies between various players imply that no one player is able to impose its own value and perception on others, and consequently decision-making results from consultative and negotiative interaction between the players (de Bruijn and Dicke 2006). Except for formal coordination, however, there may exist informal linkages between

actors: spontaneous contact between individuals in their organizational roles and positions to create informal channels of interaction (Chisholm 1989).

There are cities which can demonstrate formal and informal coordination during the process of orchestrating TOD plan and delivering transit services. In Stockholm, for example, the city council played an important role in coordinating actors from land use and transportation departments during the post war period. Transit planning in Stockholm would not have been possible if the city council did not purchase land in advance of need (Cervero 1995). In Copenhagen, land use planning is achieved in a hierarchical way, with the national government perched firmly at the top. It is the Danish national government that has spearheaded much of the planning process and drawn up national TOD directives. The national directives, then, shaped regional plans which in turn shaped the local plans. Moreover, in Munich where a decentralized approach was applied to TOD planning and management, a high degree of institutional coordination has been established through building up a regional transit authority as an independent umbrella organization for planning and coordinating bus and rail services and fares (Kirchhoff 1995). In addition to the above formal coordination, the transit system in San Francisco Bay Area is a typical example where informal ways of coordination were extensively used between fragmented transit agencies as a complement to formal forms of coordination. In this case, the planning and operation processes were facilitated and speeded up by operators' use of personal linkages, and many of the emergencies and conflicts were solved by managers' personal communications through phone calls (Chisholm 1989).

Although the San Francisco Bay Area case is regarded as an example of successful informal coordination in transit services, the weaknesses of informal coordination cannot be ignored. Some criticism of such coordination without hierarchy stem from the perception that informalities may serve personal ends first, and professional ends second. And it is believed that personal ends can conflict with formal ends of the organization. Furthermore, an apparent problem with informal agreements is that their enforceability and obscurity as contracts is suspect. However, informal coordination and decision-making are often so important because formal channels of coordination simply do not exist. Or when the decision-making process is blocked by formal rules, informal ties can come into effect, providing a momentum.

### **3.3.3 Governmental vs. entrepreneurial leadership**

Worldwide experiences demonstrate that it can be government (i.e. the public sector driven by public-interest protection motives) or entrepreneurs (i.e. the private sector driven by profit motives), or both constituting a Public-Private Partnership, that initiates, builds, operates and manages bus and rail transit as well as develops new communities. There are two varieties of entrepreneur-led TOD development. One is that, with government approval, giant enterprises that are not in the business of

operating transit services can initiate, finance and build transit lines to link their newly developed sites to urban downtowns. Another is that, due to budget pressure of public sector and enormous investment requirements on transit infrastructures, the government may contract out tasks of construction, financing and operation in transit services to private enterprises. In such cases, the selection of private contractors is usually based on competitive tendering, which not only contains costs and rewards efficiency, but also spurs service innovations (de Jong, Mu et al. 2010; Mu, de Jong et al. 2010).

Successful entrepreneur-led cases can be found in the two Scandinavian metropolises, Stockholm and Copenhagen. Bus services are contracted out on a competitive basis and have begun doing likewise for rail services. Accordingly, the operating costs have been dramatically reduced in both metropolises. In Munich, Karlsruhe, Curitiba and Adelaide as well, efficiencies have been achieved by separating ownership of fixed infrastructure assets from service provision. In these places, the lowest-cost providers deliver the service, but the governments set service standards (e.g. timetables, fares and routing) and still retain control over how services are configured. In another successful transit metropolis, Tokyo's rail-served suburbs are a product of real estate speculation, in which large conglomerations driven by profit motives have successfully packaged together new town and railway investments. While the conglomerations have fabulously profited from selling houses and operating railways, and so have the citizens, through efficient and convenient regional rail services as well as well-designed and mixed-use suburban communities. Similar cases can be found in Chinese cities, such as Shenzhen and Hangzhou, where real estate speculation is also bundled with metro investment. However, they are not as successful as Tokyo because the private players who carry on the responsibility of investing metros after profiting from real estate development did not put money into metro constructions, resulting in the situation that the government eventually took over these projects and needed to find new developers (Zhang 2010). In addition, there are cases in the United States that transit service levels are substantially reduced by private operators because the federal government cut 50% subsidies.

As can be seen, both governmental and entrepreneurial leadership in a TOD development exhibit strengths and weaknesses. TOD projects led by government are believed to be more reliable and continuous in service delivery, because the government in its nature carries responsibilities of protecting public interests. However, skills and capacities of the public sector in making profits or running business at minimum costs are relatively lower than that of the private sector, and budget availability is always limited. The private enterprises which can mitigate financial pressure of the public sector, operate transit more efficiently and innovatively with the introduction of competition. However, they might behave strategically, not complying with contractual terms, reducing service qualities or sometimes even terminating contract unilaterally (ten Heuvelhof, de Jong et al. 2009; Mu, de Jong et al. 2010).

Additionally, in most countries only through an infusion of government subsidies has it been possible to sustain transit service levels by private operators.

### **3.3.4 Compact vs. loose land use and urban design**

In worldwide metropolises, it has been observed that every transit-supportive built form is to a great extent the result of a town planning process that is farsighted, proactive and strategic. And such proactive planning processes are characterized by a high-density and mixed land use design for new towns. Although a few researchers (e.g. Martens 2000) are skeptical about the impact of land use and urban design on travel behavior, many others (e.g. Banister 1999; Cervero 1996; van Wee 2013) have concluded that land use and urban design may have a significant impact on travel behavior or even that it can be a fundamental way to influence travel behavior. The theoretical foundation for the impact of land use on travel behavior is sourced from the utilitarian travel demand theory which postulates that the demand for travel does not derive its utility from the trip itself, but originates rather from the need to reach the locations where activities take place, such as the dwelling, the workplace, and the services (Button 2010). Therefore, apart from the costs of travel (i.e. the individual's valuation of time, money and effort needed to cover the distance), the demand for travel (or the traffic generation) from the utility perspective depends on the needs of reaching certain destinations, and thus depends on the urban land use forms. That means, a high-density and mix-used development may reduce the total volume of passenger and trip length because people can reach the locations for their activities while traveling fewer kilometers and so save time and money. In addition, because of the shorter distance, more destinations can be reached by slow modes, theoretically resulting in a shift from car to slow modes such as walking and cycling. In empirical studies, Miller and Ibrahim (1999) reported that high-density urban forms have lower vehicle kilometers traveled per employee. And high-density is related to the greater use of public transport and increased level of walking. For instance, Cervero (1996) found that an increase in neighborhood density is related to a higher degree of non-car commuting. On the other hand, the degree of mixed land use is found to have a vital impact on travel patterns. For example, Cervero (1996) also reported that mixed land use would reduce motorized travel, spreading trips out more evenly throughout the day, encouraging more employees to carpool and allowing shared-use parking facilities. Frank and Pivo (1994) concluded that higher mixed land use is related to lower single-occupant vehicles, and that mixed land use significantly reduces the vehicle miles traveled, while it increases walking and bicycling. These findings suggest that a high-density and mixed land use urban environment has the potential to reduce auto-dependent travel and to facilitate the use of public transport. In the meanwhile, researchers (e.g. Marshall and Banister 2000; Boddy 2007) also imply that an aesthetic urban form with open space and pedestrian friendly streets is equally important

because the need for walking increases when urban form is built with high-density and mixed land use.

To achieve a proactive town plan, Stockholm's early vision of compact, mixed-use new towns interlinked by regional rail services led to the "pearls on a necklace" built form found today. Copenhagen's Finger Plan provided an eloquent and cogent image of how the city should ideally evolve toward a balanced and self-contained multi-centered new town where business offices, retail centers, industrial sites, bedroom communities and rail stations are located. And in Singapore, by defining some fifty differently sized sub-centers of which the primary lifelines to the urban core are rail connections, the Constellation Plan is widely embraced as the guidance for the island-state's physical development. In contrast to these cities where proactive town plans have been drawn up to guide compact urban development and thus disordered urban sprawl has been tamed, there also exist cities (e.g. Beijing, Shanghai, Karlsruhe, Adelaide) where urban areas have experienced low-density patterns of development due to an absence of such proactive town planning. In such cities, rather than drawing up proactive and strategic plans to guide urban development, they usually adapt transit services to serve the already dispersed urban form. In Beijing and Shanghai, substantial metro lines have been built to reach suburbs. In Karlsruhe, it is the light-rail network that has been expanded to follow land development. Adelaide, on the other hand, uses guided bus-ways as a choice for serving a low-density, auto-oriented Australian market.

### **3.3.5 Transit vs. automobile priority**

International experiences reveal that many successful transit metropolises owe much to their good transit services and effective strategies on restricting car ownership and usage. The level of transit services heavily impacts passenger attraction and thus transit ridership. And good transit services often depend on a high degree of intermodality, affordable fares, comfortable vehicles, a high level of accessibility, frequency and punctuality. In addition, restrictions on car ownership or usage are needed to induce more transit ridership. The extensively used strategies include setting proper prices, such as congestion fees, fuel/carbon taxes, car acquisition taxes and parking surcharges. And it is often argued that with substantially higher motoring fees, people would move closer to jobs and transit stops to economize on travel.

For transport services, many transit metropolises including Zurich, Copenhagen and Ottawa have established the "transit first" programs (i.e. improvements to the existing transit system and the development of rapid transit should take precedence over all forms of road construction and widening) and Zurich and Copenhagen also have reassigned a large amount of land areas, especially downtown streets, to trams, buses and non-motorized transportation. Moreover, many successful transit metropolises feature well-designed transit services through carefully integrated services: high-



capacity mainline services, intermediate connectors and community-scale feeders. In addition, many successful TOD models come from cities in the Netherlands, Amsterdam in particular, where bicycle plays an important role in urban mobility, and of which ample bicycle parking space is provided for riders around railway stations. For many cities in Europe and a growing number of cities in Asian, many public bicycles are offered at metro and rapid bus stations for the purpose of making transfer easy across different modes of public transport. To ensure transit service qualities, many transit cities also adopted modern advanced technologies for buses. Those technologies enable buses to dynamically adjust to shifting patterns of travel as settlement patterns evolve and unfold. And the cost-effective mix of peak-hour express services and off-peak timed transfer feeder services in Ottawa epitomizes the inherent malleability of the bus-based transit and thus improve accessibility.

In addition, an overarching design principle of most transit metropolises is that cities are for people, not cars. In Copenhagen and Munich, parts of the historic cores have been given over to pedestrians and cyclists. In almost all of the European cities, trams and light rails or buses blend nicely with auto-free zones, moving at a pace and operating at a scale that is compatible with walking and cycling. In addition, urban design is very important outside central cities. In the suburbs of Copenhagen and Stockholm, transit stations are designed as community hubs. Rail stops and public spaces (e.g. civic squares) that surrounded them are often town gathering places where people congregate during national holidays and celebrations. Concerning the condition of restricting automobile use, Singapore, Tokyo and Stockholm have mainly taken the form of punitive pricing: steep surcharges on gasoline and automobile purchase, vehicle import duties and expensive parking at city centers. And Singapore has done more than other cities to restrict automobile use by introducing road pricing on a large scale (Sim, Malone-Lee et al. 2001; Willoughby 2001; Han 2010b). However, in most cities in China, the United States and Germany, there is an absence of effective strategies or regulations on constraining automobile ownership or usage, largely due to the reason that automobile industries in these places are still regarded as economic stimulators and a major source of local revenue.

From the above experience in adopting TOD in worldwide metropolises we can generally conclude that several factors are quite essential in implementing TOD. Those include a high-density and diversity of land use, a good-quality and aesthetic urban design, a set of strategies restricting automobile use, a good transit service quality, a good governance with coordinated planning and management mechanism, and a healthy real estate market that provides affordable houses around transit stations. These factors extracted from the global experience are then regarded as indispensable preconditions for successful TOD. And the assumption would be that the more a metropolis meets these preconditions, the more effective its TOD projects would be. We will explain each precondition in more detail in the following section.



## **3.4. TOD Preconditions and Conducive Institutional Incentives**

In the preceding section 3.2, the meaning of TOD, associated with its costs and benefits, contingency and intermodality, has been examined. It has recognized that TOD is very likely to be an effective solution for heading off disorderly urban sprawl, curing problematic level of motorization and congestion, and addressing the resulting increase in energy consumption and environmental pollution due to auto-emissions. However, what factors constitute effective TOD? And what institutional incentives conduce successful TOD? From the analysis of the most salient worldwide TOD experiences in section 3.3, it can be inferred that land use density and diversity, spatial planning and urban design, restraints on automobile use, improving transit services, coordinated planning, decision-making, operation and management, and real estate market are fundamentals to achieve successful TOD.

### **3.4.1 Land use**

As demonstrated, the empirical evidence of worldwide transit metropolises reveals that a high-density and diverse land use is a precondition in favor of TOD. The mixing of land uses allows those who take transit to easily reach multiple destinations by foot once they descend from trains or buses. And a high-density land development increases city vitality and provides more people with closer physical proximity of transit services. Therefore, it has been increasingly recognized that urban development with a fine-grained mix of land uses is able to encourage transit riding, combined with walking and bicycling, instead of automobile travel. However, critics oppose land use initiatives as means of managing traffic demand and argue that preferences for low-density living, especially in developed countries, are so firmly ingrained and that settlement patterns already exist so that attempting to shape travel behavior through physical planning or reconstruction is doomed to failure. Undeniably, land use initiatives in themselves are not panaceas. When combined with other strategies, such as constraints on automobile use, which will be discussed in the following sub-sections, they can exert far stronger and more enduring influence.

Of course, certain institutional incentives are fundamental in helping leverage land use density and diversity, and thus contribute to a transit-oriented development. In both developed and developing countries, the common institutional incentive of controlling land use or land development is the zoning law (or namely zoning regulations, zoning ordinances and zoning codes) (Greenberg 2004; Munroe, Croissant et al. 2005; McConnell, Walls et al. 2006). Areas that have undergone severe sprawl are always the result of single-use and low-density zoning: commercial, residential, administrative and industrial areas are segregated by open space, infrastructure or other barriers and

consequently the places where people live, work, shop and recreate are removed far from each other, usually to the extent that walking and transit use are impractical; and single-family homes on large lots consume much more land per capita (Norton 2008). Therefore, although zoning laws sometimes are regarded as a violation of property rights (when land ownership is held by individuals or organizations, they still cannot fully determine how to use the land), zoning regulations should specify clearly the permitted uses of land, the land functions (residential or industrial), the proportion of each function in mixed uses, and the minimum densities (York and Munroe 2010). It also may regulate block size, building height, and lot coverage, which must be compatible with TOD neighboring uses.

### **3.4.2 Urban design**

One can find examples of high-density and mixed use cities (e.g. Bangkok and Jakarta) that are far from TOD metropolises because what they miss is good-quality urban design. Recently, a small but influential group of architects, advocating “New Urbanism”, sought to transform suburbia into pedestrian-friendly and transit-supportive communities. While embracing high-density and diversity land development, New Urbanism emphasizes the details of what makes neighborhood and cities livable and enjoyable, including architecture aesthetics, public space and pedestrian friendliness, which can influence people’s choice on transit riding and therefore are regarded as TOD preconditions (Saleh and Abdullah 2002; Stanley 2005; Falconer, Newman et al. 2010; Moore 2010; Stevens, Berke et al. 2010). Architectural aesthetics refers to a beautiful and delightful cityscape which retains the city tradition on the one hand and on the other hand new physical settings are organized into a coherent pattern of which districts, landmarks and pathways are easily identifiable and are grouped into an overall pattern. High-quality public space, including open space, public squares and parks, can meet the relaxation and leisure needs of the surrounding community (e.g. play, chat, etc.). And pedestrian friendliness implies a network of streets that is interconnected, linked to transit stations, well installed with amenities and scaled to the convenience of pedestrians.

Therefore, architects, urban designers and planners should base their efforts on institutional incentives that stipulate rules of building design, streetscape design standards and guidelines, location and design of public space and standards for protection historic and cultural conservation districts. In most cases, such incentives are referred as Guiding Principles of Livable Cities (Appleyard, Gerson et al. 1982; Balsas 2000; Jim and Chen 2003; Bigio and Dahiya 2004; Jim 2004). For instance, regulations may limit building design by requiring storefront retail on the ground floor with office and residential above. This will create opportunities for TOD success. In addition, many cities regulate building types that need to be consistent with the existing building patterns and creative, while in other cities, there are regulations directing that buildings should be oriented to the street with a primary entrance facing the street and a certain

percentage of glass at the ground level. Furthermore, many regulations include standards for public space and streets. A certain minimum proportion of public space relative to the urban area is often stipulated, and sidewalks are consistently required on all public streets. Many localities delineate different sidewalk zones to allocate space for plantings and street furniture, sidewalk dining or vendors. And some other ordinances or design codes establish standards for special paving or other distinctive treatments such as pedestrian-only streets.

### **3.4.3 Constraints on automobile use**

From worldwide experience, it can be asserted that constraints on the use of automobiles are effective at inducing modal shifts from private car travel to transit riding. There are policies and measures that make car travel faster and more convenient with cheap parking. This is feasible in areas without space limitations. In urban areas, in particular in large cities, however, excessive implementation of car-use policy incentives has been the primary cause of present problems in many cities. Therefore, strategies for restricting automobile usage are perceived as another important TOD precondition. In light of this, in contrast to those car-use policy incentives, policies and measures are needed and should be designed to make car travelling less attractive.

These incentives can be classified as physical (design of streets to the disadvantages of car travel), regulatory (prohibition of car traffic in certain ways) and economic/pricing (charges for driving-related behavior) (Vuchic 1999). The physical incentives can be achieved by enhancing the livability of neighborhood streets/zones which are designed as extension of residential houses, a place to walk, chat and play, that is traffic calming because speed is controlled or even car driving is forbidden (Brindle 1992; Herrstedt 1992; Kjemtrup and Herrstedt 1992; Allpress and Leland Jr 2010). This is what has been discussed in the above urban design sub-section. The regulatory incentives, however, include measures such as even/odd license numbers which is a decree that on alternative days only cars with even or odd license numbers respectively may be driven, car purchase through lotting which is a method aiming at reducing the number of people who can buy a car and consequently controlling private car ownership. In addition, regulations should also aim at parking control: parking subsidy and supply should be reduced. Related to this, an anti-parking validation scheme may be introduced especially for merchants who operate shopping malls and view customer free parking as a competitive marketing tool. This scheme aims at providing the same or similar non-free parking conditions for all stores in a given area, or otherwise any store that validates parking must also compensate passenger fares for customers who come by transit. Similarly, an anti-parking reimbursement scheme should be adopted by government on those employers who provide their employees with parking allowance (Verhoef, Nijkamp et al. 1995; Petiot 2004; Albert and Mahalel 2006; Calthrop and Proost 2006). Finally, the economic incentives are often considered pricing

strategies, including registration fees and taxes of car purchasing, fuel taxes, toll roads, congestion pricing as well as the just mentioned parking surcharges (Wang 2010).

### **3.4.4 Transit service qualities**

Given the fact that many countries encourage car ownership to strengthen their automobile industry, the above mentioned policies might seldom be taken into account. In addition, the incentives concerning car-use pricing also present a major problem for contemporary societies where people have a rising personal disposable income and may do not care much about the surcharges. As a result, policy measures should also focus on increasing the role of transit, and seen from the worldwide experiences high-level qualities of transit services are regarded as fundamental TOD preconditions.

Common practice in many western European countries, transit first policy is the most basic institutional incentive improving several aspects of transit service qualities such as speed and punctuality, and is accordingly conducive to more transit riding. This policy may set regulations that allow transit vehicles to travel faster and to experience fewer delays along their routes because under this paradigm transit vehicles are separated from private traffic by curb-protected lanes. At signals, they either get a green light before other traffic, or get an immediate green light as they approach an intersection. Transit stops are located conveniently for pedestrians and transit vehicles are allowed to travel through certain neighborhoods where other vehicles are prohibited. The benefit of the transit first measures lies not only in the better services they provide, but in the distinct image and competitive advantages they give transit over other traffic (Dion and Hellinga 2002; Eichler and Daganzo 2006; Zhou, Gan et al. 2007; Liu, Zhang et al. 2008; Mesbah, Sarvi et al. 2011). Apart from the transit first policy, institutional incentives effective for conducting more transit riding are related to intermodal integration in order to ease modal transfers. We will discuss them in more detail in the following sub-section. Besides, fare policy which has a significant impact on the attraction of travel by transit is recognized as the most important institutional incentive determining the level and structure of ticket pricing (Gkritza, Karlaftis et al. 2011). The fare policy should present an optimal balance between the need to maximize revenues and the dominant goal of fare affordability. However, how high fares can be while still attracting potential riders depends on local conditions in a city, the pricing of other competing transport services as well as the amount of subsidies local governments can offer to compensate operation lost. Last but not least, regulations on the use of advanced technologies which can detect and record service qualities such as headway, punctuality, speed and safety, can be effective monitoring incentives (Tyrinopoulos and Antoniou 2008).

### 3.4.5 Urban governance

There are a growing number of calls for greater coordination in processes of planning, policy-making, operation and management of a TOD project. This is in an age where decision-making is facing increasing complexity as a result of various trends such as fragmentation and decentralization of public administration and a higher number of actors involved in the policy process, the emergence of the information society, greater emphasis on public participation and the increasing role of non-governmental organizations. All these trends make urban governance where policy-making and implementation is coordinated difficult but more compelling to achieve.

However, some institutional aspects are recognized as barriers of coordination. For instance, coordination is less likely when government departments and agencies are able to develop policies or to draw up plans in isolation and in the absence of overall objectives. For instance, plans and policies of land use and transport in an urban area can be made separately if departments for spatial planning and authorities for managing urban transport are totally autonomous. Accordingly, policy inconsistencies can arise, and often policy measures are only able to fulfill department-specific targets rather than the problems outside the department. In addition, there is a phenomenon that although it seems that different departments enjoy equal status in administrative and political sense, there is often the fact that the influential power of one department/agency relative to others is different. Taking China's transport sector as an example, the railway department is much stronger than any other transport department including road, waterway and civil aviation, not only in terms of the large organizational size, but also its stupendous political and economic influences. In such circumstances, the department with stronger power to make decisions might be probably not willing to cooperate with others due to various reasons such as vested interests (Geerlings and Stead 2003; May, Kelly et al. 2006; Hull 2008; Stead 2008).

Aiming at these problems, institutional incentives should be well designed to promulgate effective coordination. Some institutional mechanisms are regarded as useful tools to increase the likelihood of coordination if they are well implemented and enforced. One way is coordination by authority: affecting relevant actors' decisions and behaviors by command and control. Examples include setting up umbrella organizations with legal power such as interdepartmental committees, working groups, and steering/monitoring groups which can help bring decision-makers from different authorities and agencies together and promote communication and cooperation. Another way is the exchange of information and good practices. This can be realized to some extent by human resource policies such as job rotation and concrete activities such as periodical conferences on specific policy issues that can be used to promote mutual understandings between different departments and to facilitate dialogue and exchange of information. The third way is related to cultivating shared values and goals, and in this case coordination is largely based on solidarity and/or reciprocity,

even in absence of mandate controls or monitoring mechanisms (Alexander 1995; Stead 2008).

### **3.4.6 Real estate market**

Important but less often mentioned in the international empirical studies, effective TOD is also strongly associated with the local condition of the real estate market which should deliver mixed-income housing in transit served neighborhoods. As TOD grows increasingly popular and land developers recognize its potential, there is a danger that virtually all of the new development near transit might be unaffordable to lower income households. It is also probable that new or enhanced transit service could trigger considerable displacement in existing low-income and mixed-income neighborhoods. The high price levels emerge partly because of the high cost of land in and around existing and future transit stations and also because usually small parcels of land around stations make it difficult for developers to find sites that are large enough to economically produce high density and high-rising housing that could keep prices down.

The incentives conducive to TOD inevitably are associated with the above mentioned land use institutions that promote a diverse land use within the TOD communities through zoning regulations. However, they also relate to the regulatory policies that focus on the management of the commercialized real estate market and on the public housing program. The main objective underlying the commercialization of the urban housing system is to give an official ending of the allocation of welfare housing and consequently to reduce the state's burden of housing provision to the public. It thus largely depends on the ability of the "invisible hand of the market" whether the demand and supply sides of urban housing are regulated. This gives rise to the problem of a rapid increase in housing prices under the influence of rural-urban migration, and it leads to some degree of market failure when real estate speculation emerges. The speculators who treat the houses as investment assets rather than living space strategically raise the housing price and gain excessive profits, which seriously threatens housing affordability. Therefore, the institutional incentives should pay more attention to restricting the strategic purchase of houses and property transfer. Regarding the public housing projects, scholars and worldwide governments hold contrasting views. Some argue that the ineffectiveness of the "invisible hand" necessitates the existence of public housing programs, especially for low-income households, in order to keep a mixture of housing types at the TOD precincts. Others argue that housing the urban poor in high-density public houses is patently destructive because public housing projects have become traps of the poorest of the poor rather than a launching pad for families trying to improve their lives. Aiming at this issue, international practitioners advise to introduce incentives allowing the government to transform project-based public housing subsidies into tenant-based rental assistance (Rusk 1995; Rusk 1999).

When we look into these conditions, however, we can make a distinction between critical and important conditions. For instance, urban design, “pedestrian friendliness” in particular, is one of the critical conditions for effective TOD: only if the streets are well paved, installed with facilities such as light and infrastructure to permit crossing, isolated from high-speed traffic, effectively connected to transit service, clean and even decorated green, TOD can be realized. In addition, good governance is also a critical condition because a weak administration system that is fragmented, or does not have a strong and smart vision on urban development can never produce TOD. Moreover, service qualities of the public transport system constitute another critical condition since high quality levels are essential for attractiveness to the passenger and fundamental for a favorable modal split for public transport. Regarding factors such as congestion pricing and imposing taxes on car use, they would be merely important conditions: they help TOD but the realization of TOD does not entirely depend on them. Furthermore, conditions like land use and housing supply can also be regarded as important conditions. The reason is that there are various American and European cities that do not possess density levels as high as those of Asian cities but those have successfully become transit-oriented metropolises. Such a distinction in conditions allows us to think further: if there must be a sequence in satisfying these conditions in the process of adopting the TOD policy because of resource limitations and/or urban specific contexts, which conditions should be given priority? And can TOD work in a reasonable way if some of the important conditions are not fulfilled?

Finally, the establishment of the conditions for an effective TOD, affirming how things should or ought to be to achieve TOD, implies that TOD is a normative concept. Furthermore, to fulfill these conditions, we should not perceive TOD as a static concept, but rather a direction, or a transition (Rotmans and Loorbach 2009). The reason is that combating the urban crisis aroused by the problematic level of motorization requires a restructuring of urban system that is a result of a coevolution of the urban subsystems such as natural, physical, social and actor as depicted in chapter 2. Obviously and already demonstrated in chapter 2, urban systems, because of their complexity, cannot be intervened in command and control terms. We, however, hypothesize that it is possible to influence the direction and pace of a transition of an urban system into a more TOD direction. Therefore, the fulfillment of these conditions does not simply mean the realization of TOD, but it creates a more favorable environment where TOD policies can be implemented.

### **3.5. Conclusions**

To summarize, in this chapter we have studied the concept of transit-oriented development by exploring its associated costs and benefits, comparing different kinds of transit modes and analyzing the circumstances of fitting the appropriate transit



modes into different sized cities, and emphasizing the importance of intermodality in this concept. Good and bad experiences with adopting TOD in worldwide metropolises are investigated and contrasting lessons are drawn concerning the issues of centralization vs. decentralization in planning and decision-making; formal vs. informal coordination; government vs. entrepreneur leadership; compact vs. loose land use; and transit vs. automobile priority. Accordingly, these experiences imply a number of preconditions that underlie effective TOD. Examples include high levels of diversity and density in land use; pedestrian friendly, beautiful and vibrant urban environment; the presence of effective strategies on restricting car use; giving transit priorities and improving transit service qualities; proactive and coordinated planning and decision-making in urban governance; and a healthy real estate market. To fulfill these preconditions, they are further distinguished between critical and important ones, as summarized in table 3.3.

Table 3.3 TOD preconditions

Preconditions		Literature	Important?	Critical?
<b>Urban Design Conditions</b>				
<i>Architecture aesthetics</i>	An attractive cityscape retaining the city traditions on the one hand and on the other hand organizing new physical assets into a coherent pattern of which districts, landmarks and pathways are easily identifiable and grouped into an overall pattern.	New Urbanism (Saleh and Abdullah 2002; Stanley 2005; Newman and Jennings 2008; Falconer, Newman et al. 2010; Moore 2010; Stevens, Berke et al. 2010) emphasizes the importance of architecture aesthetics and civic space in creating livable and enjoyable neighborhood that is transit-supportive;		√
<i>Public space</i>	A provision of high-quality public space, including open space, public squares and parks, to meet the relaxation and leisure needs of the surrounding community (e.g. play, chat, etc.).	Government and policy advice reports (Appleyard, Gerson et al. 1982; Transportation Research Board 2004; Wright 2005; Steer Davies Gleave (The Transportation Consultant) 2009; Queensland Government 2010)		√
<i>Pedestrian friendliness</i>	A network of streets that is interconnected, linked to transit stations, well equipped with amenities, and scaled to the convenience of pedestrians.	also put much emphasis on the construction of open space, civic amenities and pedestrian friendly streets for successful TOD.		√

<b>Governance Conditions</b>		Academic work as well as government reports (Chisholm 1989; Certero 1998; Williams 1999; Goodwill and Hendricks 2002; Geerlings and Stead 2003; May, Kelly et al. 2006; Wu 2007; Hull 2008; Stead 2008; Vanessa 2009; Hull 2011; Mu, de Jong et al. 2012) point out that effective city governance in terms of public transport coordination (or system integration) and proactive/strategic new town planning can help TOD.		
<i>Transport service coordination</i>	An established approach for inter-organizational coordination in the processes of transit design, planning, operation and management, as well as for the coordination between land use planning and transport planning.			√
<i>Pro-active town planning</i>	A forward-looking and visionary regional/local planning approach, including the setting of project objectives, the formulation of land use visions, the careful evaluation of alternatives for transit investments with realistic budget constraints and strategies for implementing the plan.			√
<b>Land Use Conditions</b>		Land use in the form of a high density and diversity has been widely regarded as factors that contribute to TOD implementation in various literature (Bernick and Certero 1997; Certero and Landis 1997; Badoe and Miller 2000; Rodier, Johnston et al. 2002; Dittmar and Ohland 2004; Lin and Gau 2006; Loo, Chen et al. 2010; Oлару, Smith et al. 2011; Sung and Oh 2011).		
<i>Density</i>	A high-density urban development (or dense residential areas) to increase vitality and to provide closer physical proximity of transit stations, protecting against the urban sprawl characteristic of car-oriented city planning.		√	
<i>Diversity</i>	A mix of land uses to create a greater variety of daily services catering for the diverse needs of a community (e.g. retail shops, schools, restaurants, hospitals, banks, pharmacies, bookstores, health clubs, etc.).		√	

<b>Conditions for Restricting Automobile Ownership and Usage</b>		A large body of literature confirms that imposing constraints policies on automobile use and purchase is preferable for the adoption of TOD (Brindle 1992; Herrstedt 1992; Kjemtrup and Herrstedt 1992; Foo 1997; Foo 1998; Crawford 2000; Foo 2000; Willoughby 2001; Mark 2002; Albert and Mahalel 2006; Calthrop and Proost 2006; Allpress and Leland Jr 2010; Han 2010b).		
<i>Tax/fee on car acquisition</i>	A legitimate surcharge over car purchase, registration and/or obtaining plate.		√	
<i>Tax/fee on fuel</i>	A legitimate surcharge over fuel use.		√	
<i>Congestion/road-use pricing</i>	A legitimate surcharge over driving in city center area.		√	
<i>Parking</i>	High parking fees or other restrictions and curbs on easy and cheap parking.		√	
<b>Transport Service Conditions</b>		A wide range of international experiences and user surveys (Cervero 1998; Vuchic 1999; Vuchic 2005; Joewono and Kubota 2007; Vuchic 2007; Currie and Wallis 2008; Tyrinopoulos and Antoniou 2008; Joseph 2011; Lai and Chen 2011; Morency, Trépanier et al. 2011) have shown that high levels of transit service qualities can give public transport system strength in competing with private automobile and thus helping TOD.		
<i>Intermodal connections</i>	A high level of physical interconnectivity of different transport modes to facilitate modal interchange and transfer.			√
<i>Fare</i>	A pricing mechanism that ensures the affordability of transit services for different groups of people and improves the profitability of transit provision.			√
<i>Accessibility</i>	A high coverage/density of the transit system.			√
<i>Headway</i>	A short time interval between departures			√
<i>Punctuality</i>	Arrival at scheduled hours.			√
<i>Comfort</i>	Vehicles with good conditions (fresh air inside vehicle; cleanness; good seats, etc.) and stops with good amenities for waiting and disembarking.		√	

<b>Real Estate Market Conditions</b>			
<i>Mix of housing types</i>	A regional or local real estate market supporting transit development by supplying diverse types of housing, such as houses for the rich and poor, houses for singles and families, houses for young and old, as well as houses for sale and rent.	There are quite a few studies that investigate the role of real estate market conditions on effective TOD, and TOD's impact on land value/housing price (Cervero and Landis 1993; United States Government Accountability Office 2009; Cervero and Kang 2011; Du, Ma et al. 2011; Olaru, Smith et al. 2011; Jun 2012).	√
<i>Housing affordability</i>	A limited percentage of income spent on housing, especially for lower income groups.		√



## 4. Dalian Profile: the Context of the Case

### 4.1. Introduction

Dalian is located at the southern tip of the Liaodong peninsula in northeast of China, with the Yellow Sea to the east and the Bohai Sea to the west, providing Dalian with a vast hinterland area for its shipping industry. It also offers Dalian an advantageous location to serve as a marine gateway to Beijing and other regions of northern China (figure 4.1). As the second largest city in Liaoning province, next to the capital Shenyang, the city has a significant history of being used by foreign powers as a port. Today it serves as a regional financial base and an important international shipping center and logistics hub in Northeast Asia. The city had a total administrative area of 12,573 km<sup>2</sup> in 2010, including 389 km<sup>2</sup> urban areas, 2,309 km<sup>2</sup> rural areas and 9,875 km<sup>2</sup> protected ecological areas/natural preserves. Urban areas include four districts (Xigang, Zhongshan, Shahekou, and Gangjingzi), while the rural areas consist of two suburbs (Lvshun and Jinzhou) and three county areas (Pulandian, Wafangdian, and Zhuanghe) (figure 4.1). In our case, we narrow down the geographical boundary from the greater Dalian region to the urban areas of the city. The reasons are simple: the complexity of public transport services, in terms of physical network and operational mode, as well as the travel behavior of the residents are extremely different between urban areas and counties and suburbs.

As a result of chronic tectonic movement, Dalian's topography abounds with mountains and hills, while plains and lowlands are rarely seen. The terrain, high and broad in the north, low and narrow in the south, tilts to the Yellow Sea in the southeast and the Bohai Sea in the northwest from the center. The Qianshan Mountain range of the Changbaishan Mountain system passes through the whole city from north to south. For this reason, mountain regions and long eroded foothills are widely dispersed within the city (totaling 80% of the terrain). Plains and lowlands (20%) are only interspersed near the confluence and in some valleys. Therefore, karst topography and sea erosion topography are everywhere. As a consequence, Dalian's utilizable land resource is scarce, and it is risky for underground space development due to the high possibility of landslide. Therefore, efficient urban planning, especially land use planning, as well as the sound design for transport infrastructures appear to be crucial for people's living and travelling.

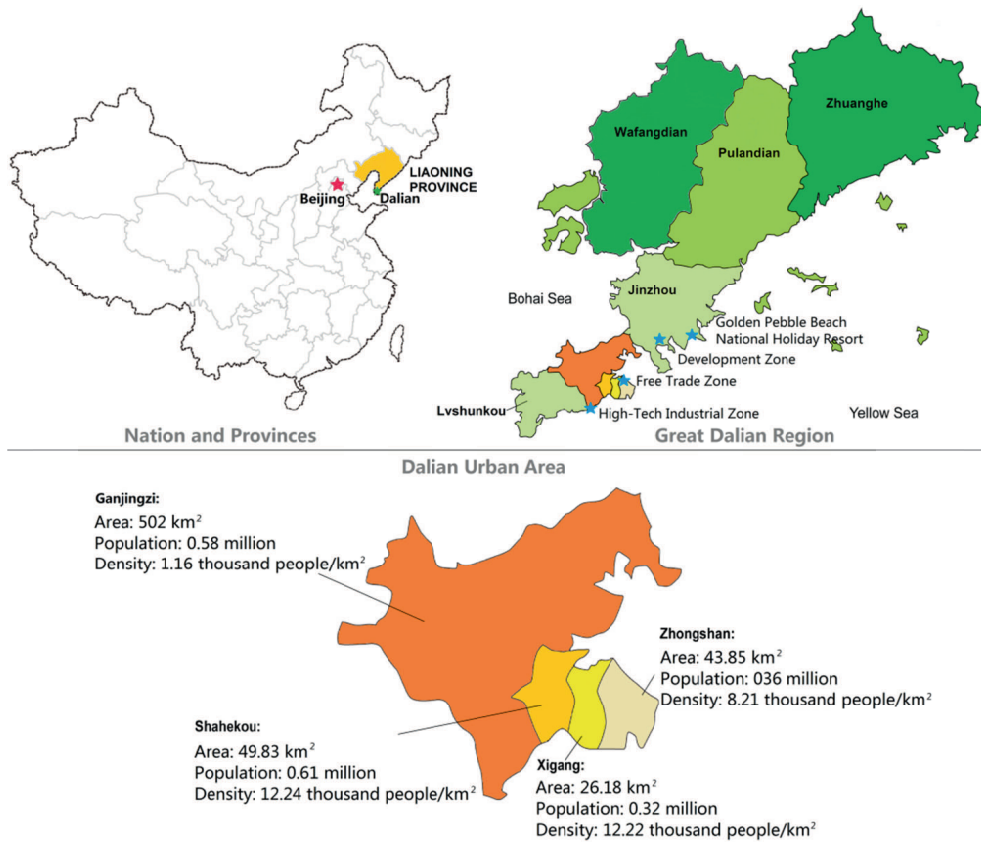


Figure 4.1 Dalian Geography

Since China's economic and political reforms, Dalian has enjoyed a continuous GDP growth because it is one of a few cities that were designated by the Chinese government as the first areas open to foreign investment, with special economic policies, new systems of management and experiments with land markets. In 2010, the city's GDP registered a 15.2% increase, reaching 515.8 billion RMB (Dalian Bureau of Statistics 2010). Its economic achievement thus ranks number one in Liaoning province, and it is ranked 13<sup>th</sup> among all Chinese cities in 2010. GDP per capita in 2011 has reached 77,704 RMB, also ranking first in Liaoning province and 17<sup>th</sup> in China. Along with this economic development, the city-state of Dalian has progressed from a small fishing village to one of China's most dynamic and modern industrialized economies (Geng, Zhu et al. 2009). In addition, Dalian is also one of China's most prosperous business areas as well as a distribution center for goods and materials throughout Northeast China. It acts as a key hub of land and sea communications with the Dalian Container Port linking more than 20 international ocean-shipping routes, playing a significant role in generating the local economic growth. In 2011, the urban residents totaled 3.6 million. And its growth is mainly driven by rural migration (the migration



rate is around 16% per year). Regarding the natural growth rate, it has been kept at 1.7% in recent decades.

In parallel with its economic development, Dalian has heavily invested in transport infrastructures in the past thirty years. Most significant is the high-speed rail linkage between Dalian, Changchun, and Harbin with a length of 904 km, which was opened to traffic in mid-2012. It creates the fastest passenger mobility in the northern part of China. As for the urban rails, Dalian has one light-rail in operation with a length of 48.6 km, and in 2015 the scale of the urban rail network will increase by 191 km, accompanied with the completion of four metro lines. Regarding roads, Dalian has the first (in 1990) and the widest (8-lane) expressway in China, connecting the city to Shenyang with a length of 350 km. For urban roads, the total length is about 997 km in 2009, in which there are 25 km urban expressways and 198 km trunk roads. The road network occupies about 10% of the total urban utilizable area. With respect to the public transport, Dalian has 105 bus lines (including 1 rapid bus, 2 streetcars, and 1 trolley bus), totaling about 1,200 km with a coverage of 3.2 km/km<sup>2</sup>. In addition, Dalian has the largest multi-purpose port in Northeast China serving the seaports North Asia, East Asia and the Pacific Rim. It has 81 international container routes and 48 berths. It covers an area of 18 km<sup>2</sup>, its warehouse area has reached 320 thousand km<sup>2</sup>, and its yard area is about 3.2 million km<sup>2</sup>. Dalian port handles about 100 million in cargo throughput annually. Regarding Dalian airport, it has one 3.3 km runway (class 4E) and a 65 km<sup>2</sup> terminal building. As of late 2011, 2.2 billion RMB has been spent on the expansion project of the airport which is a new 71 km<sup>2</sup> terminal building. In 2010 the airport handled 11 million passengers, making it the busiest airport in the Northeast of China and the 16<sup>th</sup> busiest nationwide.

## **4.2. Dalian Urbanization in History**

### **4.2.1 The Russian lease period (1898-1905)**

Historically, the settlement was occupied by the British in 1858 for port construction, returned to the Chinese in the 1880s, and then occupied by Japan in 1895 during the first Sino-Japanese War. Based on the Treaty of Shimonoseki Japan intended to lease the port and its surrounding areas. However, due to the Tripartite Intervention by France, Germany and Russia, the Russian Empire in 1898 succeeded in leasing the peninsula from the Qing Dynasty. Since then, Dalian became Russia's primary port-city in Asia by linking it to the Trans-Siberian Railway's branch line, and for this reason the Russian government contributed more than 10 million golden rubles to the further construction of the city. Therefore, most of today's downtown area and the port were developed and heavily fortified by the Russians with classical and baroque style

architecture and cobweb fashioned street networks in the period prior to 1904 when the Russo-Japanese War broke out (Liu 1999) (figure 4.2, picture 4.1).

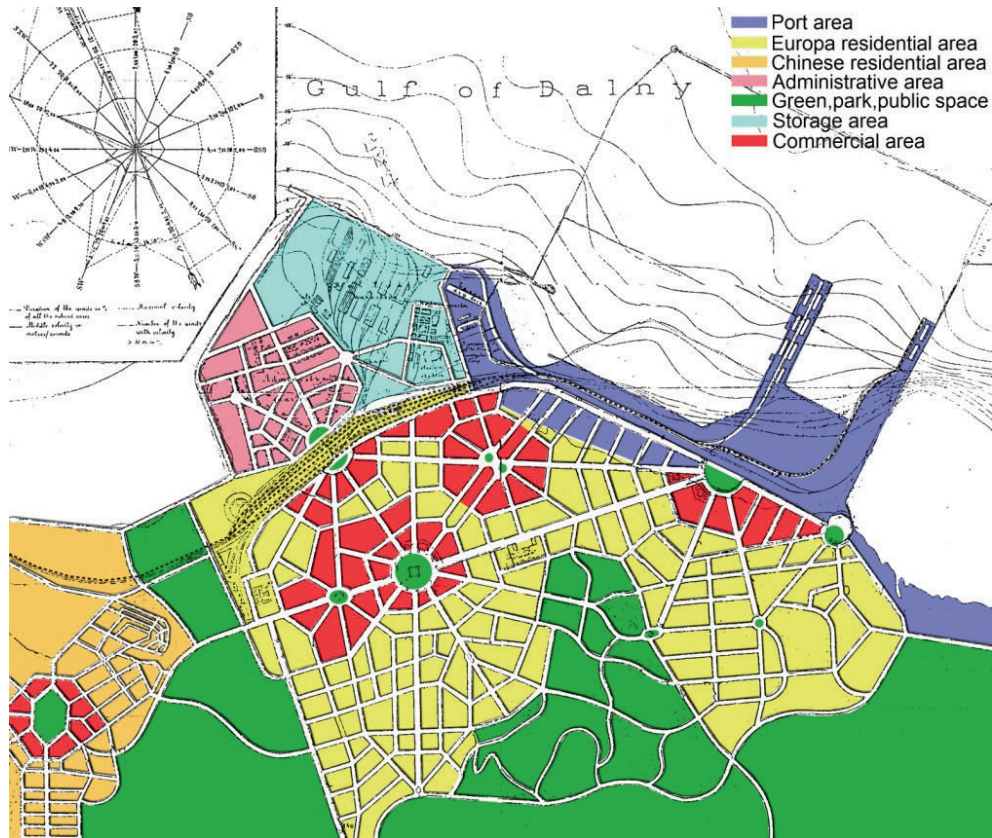
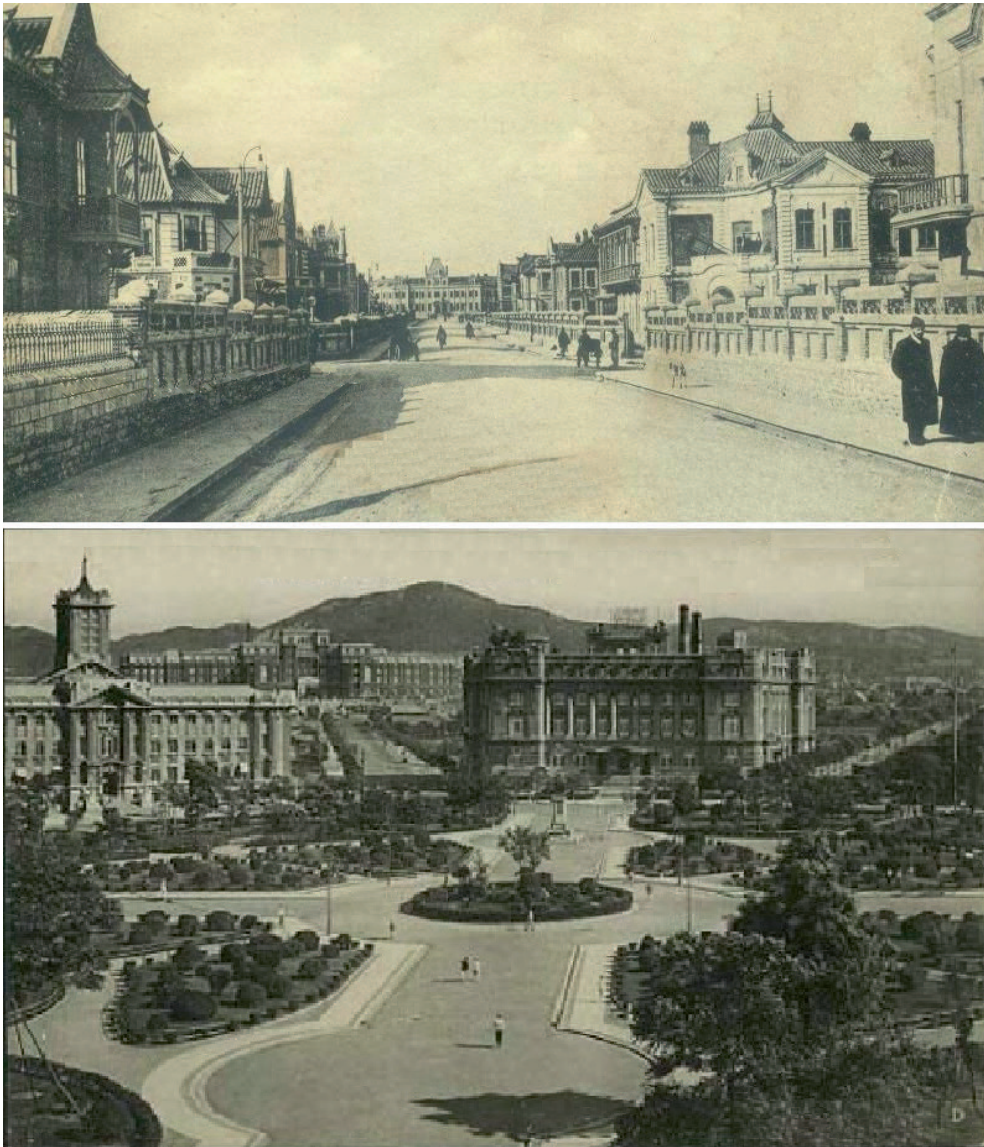


Figure 4.2 Dalian urban form during the Russian lease period

Table 4.1 The diversity of land use during the Russian lease period

Land functions	Areas (km <sup>2</sup> )	Percentage
Public squares, green areas and parks	1.036	16%
Residential area	2.212	34.17%
Commercial area	1.316	20.33%
Administrative area	0.382	5.9%
Storage area	0.21	3.23%
Port and railway station area	1.318	20.37%
Total	6.474	100%



Picture 4.1 An attractive neighborhood and street, a pedestrian-friendly square during the Russian lease period of Dalian.

As figure 4.2 shows, the total planned urban areas were about 6.5 km<sup>2</sup> with a population of 60 thousand, among which 0.44 km<sup>2</sup> land was planned for administrative functions which also includes some living space for the public officials and their families, 4.14 km<sup>2</sup> land was designed as the Europa area with mixed functions including residential land use, commercial land use, public space, as well as the main transport terminals, i.e. the port and the railway station. In addition, around 1.92 km<sup>2</sup>



land was assigned to the purpose of providing the Chinese people with living space. The diversity of land use during the Russian lease period can be read from table 4.1. From this urban plan and implementation, we can see that the public space has been paid much attention to, accounting for 16% of the total developmental area. In addition, the baroque architecture style and cobweb fashioned street networks are highly suitable for walking and carriages which were historically the main modes of urban transport.

#### 4.2.2 The Japanese occupation period (1905-1945)

After the Russo-Japanese war, the port was conceded to Japan which extended the land use area in the Russian period for the purpose of adding some industrial land use arrangements, and developed the southern part (i.e. Lvshunkou district) of the present Dalian as its military base. Therefore, the city was enlarged and modernized by the Japanese. In the early stage of the Japanese occupation (1905-1919), the Japanese government followed the urban planning method of the Russian people, distinguishing land functions into the military use, residential area for Japanese, and living space for Chinese. In this period, the Japanese government allowed and encouraged the migration of the Japanese people to Dalian, and thus there has been a sharp increase in its urban population from some 60 thousand in 1905 to about 700 thousand in 1945. As a consequence, the Japanese government made several plans for urban expansion, in which more than 40 km<sup>2</sup> new land area in western Dalian was gradually added to the origin planned area in the Russian period (figure 4.3). And differing from the cobweb fashioned street network, the Japanese planners designed a grid pattern street network, which was somewhat disconnected with the cobweb-style street network at the interface.

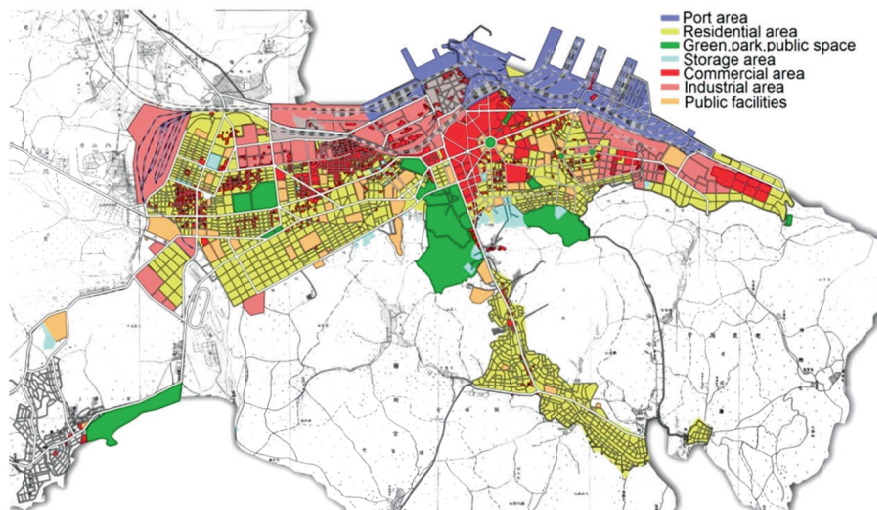


Figure 4.3 Dalian urban form during the Japanese occupation period

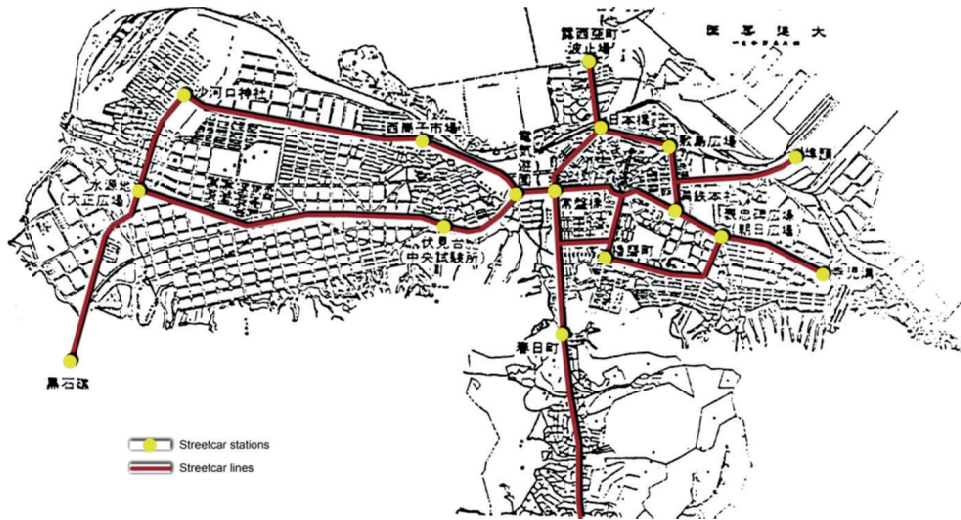


Figure 4.4 The streetcar network in 1925

As a result of the population increase, urban expansion and the growth in traffic volume and distance, the Japanese government planned and constructed 3 streetcar lines, totaling 9.8 km (figure 4.4). These rail-based transit lines, therefore, assumed almost all of the travel demand of the citizens at that time. One streetcar is red colored, without seats in vehicles, mainly transporting physical workers from their residential locations to the railway station and the port to work, while the other two lines equipped with seats are white, running in the west-east and north-south corridors in Dalian's urban area. In spite of the absence of data regarding the diversity of land use, available information implies that the areas of public space have been largely reduced to 0.13 km<sup>2</sup> from the original 1.036 km<sup>2</sup> in the Russian period. And large tracts of land in the current urban core were designated for industrial manufacturing. The commercial area as it was in Russian lease period remains, while many pieces of land in western areas were built up with small-scale commercial market among the residential areas. Although the Japanese occupation period has witnessed Dalian's first urban expansion, we can see from the plan of the streetcars that the public transit system has been given much attention to cope with this urban sprawl (Liu 1999). And picture 4.2 shows the lovely street landscape.



Picture 4.2 A comfort environment and urban landscape for pedestrian helps streetcars succeed in the Japanese lease period of Dalian.

### 4.2.3 The PRC centrally-planned economy period (1945-1990)

After the unconditional surrender of Japan in 1945, China took back the administrative power over Dalian under a centrally-planned economic approach. But because of the Second World War, China's Civil War and the Korean War, Dalian's urban planning was not on the policy agenda, and thus its urban construction did not experience significant development until 1958 when the Chinese government drew up the first urban plan for Dalian. For urban size and density, the ideology of this plan dictated urban planners that "it is not good if cities are too big" partly because many of the urban ills tended to occur when "cities grow too big" and partly because excessive urban concentration would exacerbate the devastating effects of nuclear attacks from the US. As a result, the central government instructed the urban planners that "we



must disperse the urban residents to the rural areas because under the condition of atomic war this would be relatively beneficial". This ideology was reinforced by the *hukou* system (i.e. household registration system) introduced in 1958 that limited residential migration from rural to urban areas. Despite these efforts to prevent large scale urbanization in the first ten years of the PRC, Dalian expanded dramatically into the western and northern areas because of a rapid increase of urban population resulting from famine in the countryside in 1960s (figure 4.5).

As regards the city layout, urban commercial areas in the Russian and Japanese periods were replaced by residential and industrial purposes because service activities and consumption were considered to be "non-productive" and even "exploitative" in "old" China and they were believed to exploit the surplus value yielded by the industry and to create no new wealth for society (figure 4.5). Moreover, the essence of this plan, which is the same as those of other Chinese cities, is to organize land use based on a *Danwei* scheme. *Danwei* (or work unit) is a generic term denoting the socialist working place in China. Apart from salary, *Danwei* used to provide employees a comprehensive package of welfare and services including housing, medical and educational facilities such as clinics and kindergartens, daily life facilities such as dining halls, bathing houses, sports fields and shops. Most importantly, *Danwei* assumed the full responsibility of housing provision for its employees. Employees were allocated housing according to their ranks, needs, and years of service in the *Danwei*. This system left the employees no choice but to live in houses allocated by their affiliations, and normally these houses were affordable, small but enough as dwellings. Therefore, before the 1980s, the *Danwei* was the basic unit of economic, social and spatial organization in which economic activity, social life and political control were integrated in urban areas. As a result, the land use pattern showed high levels of density and diversity. Because of such jobs-housing relationships, residents' commuting trips were extremely short and could be made on foot. And due to a mixed land use structure, most people's travel needs for daily activities were concentrated in the *Danwei* area (which ranges from some 0.4 km<sup>2</sup> to 0.7 km<sup>2</sup>, the scale equivalent to a TOD neighborhood defined in chapter 3). For this reason, two of the streetcars inherited from the Japanese period were cancelled and only one streetcar remained. For long distance trips, people took buses that were distributed over the road network and carried 74% of all urban trips, while cars were rarely seen on streets. The following photos give an illustration of Dalian landscape during this period (picture 4.3).



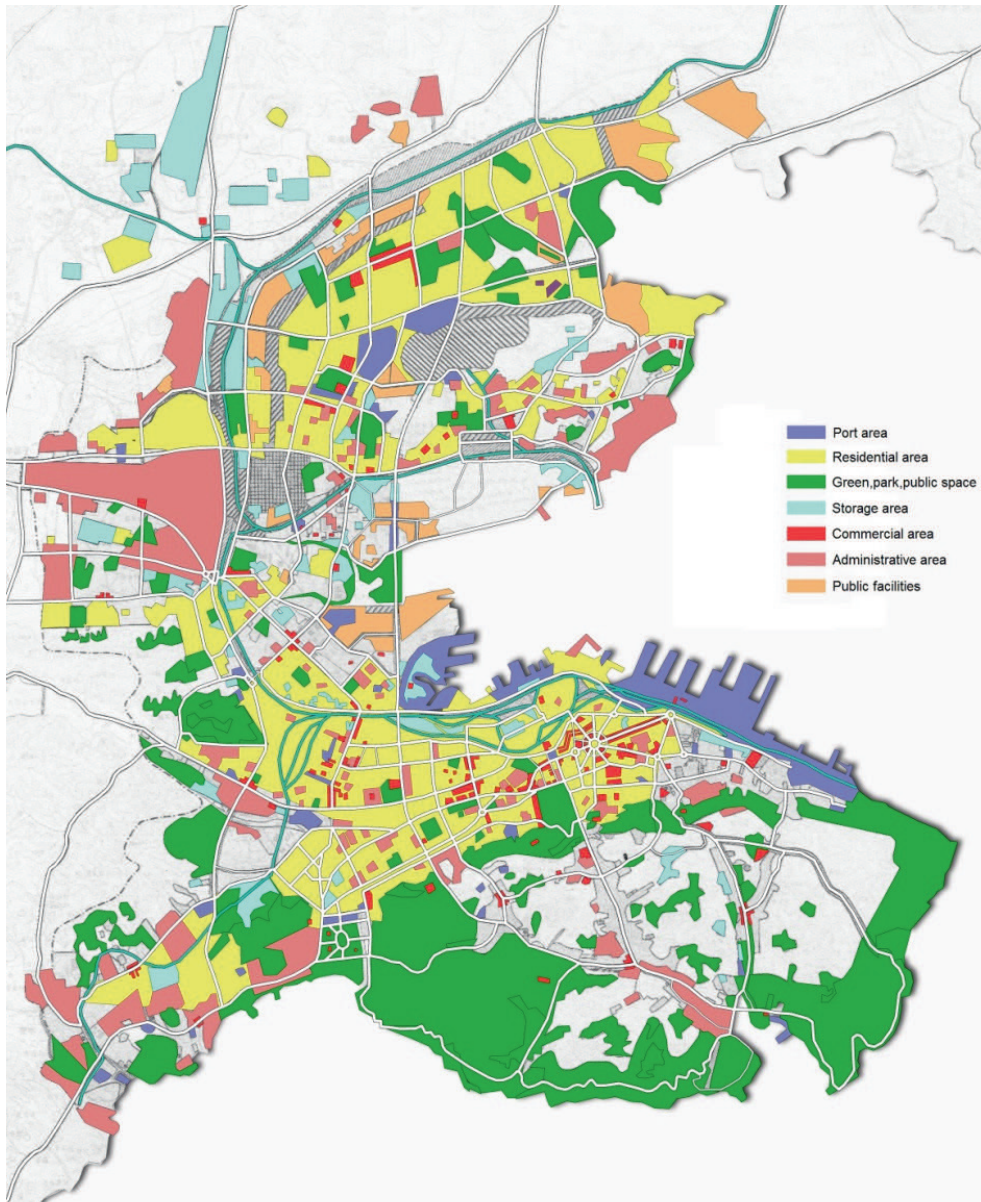


Figure 4.5 Dalian urban form during the centrally planned economy period



Picture 4.3 Buses and streetcars can fulfill the traffic demand of Dalian citizens living in the *Danwei* system during the centrally planned economy period.

#### 4.2.4 The early economic reform period (1990-2000)

China's market-oriented reform was formally proposed in 1978 but was practically implemented after Deng Xiaoping's Southern tour in 1992. This economic reform has not only revitalized the economy but also changed the physical structure of Chinese cities, which used to be largely determined by the socialist *Danwei* system. *Danwei*'s dominance in employment changed with the emergence of market-based employment organizations such as joint-ventures and privately-owned firms that employed an increasingly large share of the work force. As the figure shows, until late 2000 almost 40% of the national urban workforce was employed by various kinds of market-based firms,

and the figure is much higher today. Different from the traditional *Danwei*, these market-based firms pay salaries but do not provide employees with housing. And many non-essential functions have been removed. People resided in housing rented or bought from the open market. Many of these houses are located in outskirts, far from the places of work, and with larger space but relatively cheap. Figure 4.6 shows Dalian's urban expansion towards its northeastern periphery during the early economic reform period. As a consequence, the levels of diversity and density of land use as they were in old times have been largely reduced. And thus the balance between land use and urban transport was broken: jobs-housing commuting distance was much longer than before. And in pace with such an urban expansion, the Dalian government extended the road network with public funds to cater for new land developments: urban elevated high-speed roads were constructed; and the trunk road network was also heavily expanded in comparison with the situation of the 1980s.

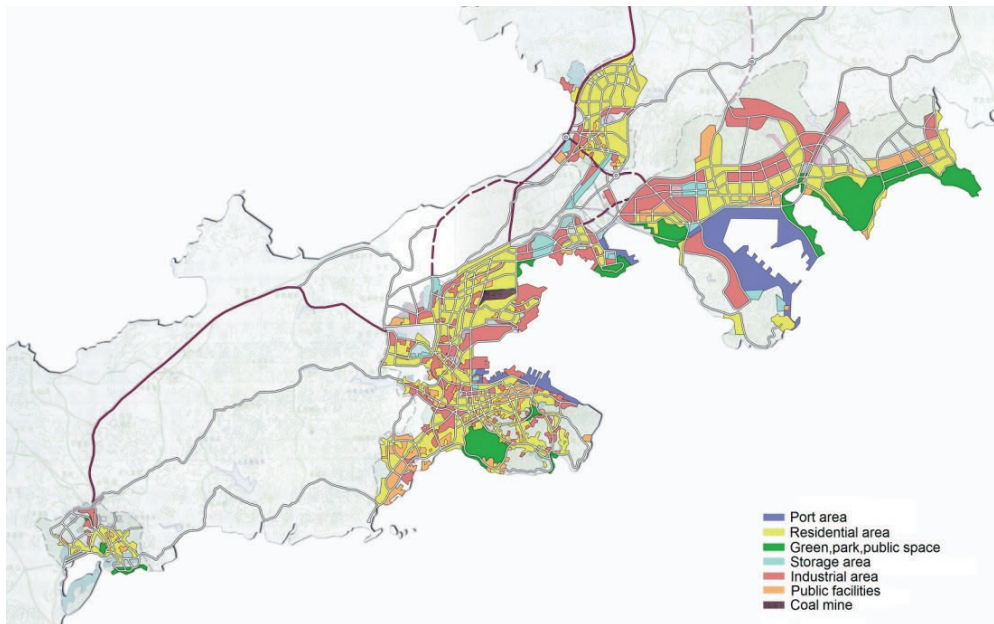


Figure 4.6 Dalian urban form during the early economic reform period





Picture 4.4 Aesthetic urban landscape of Dalian during the economic reform period creates a good environment for the use of public transit.





Picture 4.5 Public transit (BRT and LRT) begins to compete with private automobile. In spite of the enormous expansion of urban expressways, traffic congestion has been very serious.

Under China's larger environment of economic reforms, Dalian has experienced some unfavorable conditions for implementing TOD as the density and diversity of urban land structure have been reduced. In this period, however, the city benefited enormously from the attention of Bo Xilai who was the city mayor and who, among other things, banned motorcycles, restored the streetcar system, built large areas for walking paths, emphasized urban greening, created large, lush parks in the city's many traffic circles and generally built very attractive architectures (Chen, Dong et al. 2008; Song 2009). In addition, he also preserved much of Dalian's interesting and attractive Japanese and Russian architectural heritage. With the historical architecture and modern attractive urban environment, Dalian was thus ranked ninth in the 2010 Report for Chinese Cities Competitiveness (Chinese Academy of Social Sciences 2010) and its degree of urban aesthetic was ranked eighth (Jiang and Shen 2010). Therefore, it is unsurprising that Dalian is a relatively propitious city in terms of architectural aesthetics, public space and pedestrian friendliness (picture 4.4). These are good scores on the urban design requirements for TOD development. Because of this, Dalian was awarded the title "Environmental Protection Model City" by the state council in 1997; and in 2000 it was granted with "Environmentally-Friendly Global 500" by the United Nations and with "China Habitat Environment Award" by the Chinese Ministry of Construction.

#### **4.2.5 The economic transition period (2000-2010)**

During the economic transition period, Dalian's urban form has undergone significant transformation as a result of the latest Urban Master Plan introduced in 2005 which promotes urbanization in three ways (figure 4.7, picture 4.5). First, Dalian warmly embraced the concept of a western-style CBD. Unlike previous plans that aimed at redeveloping Dalian into a heavy industry city, the objectives of this plan were to effectuate industrial relocation through removing over 120 heavily polluting and high energy consuming factories to suburban areas and thus nearly 4 km<sup>2</sup> land in central areas being released for urban green space, advanced-technology, knowledge-intense, financial and other service industries. In addition, the plan set strategies for a reconstruction of the old city center: more than 7,000 households were moved to the periphery and thus over 1 km<sup>2</sup> of land was released for developing the CBD which currently accommodates 82.5% of the city's commercial and financial companies (Zhao and Yang 2008). These projects will surely create efficient land use at access-sensitive locations (where much of the public transport lines depart and the railway station is located), as it has been the government's argument for such redevelopment. However, their overall impact on urban access is difficult to assess because the replacement of downtown housing by business function forcing in-town residents to the periphery will definitely lead to long radial trips for the new commuters. In response to this, Dalian's master plan also includes the construction of urban express roads to improve

accessibility by motorized traffic. In 2009, the total land area of the fast roads has reached around 41 million m<sup>2</sup>, an increase from 8.72 million m<sup>2</sup> in 1990.

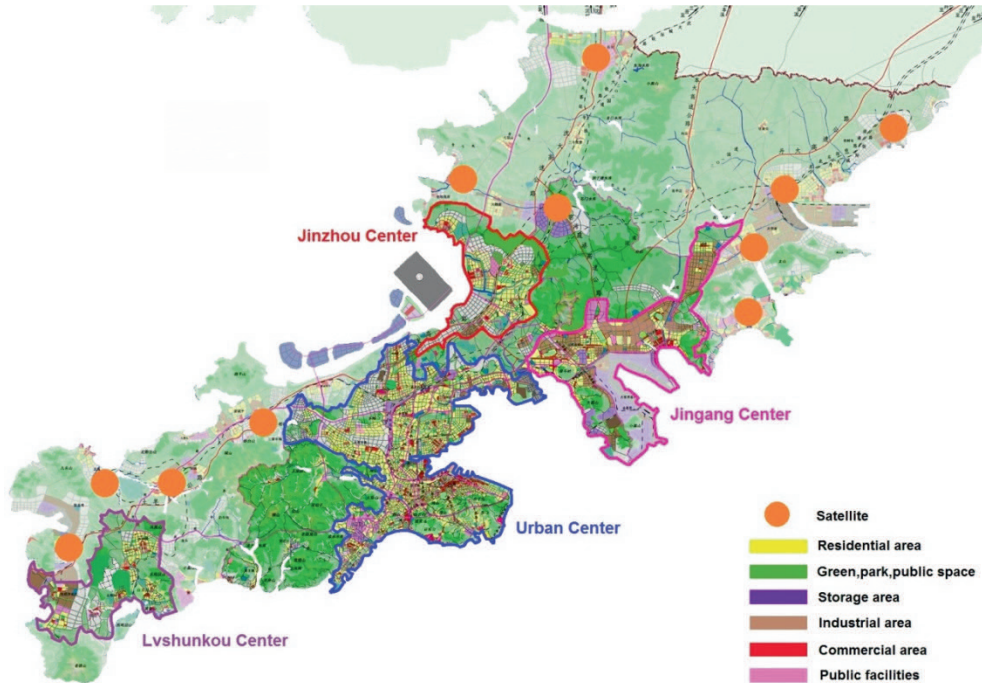


Figure 4.7 Dalian urban form during the economic transition period

Second, urban expansion in Dalian was directed by establishing important organizations in suburbia and inducing development/growth around these locations through the 2005 Urban Master Plan. Usually, universities and big state-owned enterprises are moved/located there as the anchor for attracting additional urban activities. In Dalian, 11 satellite communities have been planned and now they are under construction. Furthermore, by 2009, Dalian had established 5 development zones with a planned land area of some 2,000 km<sup>2</sup>. These development zones have different titles such as high-tech (software), ecological and exporting industrial parks (Zhao, Watanabe et al. 2009) (figure 4.7). However, the transport consequences of these satellites need to be considered one-by-one because they might successfully generate communities of mixed uses that encourage shorter trips, or they might become areas where amenities and relatively cheap housing units attract residents whose trip sets still include many distant destinations (such as to the workplace). Therefore, the effectiveness of satellite communities in significantly reducing travel demand would depend on the details of the occupying population and the evolving destination sets within the specific satellites. For the development zones, their transport implications also depend on the labor pool. On the one hand, because of financial and urban-



passport limitations<sup>1</sup>, floating labor is often housed at high-density residential areas which are near the employers' locations in the development zone. The resulting transport demand is low. This is the case in many suburban localities of the development zones in Dalian. On the other hand, some urban residents who are employed by the companies in the development zones may be unwilling to abandon their urban houses or live in the periphery. Therefore, the selection to keep the urban house and the job in the periphery implies sustained commuting, and at present such commuting in Dalian is increasingly dependent on car use (Du, Ma et al. 2011).

Third, Dalian traditionally adopted a single-center layout. By contrast, the 2005 Urban Master Plan designs Dalian with a multi-centered urban structure: downtown Dalian (i.e. the old city center) would retain its position as the dominant commercial, financial and cultural center of the region and would be orbited by a hierarchy of primary and secondary urban centers. Under this master plan, centers would have varying degrees of self-sufficiency so that jobs and amenities are distributed as close to homes as possible. Almost building upon the previous land use patterns, each center is to have its own industrial and economic base and a distinctive identity. These urban centers have begun to take shape. However, amenities at Lvshunkou, Jinzhou and Jingang centers still need further improvement. The reason for this transition towards other urban centers is that the single-centered city layout is often criticized for having too high a traffic density in the urban core. And the concentration of offices and commercial activities has generated intensive vehicle trips that cannot be handled by expanding the road network. Therefore, multi-centered cities could theoretically reduce traffic density around the city core through dispersing the trips to other urban centers.

Important but less often mentioned, in this period, China has experienced a process of commercialization of urban housing (Wu 2001; Chen, Guo et al. 2011). Underlying this housing commercialization is the evolution of Chinese land policy which separates land use rights from land ownership and thus private land developers could purchase land use rights through auction from existing right-holders such as municipal governments and then enter the real estate market as housing developers. Given the establishment of the market-oriented urban housing system, the allocation of welfare housing from the state or state-owned enterprises was officially stopped in the late 1990s. Currently, most Chinese families must turn to the commercialized housing market to satisfy their accommodation needs. Before this transition, around 90% of housing investment came from the government or state-owned enterprises. By contrast, the percentage decreased to less than 50% after 1995. And in 2009 the private development of urban housing in most provinces has already increased to 90% and in Dalian to almost 100% (Wang and Chai 2009). With this major conversion, the CPI deflator-adjusted price of residential housing in Dalian increased quickly from some

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<sup>1</sup> The urban-passport limitation is an institutional arrangement of the Chinese government to control the amount of urban population by limiting the number of residency permits issued to the rural migrants.

2000 Yuan per m<sup>2</sup> in 1999 to around 12,000 Yuan per m<sup>2</sup> in 2011 on average. In addition, the housing prices near transit (particularly metros) are 25%-30% higher than those of houses far away from transit stations. A key indicator of housing affordability around transit stops, the ratio of housing price to annual household income, has been 1.2 in 2011 which is the highest in history, meaning housing is unaffordable for much of the normal working class.

## **4.3. Dalian Motorization**

Accompanying the urbanization process, and along with the booming of the automobile industry and the rising personal disposable income, Dalian is experiencing rapid motorization. According to the statistics, there were only 13,700 motor vehicles in 1980, among which about 20% are private-owned. However, the private car ownership of Dalian has grown to 140,000 in 2000, and to some 400,000 in 2009 (Dalian Bureau of Statistics 2010). A combination of factors – car-friendly policies; enormous expansion of urban roads; and fragmented transit services – have contributed to this rapidly rising private car ownership in Dalian.

### **4.3.1 Car-friendly policies**

Facing the rapidly rising private car ownership, Dalian has never taken local-specific policy measures to contain automobile traffic for the reason that the automobile industry is now acting as the main stimulator for local economic growth. Dalian is only adopting the central policies of imposing tax on car acquisition and replacing road maintenance fees by fuel taxes. The car acquisition tax was enacted in 2001 through the national “Provisional Regulations on Vehicle Purchase Tax” and it is a one-time fee of 10% of the vehicle price. In 2009, these provisional regulations were adapted to impose a car purchase tax that is reduced to 5% of the vehicle price for those cars with less 1.6 liter auto-emissions for the purpose of promoting China’s auto consumption. In addition to the tax “deterrent” to car ownership, China also levied a road maintenance fee on automobile owners until 2009 when this fee was replaced by a fuel tax to more accurately measure the use of the car. The fuel tax is set at 30% of pump prices, incomparable to Singapore and most European countries which set 50% of fuel prices. However, as disposable incomes steadily rose, these surcharges proved incapable of dampening car ownership in Dalian. In addition, apart from roadside parking being generally prohibited, Dalian has never intended to establish policies restricting car use, unlike some famous examples where car ownership is constrained through effectively restricting the supply of car licenses, and where cars are banned from operating on particular roads and/or days (e.g. the low emission zone in London; restrictions on vehicle circulation). In addition, residential and office buildings and shopping malls in

Dalian are constructed with affluent underground parking areas, some of which are even free to drivers. This is, undeniably, adverse for controlling car use.

### **4.3.2 Expansion of urban roads**

We already indicated in section 4.2 that building new roads and expanding existing ones used to be seen as the most promising ways to increase urban accessibility while reducing congestion under circumstances of urban sprawl. This idea seems reasonable at first sight. Since the early 1990s Dalian has followed this line of thought. For example, in 1993, a Port Rd. of 24-km length and 34-m width was finished with a construction as the main west-east corridor in Dalian. In 1996 the largest urban expressway (locally known as Dongbei Rd.) with a length of 22 km and a width of 35 m was opened to traffic, and the travel time by car from the city center to the development zone was reduced from 40 minutes to 10 minutes. In the same year, the Zhenxing Rd., one of the trunk roads in Dalian, was widened from a 4-lane to a 6-lane urban expressway, and the designed speed was set at 100 km/h. In 1997, around 0.8 million m<sup>2</sup> land was constructed with new fast roads spreading all over the city. Although the fact that building and expanding roads increased, rather than decreased, congestion and ultimately induced higher levels of travel demand, as is known from foreign examples, most recently in 2008, an ambitious plan which proposed an unprecedented expansion of the trunk road network (5 horizontal and 5 vertical urban high-speed roads) in Dalian was laid out in the “Roads to Prosperity Government Report”. According to a traffic study, Dalian has a 12% annual growth rate of car volume with only a 5.1% growth rate of the road network. However, current statistics show that during peak hours the degree of saturation of the roads in the central area reaches 95% and the average degree of saturation of a whole day is now at 70%. The continuous length of congested roads has gone up to 6.5 km and the average speed of car on trunk roads has declined to 10 km per hour (Li and Du 2007; Li and Xu 2008; Feng, Zhang et al. 2010). Therefore, although the intensive urban road construction has an obvious short-term congestion relief benefit, the long-term effect is arguable. It is doubtful whether these roads can sustain high mobility in the long run because of substantial latent demand. And they may guide urban development in directions not easily served by public transport. Because of the widening of the roads, the original wide, well-maintained and clean pavements for pedestrian have been largely destroyed. Street furniture in many areas in Dalian, including flower-beds, trees and benches, has been removed. And safe crossings have been interrupted by the urban expressways. This situation substantially reduces the incentive to walk that has to be an integral part of transit riding.

### **4.3.3 Fragmented transit services**

Another factor has also fueled rapid motorization. That has been the growing fragmentation in transit services. Travelers may be tired of, and abandon transit due to

the difficulties of intermodal transfer. As we discussed in chapter 3, the difficulties may be induced from physical disconnection between transit modes and operational incompatibility between service providers. Physical disconnection can be evidenced by the fact that the network layouts of various transit modes are not designed in such a way that passenger transfer is safe, fast and seamless. Stops of regular buses are located far away from metro stations, trolley buses, taxis or streetcars in Dalian, and there is a lack of short-distance connecting walking paths or efficient physical interchange facilities. Very often, people have to access bus stops or make transfers by walking across urban fast roads. Moreover, Dalian's transit system has serious problems concerning operational incompatibility. Now Dalian has 13 transit operators that have long-term contracts with the government, working separately from one another. This is evidenced by the fact that different segments of transit services are not well coordinated by routes, ticketing or timetables. In operationally integrated service, fares are paid only once for each trip, regardless of the modes used. This is still absent in Dalian. In addition, some technical and operational innovations, such as "smart cards" and "transit passes" which can improve the convenience of fare payment and ease the transfer, are not applied in Dalian. Passengers have to buy a new ticket from the driver once they get on a transit vehicle, which, in many circumstances, prolongs passengers' traveling time and delays the departure time. In addition, real-time travel information about interchange options, which is considered an important factor in making public transport a more attractive choice relative to the car, is unavailable for Dalian residents. As a consequence, the uncertainties associated with the costs and the travel time by transit system seriously affect passenger attraction and discourage people from using public transport.

## 4.4. Conclusions

In this chapter we have examined Dalian's natural, physical and wider social subsystems through looking into its urbanization and the rapid motorization process that went along with it. And Dalian's scores on the city parameters of each subsystem have been summarized in table 4.2. As can be seen, there were days, not long ago when Dalian had a good record in public transit use, and many TOD preconditions discussed in chapter 3 showed favorable scores in Dalian:

- In foreign occupation periods, urban development and public transport development went hand in hand. Russian planners built cobweb-fashioned street network which is good for walking and carriage, while Japanese introduced streetcars in Dalian to cope with urban expansion;
- In the new China period, it was public enterprises (i.e. *Danwei*) with a strong collectivist orientation that provided employees with houses that were small but adequate to dwell in and near to their working places. Thus, people used to live

in neighborhoods with high densities. Accordingly, demand for long-distance travels was extremely low, and a majority of commuter trips could be made by foot;

- Around such mixed-function areas, land used to offer workers a mix of daily services including schools, hospitals, retails, restaurants, parks and public squares for leisure activities. This implied a diverse land use pattern surrounding residential communities until recently when the land was commercialized for optimizing its economic use;
- The residential communities all originated around bus stops, and a large proportion of urban roads were designed as streets that were pedestrian friendly, convenient and safe;
- In addition to walking, public transport modes (buses and streetcars, for instance) were almost the only means of transport in urban areas. Automobiles were not only luxurious and unaffordable but private purchasing was also often prohibited;
- Efforts were made to preserve its historical core.

This starting position gave Dalian a decisive competitive advantage in its modal split over all other Chinese cities years ago. While nationwide modal split of transit decreased from 76% in 1975 to 26% in 2005, the ridership figures for transit's market in Dalian remain almost flat: 74% in 1975 and 68% in 2005. Therefore, during that time Dalian was a hallmark of achievement for public transport among its peers. However, in recent years mass transit began to compete with the private automobile, and its market share has eroded rapidly. Modal split has fallen from 68% in 2005 to some 40% in 2010. Although 40% is still relatively higher than that of other Chinese cities, Dalian's good record in using public transport is under threat. This is due to the urbanization process taking place in the past twenty years that induced low-density, low-diversity land developments and more long-distance trips. This essentially has to do with two things:

- Willingness on the part of public authorities to curb and strictly regulate cars in the public space. Rather than discouraging the purchase and use of automobiles, extensive road construction, almost limitless use of parking lots and comparatively low taxes on car purchases, petrol consumption and road maintenance make skyrocketing motorization an almost logical option. Given the fact that car ownership is a status symbol in most cities in emerging economies, Dalian being no exception, the modal split is shifting markedly in recent years and will continue to do so in the coming years when the expansion of the suburban satellite towns fully takes shape.
- Enhancement of the coordination among and professional management of the various companies involved in public transport. Dalian has not yet arranged

inter-modal ticketing, customer-oriented information provision and services regarding schedules and delays.

The car-friendly policies, the expansion of urban fast roads, the fragmented transit system have been as alarming in Dalian, prompting some observers to warn that Dalian is losing its good tradition in using public transport, and that something needs to be done if the Dalian municipal government intends to implement the TOD policy and thus still wants to remain as an environmentally-friendly city and a comfortable living habitat. Generally taking the current scores of the natural, physical and social subsystems of Dalian as given, we are led to the empirical research questions to be discussed in the following chapters 5-7: what does the actor subsystem of Dalian look like? And how do the various actors make decisions and take actions from the policy analyst, legal and political perspective?

Table 4.2 Scores of Dalian with respect to the natural, physical and social parameters

PARAMETERS	CURRENT SCORES
<b>Parameters in the natural system</b>	
1 Total area	12,573 km <sup>2</sup> (2010).
2 Land area for urban construction	389 km <sup>2</sup> utilizable urban areas (other than 2,309 km <sup>2</sup> rural areas for agricultural crop and 9,875 km <sup>2</sup> natural preserves, i.e. mountains and forests) (2010).
3 Geological conditions (e.g. rock, clay, or silt)	Karst and sea erosion topography which is unfavorable for underground construction because of the high possibility of landslide.
<b>Parameters in the physical system</b>	
4 Land use density	See the score of "population density".
5 Land use diversity	Land use diversity is markedly reduced because of the disruption of the <i>Danwei</i> system.
6 Capacity and coverage of the transport networks	
6a. capacity and coverage of roads;	350 km Shenyang-Dalian expressway, 8-lane; 997 km urban fast and trunk roads;
6b. capacity and coverage of regular buses;	105 bus lines, totaling 1,200 km and with a coverage of 3.2 km/km <sup>2</sup> ;
6c. capacity and coverage of (urban) rapid rails (e.g. light-rails, metros);	904 km Dalian-Harbin high-speed rail line; 48.5 km urban light rail line; and in 2015, 191 km metro lines;
6d. capacity of port;	81 international container routes; 48 berths; 320 thousand km <sup>2</sup> warehouse areas; and 3.2 million km <sup>2</sup> yard area; 100 million in cargo throughput annually;
6e. capacity of airport.	one 3.3 km runway (class 4E) and two terminal buildings, 65 km <sup>2</sup> and 71 km <sup>2</sup> respectively; in 2010 the airport handled 11 million passengers.
7 Architecture aesthetics	Dalian's architecture aesthetics is generally beautiful given its protection of lovely historic architecture heritage and its construction of aesthetic buildings in the modern

8 Public space	time, as well as the development of urban green and aesthetic urban landscape. Dalian's public space has a high quality due to the emphasis given to the construction of many civic squares, traffic circles and parks.
9 Pedestrian friendliness	Pedestrian friendliness is weakened compared to the historic period in which the street network was designed with a cobweb fashioned and pedestrian-oriented style, because currently the entire urban area is filled with fast urban roads and different communities/ building blocks are separated by the elevated road system.
<hr/> <b>Parameters in the social system</b>	
10 Population size and growth rate	3.6 million residents in the urban area, with an annual natural growth rate of 1.7‰ and an annual rural migration growth rate of some 16%.
11 Population density	9,178 person/km <sup>2</sup> , making Dalian the 6 <sup>th</sup> densest city in China after Shenzhen, Shanghai, Beijing, Tianjin and Shenyang.
12 GDP	515.8 billion RMB with an annual growth rate of 15.2% (2010), ranking number one in the Liaoning province and at the 13 <sup>th</sup> position among all Chinese cities.
13 Personal/household disposable income	GDP per capita: 77,704 RMB (2011), ranking the first in the Liaoning province and at the 17 <sup>th</sup> position among all Chinese cities.
14 Housing affordability	Housing affordability (especially for the houses near to transit services) is low due to the disruption of the <i>Danwei</i> system and the commercialization of the real estate market.
15 Car ownership	400,000 private cars in 2009 and 1,050, 000 private cars in 2012.
16 Traffic demand	Traffic demand is rapidly increasing due to the increase of various economic activities and the transformation of land use patterns toward low density and low diversity development.
17 Travel distance	Travel distance is much longer than before because of the centrifugal movement of people and jobs.
18 Modal split	Modal split in public transport is rapidly eroding as a result of the fast motorization process, the fragmented public transport services, as well as the car-friendly policies and urban programs.
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# 5. A Policy Analyst Perspective

## 5.1. Introduction

To understand what the current situation with respect to the actor subsystem looks like in Dalian, we recall the first decision-making perspective, the Policy Analyst, as presented in chapter 2, which enables us to translate the above original question into the question “what are the policy analysts doing in assessing the options for improving the urban transport system in Dalian that helps TOD?”. The contribution of this perspective to our explanations and predictions of public transport administration in Dalian is considerable because this lens reduces the legal and political complications of policy process in the government to the simplification of a rational-style and model-based decision-making. This chapter starts with introducing the policy analyst landscape in Dalian (section 5.2). Then, it looks into the policy analysts’ qualitative analyses and comparisons over three different policy measures with respect to urban transport (section 5.3). In section 5.4, a model is built up to simulate residents’ travel behavior in any given transit system. This model is the one that is used by the transport engineers in Dalian to calculate the performance of the transit system of different circumstances/future specifications. In section 5.5, therefore, by applying the model future circumstances are tested to see if actions proposed by the policy analysts have been incorporated into the current transit system in Dalian. In section 5.6, we present the model results and we question the influence these results have on the forthcoming government actions. Finally, in section 5.7, based on the evidence shown in the previous sections, conclusions are drawn in terms of the scores of Dalian with respect to some partial parameters in the actor subsystem.

## 5.2. The Policy Analyst Landscape in Dalian

We mentioned in the policy analyst perspective that the policy analysts are purely scientists, engineers and professionals with specialized skills and knowledge to generate information concerning the consequences of various policy options and thus to advise policy-makers to take decisions/action. In Dalian, there are several organizations from which the policy analysts hail. One is Dalian Maritime University where a Transport Planning Institute is present, taking the responsibility of collecting geographic data on the transport infrastructure, conducting surveys with residents and building mathematical models for analyzing travel behavior. Another is the Dalian

University of Technology and its School of Transportation & Logistics. People from there are mainly professors and researchers primarily in charge of developing an intelligent urban transport system: how to use advanced transport technologies and information communication systems to increase service qualities. In addition, Dalian's policy analysts also come from research institutes. There is the Dalian Urban Planning and Design Institute that makes land use plans and urban landscape designs at both the city and community levels, and within this institute the Dalian Transport Research Institute is located, engaging in synthesizing all pieces of information provided by academics in the universities and packaging up an urban transport plan to be approved by the central government. Generally, these organizations are either semi-governmental agencies or fully government-funded groups. Policy analysts in Dalian rarely come from consulting firms owned by joint ventures or the private sector. For technically difficult analyses, Dalian occasionally refers to, or collaborates with the transport engineers from the Transport Research Center at Tsinghua University in Beijing.

Aside from policy analysis, the major task of these organizations, especially for those affiliated with universities, lies in education. Therefore, their principal mission is teaching and administrative responsibilities, rather than conducting policy analysis. Unlike American research institutes, such as the Brookings Institution and the Hoover Institution, which are composed of dozens of academics hired only to write scholarly studies, to promote a greater understanding of important social, economic and political issues confronting society, work Chinese universities do in this field is primarily intended for students. Scholars working in these institutes thus regard teaching and student administration as their primary mission. Aiding government decision-making is not viewed by the scholars as their main job. Research-driven institutes without students or only with doctorate students, such as the Chinese Academy of Social Science and the Chinese Academy of Sciences, indeed exist in China, but policy recommendations are only made to the central government, and they are rarely engaged in specific urban studies. As a consequence, we can say that the capacity of doing public policy analysis in these organizations is weak.

In addition, it is important to note that a majority of the analytical tasks are not spontaneously initiated by these analysts, but appointed by the Dalian local government as a mission. Only little urban transport analysis is done by academics just because they are interested in this subject and would like to gain research funding from the government, or to publish papers. Such analysis, however, rarely plays a decisive role in assisting the decision process. In most circumstances, these organizations are actually government contractors. They sign contracts before they carry out the surveys and the modeling tasks. In the contracts, governmental objectives are defined; the duration of the analysis is set; and the amount of repayment is determined. For policy analysis on urban transport (e.g. making forecasting of traffic demand; designing urban transport network; or drafting urban land use plans), the payment is usually about 300 thousand RMB. However, according to the information obtained from the experts at

Dalian Maritime University, it is hard for these research institutes to really receive the payment from the government after they submit the analytical reports. And this fact provides bad incentives for the research institutes to carry out deliberate calculations and comparisons, which leads to low quality of analysis.

Furthermore, we need to clarify that policy analysis in urban transport tends to dominate only in the early planning phase, while it gives way to the bureaucrats and power-play politicians in the later implementation phases. Through informal ways like making telephone calls, analysts as government contractors regularly check with the government leaders concerning their preferences on the analytical results during the process of conducting analysis, and they can adjust the analysis as well as the data in order to finally generate results acceptable to the government. Here, we do not focus on this but more evidence on it can be found in chapter 7. Because of all the above, it is hard to say that analytical results are neutral or rational.

Notwithstanding the questionable quality of analysis, we do not suggest that the analysts in Dalian are without intellectual significance. The above mentioned organizations still command some authority on the basis of their scholarly evidence and data, and the rigorous and professional analysis of policy issues. They try to act scientifically not only because they intend to strengthen their reputation of neither catering to the interests of market nor the government, but also because they attempt to build up a database of urban transport as accurate as possible for information storage and utilization both for educational and academic activities. It occasionally happens that the analysts prepare two versions of policy analysis reports: one detailed, neutral and scientific, stored for their own administration and education, and another brief and probably adjusted, submitted to the governmental authority.

After understanding the general landscape of the policy analysts in Dalian, in the following sections, we present the analytical process for urban transport in Dalian, and finally we discuss to what extent these analyses have influence on the policy-making process.

### **5.3. The Comparison of Policy Measures for Urban Transport**

As chapter 4 discusses, in the last several years mass transit in Dalian has been struggling to compete with the private automobile, and its market share of urban travel has been rapidly eroding. Confronted with this fact, it has been remarked with increasing frequency that the car-friendly policies, the endless urban expressway constructions as well as the fragmented and deteriorating transit services are the decisive factors underlying such an adverse trend. These factors were first considered at the 55<sup>th</sup> meeting of the Executive Committee of Dalian Municipal Government, which

convened on June 13, 2007. Correspondingly, discussion at that meeting generated three alternative hypotheses, imposing car restriction policies, reducing investments in urban expressways, and lifting fragmentation in transit services, which were more precisely reasoned by the policy analysts in Dalian in the days that followed. Eventually, lifting the fragmentation has been selected as a rational choice after substantial debate and reasoning, and a model-based analysis has been done to test the effectiveness of this choice in improving Dalian's situation as the breeding ground for TOD. Therefore, careful examination of the details of policy analysis allows us to understand more accurately what Dalian's policy analysts had in mind and how they aided decision-making.

### **5.3.1 Policy measure one: Imposing car restriction policies**

Policy analysts in Dalian have envisaged imposing restricting policies on car use such as the most famous ones: congestion pricing, new plate quota (NPQ) and driving bans with the intention of using them to reduce the attractiveness of driving so as to give transit more opportunities. Proponents of this alternative mainly refer to the argument that these car restricting policies have been efficiently implemented in foreign industrialized cities as well as some large first-tier Chinese cities like Beijing and Shanghai so they could also work well in Dalian. However, opponents doubt the effectiveness of local application of these foreign policies given the unique context of Dalian city as described in chapter 4. They assert that the realized benefits of these car constraint policies in foreign experience should not be replicated in Dalian for the following reasons. Taking the congestion pricing as the first example, it is difficult to designate a suitable size of the cordon area. If the cordon area is too small, congestion outside the area will not be alleviated and could be aggravated due to diverted traffic. However, if the cordon area includes most of the congested roads, it can be expected that the volumes of residents and vehicles within the cordon will be large enough to generate standstill traffic. In addition, although Dalian is relatively open it is still in economic transition with a powerful public sector that is directly under the jurisdiction of the central government, and thus the "public" (government departments and state-owned enterprises) cars make up a large proportion of total automobile volume in Dalian. Congestion pricing is unlikely to work for these cars because they are either exempted from or insensitive to such costs. Actually, the money paid for congestion constitutes merely an intra-governmental transfer. For the NPQ policy as well, policy analysts propose that to understand whether NPQ will effectively reduce automobile growth, one must consider the extent to which Dalian could prevent residents from registering their cars in neighboring cities like Shenyang, Yingkou, Anshan and Dandong. This is hard not only because there is lack of a regional cooperation on NPQ, but also because Dalian will generate positive fiscal externalities to its neighboring jurisdictions which have the incentive to collect fees from cars that do not travel on their roads. Therefore, Dalian is reluctant to support this idea. Another example comes

from the driving ban. Policy analysts argue that given the very rapid income growth in Dalian, the long-term effectiveness of driving bans is questionable: a lot of households are thinking of buying a second car to circumvent this policy, and also new drivers will fill up the road quickly. Although this policy seems easy to implement, there still can be a strategic response: a thriving black market for counterfeit license plates will emerge, and numerous requests for exemptions will pop up from those who have connections. Apart from these analyses, opponents of this alternative mentioned that now the car industry is playing an important role in supporting Dalian's local GDP growth, controlling car purchase or use may be not consistent with the prevalent pro-growth ideology in China.

### **5.3.2 Policy measure two: Reducing investments on urban expressways**

Reducing investments on urban expressways was the second hypothesis during the discussion at the meeting. Some policy analysts back this hypothesis because they think the construction of urban fast roads or expressways, normally elevated, has destroyed Dalian's cityscape on the one hand, and on the other it has damaged the city's original pedestrian-friendly street network. Those are things that make TOD hard to realize. In addition, they added that the funds for urban expressway constructions should be invested in rail-based transit infrastructures. In spite of these merits, however, this policy measure is not tenable. Arguments made by opponents mainly revolve around two points. First, they claim that urban expressways usually connecting urban areas with villages and counties play an important role in reducing urban-rural inequality as well as rural poverty. The urban-rural dichotomy is a distinctive institutional character of Chinese cities, Dalian included, introduced under the pre-reform socialist regime, and its major institutional component such as the household registration system remains in effect until now. As a consequence, transport connections between urban and rural areas have been scarce for many years. Rural residents are thus separated from fully taking advantage of urban benefits such as educational and medical services because these social services are located within the urban administrative boundary. Road development, however, can make a significant contribution to reduce such inequality. And better roads also reduce trade costs. Individual agricultural producers gain quicker and cheaper access to market and township and village enterprises are able to deliver their products to consumers, which improves rural economy and reduce poverty. Second, some of the policy analysts argue that urban expressways are serving as essential transportation arteries for freight mobility from/to Dalian port. Although before railways carried a large proportion of land-ocean communications, inherited from the Russian and Japanese plans that built railways into the port, the share of goods arrived at the port by rail has declined in favor of road transport in the last twenty years due to nimble, flexible, and cheap road logistics. Therefore, the intention

of managing urban transport by reducing road investments seems unattractive given the economic benefits that roads bring to Dalian as a port city.

### **5.3.3 Policy measure three: Lifting fragmentation in transit services**

Lifting the fragmentation in Dalian's public transport system became more attractive as the policy analysts dissected the other policy measures. The expectation is that if the transit system is better integrated, service quality would go up and the transit system would be more attractive than otherwise. The reason underlying the fragmentation of the transit system in Dalian is China's institutional reforms following New Public Management (NPM). Important features of the NPM reforms are generally the unbundling of the public sector into corporatized units, competition, introducing measures of performance, output controls and private sector styles of management (Sørensen and Longva 2011). Not least the transport sector, in particular public transport, has experienced extensive NPM institutional rearrangements in major Chinese cities, Dalian included, along these lines. Prior to the NPM reforms in China, urban transport services in Dalian were delivered through public monopolies. Hence, planning and operation of different transport modes were integrated organizationally. After the NPM reforms, 13 transit providers<sup>2</sup> serviced in Dalian for many years partly based on the compulsory, competitive tendering of local transit services (Chen 2003). Alongside this transformation, however, there is an issue that has been obscured but which is of considerable importance given the impact of privatization and decentralization on transit operations. This is the issue of system integrity. An inevitable effect when nationalized public transport monopoly is privatized is a degree of fragmentation of what was before a monolithic single system. If not counterbalanced by good municipal governance that encourages and incentivizes providers to coordinate their bus operations, ticketing and schedules, this fragmentation may lead to a serious downfall in quality performance (O'Sullivan and Patel 2004). Therefore, although the reforms' popularity is related to their alleged ability to clarify roles and improve efficiency, a major drawback exists in that the reforms have contributed to fragmentation or incoherence in the process of transit service delivery. Recognizing these problems standing in the way of improving the transit service qualities, the policy analysts have recommended to choose "lifting fragmentation in transit services" as a rational course of government action. To know the effectiveness of this choice, a mathematical model has been built to estimate the possible system performance after a reduction in this fragmentation.

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<sup>2</sup> The operators are the Bus Operation Corporations from No.1 to No. 6, the Streetcar Operation Corporation, the Jietong BRT Operation Corporation, and the Jinma RRT Operation Corporation.



## 5.4. Model

Lifting fragmentation would be the most promising way to improve urban transport system performance. The assumption is that if the transit system is better integrated, service quality would go up and the transit system would be more attractive than otherwise. To comprehend the consequences of system integration the policy analysts need to build up a model simulating travel behavior of the Dalian residents in any given transit network, including the possibilities of them selecting any given transport mode (including the car) when making trips, and the route choices in a given transit network.

Normally, the planning of urban transit services relies on the use of passenger assignment models for predicting the way in which transit users choose routes from their origins to their destinations (Cepeda, Cominetti et al. 2006). As a result, a lot of sophisticated transit assignment models have been built by scholars. Earlier models were based on the assumption that all transit lines have unlimited capacity, vehicles can accommodate any amount of traffic demand, and thus the issue of insufficient capacity of services was not considered (Nguyen and Pallottino 1988; Cea and Fernandez 1989; Spiess and Florian 1989). To deal with the capacity-related congestion, two approaches have been developed in the academic field. One is known as “the congestion cost function approach”, in which the effect of in-vehicle congestion due to insufficient capacity is transferred to waiting time with the concept of effective frequency being used (Cea and Fernandez 1993; Wu, Florian et al. 1994; Cominetti and Correa 2001). Another is “the capacity constraint approach”, in which the excess flow on a link is either assigned to a pedestrian path with unlimited capacity connecting to the destination directly in the frequency-based method, or to passengers who fail to get on a vehicle are kept waiting until they can board the next arriving vehicle with sufficient capacity in the schedule-based method (Lam, Gao et al. 1999; Nguyen, Pallottino et al. 2001; Poon, Tong et al. 2003; Poon, Wong et al. 2004; Tian, Huang et al. 2007). Recently, the seat capacity issue has gained attention from model-builders (Sumalee, Tan et al. 2009; Leurent 2010; Schmöcker, Fonzone et al. 2011). However, in spite of this recent progress in constructing passenger assignment models, their solution algorithms still remain problematic (Szeto, Jiang et al. 2011). Apart from the congestion issue, the earlier models do not consider network stochasticity raised by supply-side uncertainty such as the randomness of in-vehicle travel time and waiting time. That is, they ignore the fact that travel time variability plays a role in influencing passengers’ route choice behavior. It is indeed essential to model this realistic travel behavior in the assignment model, but to our best knowledge only a few researchers have considered this (Yang and Lam 2006; Szeto and Solayappan 2009; Sumalee, Uchida et al. 2011; Szeto, Solayappan et al. 2011). Even so, no effective solution techniques have been developed for such sophisticated models (Szeto, Jiang et al. 2011).

The models in these papers are sophisticated, top-level, and contribute significantly to the theory of traffic planning. But, that is not the focus of the policy analysts in Dalian. When they do academic research on traffic engineering, the scholars may study and explore complex mathematical models. However, as policy analysts or government decision-making aiders, what they need is a relatively simple model that is robust enough to yield reliable outcomes. Therefore, in this section we present a relatively simple model to simulate passenger assignment in Dalian, and this simple model is indeed what the policy analysts in Dalian are using. And it is necessary to clarify that before our field studies where the traffic engineers in Dalian shared their model with us, it was never exposed to external research. In addition, for the analysts themselves, notwithstanding their ample experience in using the model, the model has not been written down on paper systematically. Therefore, the following description of the modeling process is our own synthesis of hundreds of pieces of their modeling effort.

#### **5.4.1 Model assumptions**

Many assumptions are made within the model and these are presented below:

- Due to Dalian's mountainous topography, the bicycle's modal split is extremely rare, so in the model we do not take the trips made by bicycle into consideration. The dominant modes include walking, public transit and the car, which constitute more than 95% of the trips. However, there is no competition between walking and public transit while in most circumstances walking is an indivisible part of taking transit. Rather, the challenge of Dalian's urban transport system is merely derived from the competition with public transit system and car. Because of this, there are generally two transport categories from which the residents can choose for long-distance trips. Therefore, we use a binary logit model instead of a multinomial one;
- Only travel time, monetary costs, comfort and safety are considered as the most important factors determining residents' preferences over car and over public transit;
- Passengers have full knowledge of the transit network, which means that they choose transit routes rationally according to their perceived utilities;
- Choices made by passengers are independent, meaning that the choice of one passenger does not influence the choices of others;
- At any transit stop, passengers get on transit vehicles whenever the vehicles that can arrive at their destinations come;
- Whenever residents choose public transit as their travel mode, they will wait at transit stops and do not leave even that the vehicles arrive with delays;
- Due to the non-existence of transit schedules in Dalian transit services (excluding rail transit), especially for bus service, we do not consider the punctuality issue;
- Travel times are static, meaning that the speed of vehicles is assumed to be a constant, average value during peak hours.

## 5.4.2 Model formulation

The engineers assume that residents' choices regarding traveling by car and traveling by public transit depend heavily on four factors: travel time, monetary costs, comfort and safety. The travel time of public transit users mainly consists of the waiting time and the in-vehicle time, while the travel time of car users is only determined by the in-vehicle time. The monetary costs associated with traveling by public transit primarily include fare and other costs caused by transfer. The costs related to car users mainly refer to oil spending. In addition, the comfort factor covers the issues of vehicle stability which can be measured by vibration acceleration and space occupied per person. And safety could be measured by fatality caused by traffic accident (detailed explanations are presented in appendix B). Moreover, for car users, there are some extra costs such as parking fees, car purchasing associated fees and taxes. We express the utilities of transit users and car users through the following functions (1) and (2) respectively.

$$U_{ij}^{\text{transit}} = \alpha \times t_{ij}^{\text{transit}} + \beta \times k_{ij}^{\text{transit}} + \gamma \times c_{ij}^{\text{transit}} + s^{\text{transit}} \quad (1)$$

$$U_{ij}^{\text{car}} = \alpha \times t_{ij}^{\text{car}} + \beta \times k_{ij}^{\text{car}} + \gamma \times c_{ij}^{\text{car}} + s^{\text{car}} + \delta \quad (2)$$

where the following notations have been introduced:

$U_{ij}^{\text{transit}}$  and  $U_{ij}^{\text{car}}$  are utility functions of users traveling by transit and car respectively;

$t_{ij}^{\text{transit}}$  and  $t_{ij}^{\text{car}}$  are total time needed by users traveling by transit and car respectively;

$k_{ij}^{\text{transit}}$  and  $k_{ij}^{\text{car}}$  are monetary costs of users traveling by transit and car respectively;

$c_{ij}^{\text{transit}}$  and  $c_{ij}^{\text{car}}$  are comfort of travelers using transit and car respectively;

$s^{\text{transit}}$  and  $s^{\text{car}}$  are constant values, representing safety of users traveling by transit and car respectively;

$\delta$  is a constant value, representing fees (excluding the oil spending) associated with traveling by car, such as parking fee, car purchasing fee and tax;

$\alpha$ ,  $\beta$ , and  $\gamma$  are coefficients.

With the utility functions, we can formulate the modal split formulae (3) and (4), that is, the proportions of transit traveling  $P_{ij}^{\text{transit}}$  and car traveling  $P_{ij}^{\text{car}}$  between one origin-destination pair  $ij$ .

$$P_{ij}^{\text{transit}} = \frac{\exp(U_{ij}^{\text{transit}})}{\exp(U_{ij}^{\text{transit}}) + \exp(U_{ij}^{\text{car}})} \quad (3)$$

$$P_{ij}^{\text{car}} = \frac{\exp(U_{ij}^{\text{car}})}{\exp(U_{ij}^{\text{transit}}) + \exp(U_{ij}^{\text{car}})} \quad (4)$$

Dividing formula (3) by formula (4), we can obtain the following equation (5).

$$\frac{P_{ij}^{\text{transit}}}{P_{ij}^{\text{car}}} = \frac{\exp(U_{ij}^{\text{transit}})}{\exp(U_{ij}^{\text{car}})} \quad (5)$$

Then, putting formulae (1) and (2) into equation (5) and taking the natural logarithm of both sides, we obtain a new equation (6).

$$\begin{aligned} & \ln \frac{P_{ij}^{\text{transit}}}{P_{ij}^{\text{car}}} \\ &= \ln \frac{\exp(U_{ij}^{\text{transit}})}{\exp(U_{ij}^{\text{car}})} \\ &= \ln \frac{\exp(\alpha \cdot t_{ij}^{\text{transit}} + \beta \cdot k_{ij}^{\text{transit}} + \gamma \cdot c_{ij}^{\text{transit}} + s^{\text{transit}})}{\exp(\alpha \cdot t_{ij}^{\text{car}} + \beta \cdot k_{ij}^{\text{car}} + \gamma \cdot c_{ij}^{\text{car}} + s^{\text{car}} + \delta)} \\ &= \alpha \cdot (t_{ij}^{\text{transit}} - t_{ij}^{\text{car}}) + \beta (k_{ij}^{\text{transit}} - k_{ij}^{\text{car}}) + \gamma \cdot (c_{ij}^{\text{transit}} - c_{ij}^{\text{car}}) + \\ & \quad (s^{\text{transit}} - s^{\text{car}}) - \delta \end{aligned} \quad (6)$$

The values concerning modal split  $P_{ij}^{\text{transit}}$  and  $P_{ij}^{\text{car}}$  can be obtained by conducting surveys. In our case, as will be discussed in section 3.3, 18,000 Dalian residents spreading over 170 traffic zones have been inquired about their daily trip purpose, travel mode and travel route. Therefore, through the equation (6), the values of  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  of the utility functions can be calibrated through statistical tools. In our case, the calibrated values of  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  are respectively 0.42604, 0.205746, 0.339481 and 5. After calibration, we synthesize the whole population and obtain the Origin-Destination matrix over the whole research area.

After finding out how many travelers among the total residents use public transit, the engineers analyzed what the travel behavior looks like for these public transit users, i.e. what their optimal strategies for choosing traveling route are. Researchers in this field have traditionally used the so called "Passenger Assignment Model"<sup>3</sup>. In our case, the engineers apply Wardrop (1952)'s second passenger assignment principle: at equilibrium the average journey time is minimum. This implies that each user behaves cooperatively in choosing his own route to ensure the most efficient use of the whole system. Traffic flows satisfying this principle are generally deemed "system optimal". This passenger assignment model is consistent with the above mentioned logit model in the following way. Only if we know the modal split, we know the volume of

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<sup>3</sup> Passenger assignment model concerns the selection of routes between origins and destinations in transport networks. It is the fourth step in the conventional transport forecasting model, following trip generation, trip distribution and model choice. To determine the need of infrastructure capacity and costs and benefits, we need to know how passengers choose routes, i.e. the number of travelers on each route of the network.

passengers to be assigned in a transit network. The volume of the transit passengers will influence the total traveling time of the users and thus affect the assignment results.

To simulate the behavior of passengers, we need to introduce the following notations:

- $G = (I, A)$  represents transit network;
- $a \in A$  is a link  $a$  in the transit network;
- $i \in I$  is a node  $i$  in the transit network;
- $A_i^+$  and  $A_i^-$  are outgoing and incoming links at node  $i$ ;
- $\bar{A}_i^+$  is any given set of attractive links at node  $i$ ;
- $f_a$  represents the frequency of link  $a$ .

For any given set of attractive links  $\bar{A}_i^+$  at node  $i$ , the expected total waiting time per passenger on link  $a$  can be expressed by formula (7):

$$W(\bar{A}_i^+) = \frac{1}{\sum_{a \in \bar{A}_i^+} f_a} \quad (7)$$

And the possibility of link  $a$  being taken can be written like formula (8):

$$P_a(\bar{A}_i^+) = \frac{f_a}{\sum_{a' \in \bar{A}_i^+} f_{a'}} \quad a \in \bar{A}_i^+ \quad (8)$$

According to Wardrop, the optimal strategy of passengers to reach destinations is to minimize the total expected journey time that is the sum of the travel time on the link and the waiting time at the transit stop. Therefore, for a given transit network, the assignment of trips from all origins to a particular destination corresponds to solving the following linear optimization problem (9).

$$\min(\sum_{a \in A} v_a t_a + \sum_{i \in I} w_i) \quad (9)$$

In this objective function,  $t_a$  is a constant value which can be measured on link  $a$ ,  $v_a$  can be calculated by formula (8), and  $w_i$  can be calculated from formula (7):

$$v_a = OD_i \cdot P_a(\bar{A}_i^+) = OD_i \cdot \frac{f_a}{\sum_{a' \in \bar{A}_i^+} f_{a'}} \quad a \in \bar{A}_i^+$$

$$w_i = OD_i \cdot W(\bar{A}_i^+) = OD_i \cdot \frac{1}{\sum_{a \in \bar{A}_i^+} f_a}$$

Subject to:

$$\sum_{A_i^+} v_a - \sum_{A_i^-} v_a = g_i \quad i \in I$$

$$v_a \leq f_a w_i \quad a \in \bar{A}_i^+, i \in I$$

$$v_a \geq 0 \quad a \in A$$

where the following notations have been introduced:

$OD_i$  is the passenger volume at node  $i$  that can be obtained from the O-D Matrix;

$v_a$  is passenger volume associated with link  $a$ ;

$t_a$  is passenger travel time associated with link  $a$ ;

$w_i$  is waiting time of passengers at node  $i$ ;

$g_i$  is the demands between nodes  $i$  and  $r$ .

This model will be used to calculate trip distribution on a given transport network. Therefore, by using this model we will know how the Dalian residents travel given the status-quo of the transit network, and the future possible transit networks if changes are introduced to the physical network layout. After establishing the travel behavior under different circumstances, we obtain relevant system indicators to compare the system performance in the various conditions.

### 5.4.3 Input data and algorithm

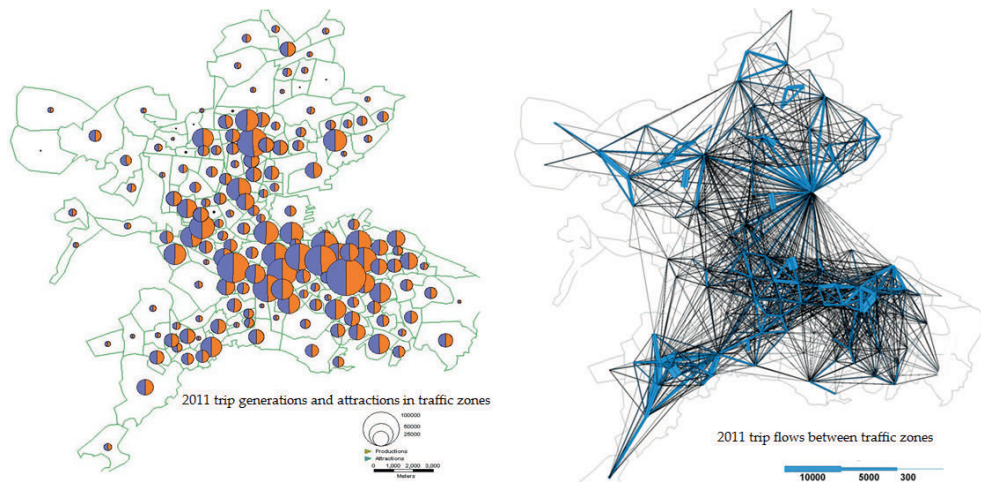


Figure 5.1 O-D Matrix in 2011

(Source: authors' data collection from the Transport Planning Institute at Dalian Maritime University)

The input data of the model include Dalian's transit network (nodes and links) and the Origin-Destination (O-D) Matrix. Regarding the O-D Matrix, the Transport Planning Institute at Dalian Maritime University, which is appointed by the Dalian Transportation Bureau, did a survey on residents' travel behavior in mid-2011. The survey covers the districts of Zhongshan, Xigang, Shahekou and Ganjingzi which constitutes the urban area of Dalian. The target population includes both permanent and temporary residents, amounting to 18,000 people. The survey results of the individual respondents are then processed statistically to generate the information of trip generations and attractions in each traffic zone and trip flows between different



traffic zones (i.e. the O-D Matrix) presented in figure 5.1. Here it is important to point out that such a way of information processing inevitably creates “aggregation bias” because the difference between individual travel behavior within one traffic zone is blurred. To avoid such bias, researchers nowadays often use the “disaggregation method”, which does not divide traffic zones or do any statistical processing, but directly use the survey results on an individual basis. Therefore, in comparison to the aggregation method, a model based on the disaggregation method will be more accurate in terms of simulating individual’s choice over traffic routes, especially when the sample size is small. In spite of this, the engineers still use the aggregation method not only because the traffic planning practice as well as transport policies in Dalian are all along based on the aggregation analyses, but also because the aggregation method gives them a more general insight in the movement of people between different zones of the urban area. More importantly, for policy analysis, the aggregation method is adequate in generating reliable outcomes, although the disaggregation method could reduce bias to some extent.

In addition, we need to point out that this O-D Matrix is adopted as input data for the scenarios defined in section 5.5, though it is widely recognized that improved public transport (e.g. network improvement and enhanced integration and intermodality of public transport services) will result in induced demand and thus in changing O-D Matrix. We do so because it is impossible for us to quantitatively measure the amount of the induced demand as a consequence of (gradual) network improvement. The induced demand is not only related to factors such as traffic psychology (i.e. how individuals characteristics, motivations, and specific situations determine travel behavior), but also related to people’s preferences, habits, attitudes and lifestyles (Klockner and Friedrichsmeier 2011; van Wee 2013). For example, some people may have a more material lifestyle, or people might simply prefer to travel by car (“car-lovers”). For them, the tendency to shift from cars to public transport is low (Murtagh, Gatersleben et al. 2012; Groeger and Rothengatter 1998). In addition, there are people who do not have any time pressure to reach the destinations might stick to slow modes such as walking. In such cases, the improved public transport services seem insensitive to them.

Regarding the algorithm, the engineers mainly adopt the approach provided by Spiess and Florian (1989), in which two steps are broadly defined: one step is to compute the optimal strategy and the expected total travel time from each origin node  $i$  to the destination node  $r$ ; and another step is to assign the traffic demand to the network according to the optimal strategy from all origins to the destination. Since the focus here is not on creating a computational algorithm, we do not provide much detailed description on computing.

## 5.5. Scenarios

In this section, three different conditions for the transit system in Dalian are defined: the first is the status-quo without any changes (Scenario A); the second is a transit system that incorporates Dalian’s plan for metro projects but that is fragmented both physically and operationally (Scenario B); and the third is a transit system that incorporates the metro plan, but also accommodates better system integrity.

### 5.5.1 Scenario A: Status-Quo

The construction of the transit infrastructures in the urban area of Dalian started in 1907 when three streetcars were built and carried almost all of the residents in the city until 1970s. Afterwards, the further development of the streetcars remained limited, while buses dominated the urban transport market. Until recently, it was mostly rapid and easy to realize gains in traffic capacity that received most attention from urban planners: buses rather than streetcars and subways. At present, in addition to roads, the transport infrastructures in the urban area include a bus network of 105 lines totaling around 1,200 km, including two streetcars, one rapid rail, locally known as the light-rail line 3, and one trolley bus, as well as one bus rapid transit line (figure 5.2). Their length, vehicles in operation, daily ridership, and modal split are shown in table 5.1.

Table 5.1: An overview of Dalian transit network (2011)  
(Source: authors’ data collection from Dalian Urban Planning Institute at Dalian Maritime University)

Transit Modes	Number of lines	Total length (km)	Vehicle in operation	Daily ridership (thousand people)	Transit modal split
Rail Rapid Transit	1	48.6	20	50	2.1%
Bus Rapid Transit	1	14	64	45	1.9%
Streetcar	2	23.4	122	110.2	4.6%
Trolley Bus	1	7.9	60	53.3	2.3%
Bus	100	1107.7	3480	2323.5	89.1%

Although the bus network matches Dalian’s lay of the land well and has a high ridership, its performance faces many challenges (table 5.2). First, bus services in different areas of Dalian underwent a rather unbalanced development. In the downtown area (mainly filled with commercial and business organizations) where 100 bus lines crisscross, the bus lines in the Zhongshan and Xigang districts are dense and show extensive overlap, while the densities in the Shahekou and Ganjingzi districts are relatively low. Second, if measured in a radius of 300 or 500 meters, bus stops can serve 55.97% and 72.82% of the land area on average, lower than the recommended values of 60% and 90%. Third, the buses (excluding only one BRT line) do not have dedicated

lines and they use the same streets and cope with the same congestion as automobiles do. As a result, the punctuality of bus services is very low. Moreover, in most cases the bus service has less influence on land use patterns than fixed-rail transit, so that the land allocated to bus stops is not safeguarded and often the land is taken back for other purposes. Last but not least, the bus service in Dalian is not “intelligent”. Routes and schedules are not flexible to serve dynamic traffic flows and do not provide passengers with individual travel information.

Table 5.2: Characteristics of the bus network in Dalian (2011)  
(Source: authors’ data collection from the Transport Planning Institute at Dalian Maritime University)

Districts	Zhongshan	Xigang	Shahekou	Ganjingzi	Average	Recommended
Density/Coverage (km/km <sup>2</sup> )	1.78	4.23	2.80	1.53	3.2	3~4
Overlap factor	3.52	3.23	3.84	4.23	3.77	1.25~2.5
Service area rate of bus stops (radius of 300 m)	50.94%	58.28%	74.43%	40.22%	55.97%	60%
Service area rate of bus stops (radius of 500 m)	70.16%	73.79%	89.65%	57.67%	72.82%	90%

As regards the rail transit, light-rail line 3 is the first rail-served rapid line in Dalian. This line forms a 57-km, 18-station metro system that was completed in 2002 and opened to traffic in 2003 at a cost of 23 billion RMB. It connects the development zones in the Jinzhou center with the old city center (where the Dalian Railway Station is located). It is a serpentine shaped line and is mostly elevated or at the ground level (Li and Ma 2003). The performance of this line is mixed. Average speed is at 60 km per hour, 50% faster than the average car moves during rush hours. And a single trip takes about 50 minutes. Although trains arrive almost always within schedule, peak period headways (i.e. time intervals between trains) are twenty minutes, which is regarded as long and results in overcrowding. The daily operation hours are from 6:00 in the morning to 20:00 at night. The last train stops so early because it was originally designed to serve just daily home-job-home commutes, which is now a complaint of many daily commuters who demand more flexibility. Regarding the fare system, it applies a ladder approach: adjacent stations 1 Yuan, every other station 2 Yuan, the full line 8 Yuan and the full branch line 7 Yuan, which is regarded as affordable (Dalian Municipal Government 2002; Dalian Daily 2010). The ridership reaches 50 thousand passengers per day and 80 thousand during tourist seasons (Sun 2004).

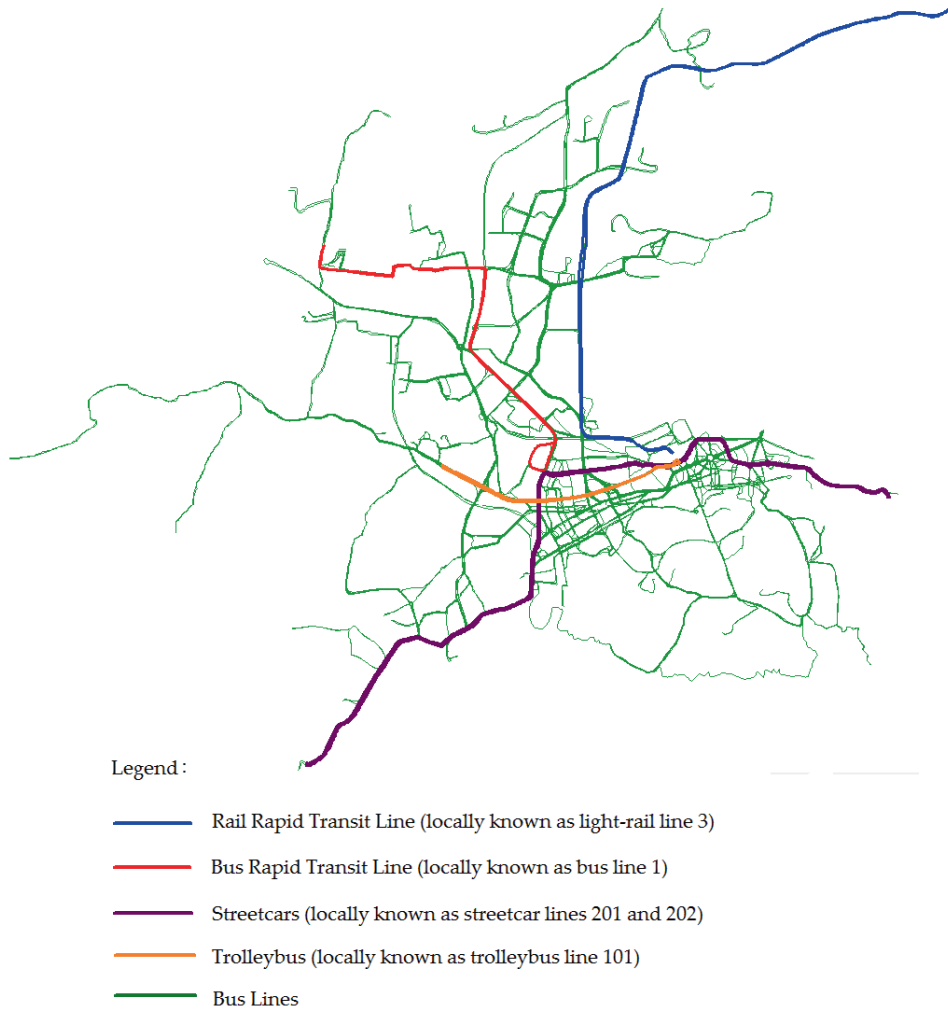


Figure 5.2 Scenario A: The status-quo of Dalian transit network

### 5.5.2 Scenario B: Fragmented transit system

Light-rail line 3 is only a part of the entire “Plan for Metro Rapid Transit System in Dalian (MRT)” which consists of 191 km transit lines passing through the urban centers and suburbs, and is scheduled to be completed by 2020. The first line is a backbone line running from west to east with a length of 24.5 km, and the second line is a circular line covering major commercial areas and residential communities in downtown Dalian with a length of 42.6 km. Line 4 with a length of 58.4 km connects the Jinzhou Center in the north through several satellite communities with the Lvshunkou Center in the

south. And Line 5 starts at the railway station, extending 8.5 km to the south. The total MRT system will be eventually 191 km in length. It will serve as the city's lifeline, connecting the primary and secondary city centers and linking residents to jobs, shopping centers and recreational offerings throughout the whole urban area. The first and second lines, which are now under construction, are in the short-term plan and their designed completion date has been roughly scheduled around 2013-2015, while Line 4 and Line 5 are part of the long-term plan, and the completion time has been scheduled for 2020. In this scenario, thus we only consider Line 1 and Line 2 as new lines which will be added to the existing transit network in the near future (figure 5.3).

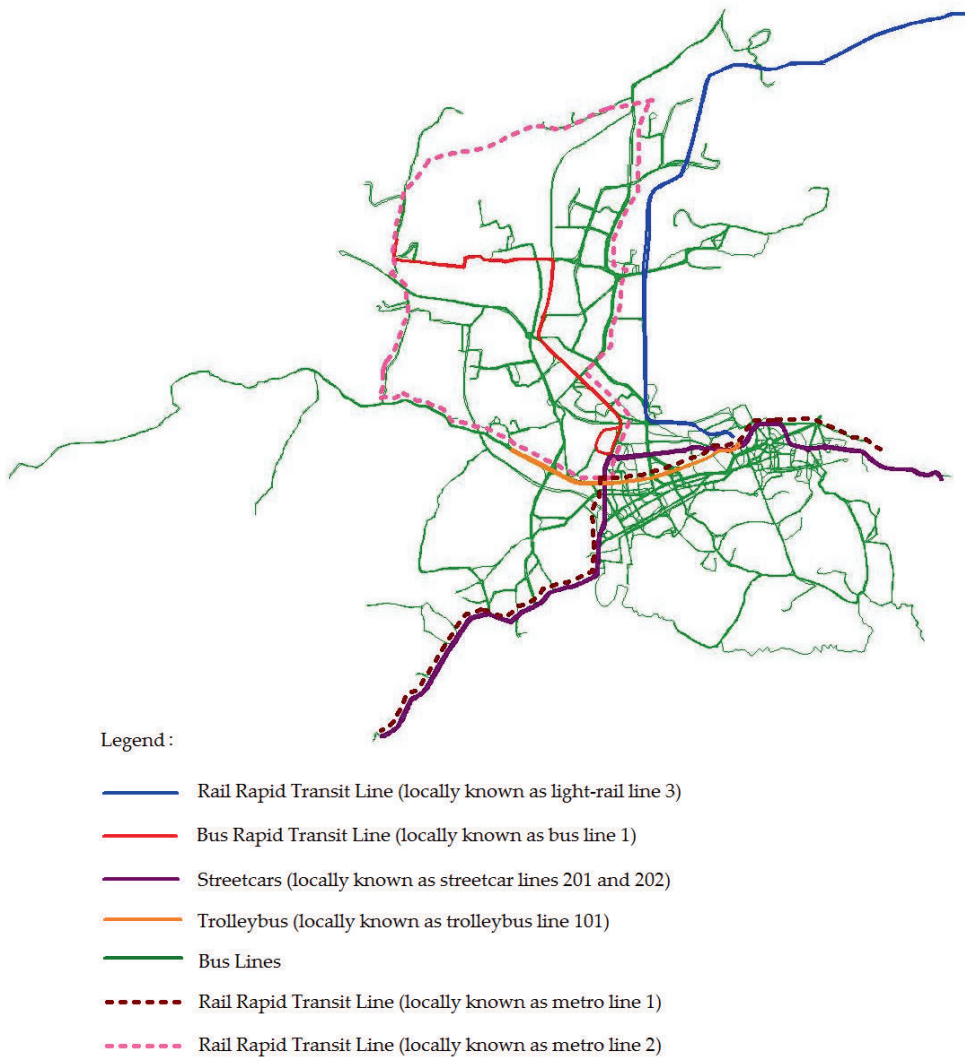


Figure 5.3 Scenario B: Fragmented transit network

Regarding the funding, these two lines have been financed only by the central government and local government considering that many of the preconditions for private participation in public infrastructures were not met in Dalian. There is both a shortage of strong private parties in the region and an absence of effective regulations to deal with professional PPP governance. For instance, open tendering, accompanied by a solid pre-qualification process, is sometimes left aside for choices made based on untraceable criteria. Because of the absence of a transparency law, the odor of fraud and corruption easily emerges (de Jong, Mu et al. 2010). Hence, the institutional framework for using private players in China has not been completed, and state-owned enterprises enjoy a major advantage here. In our case, the construction work was contracted out to two state-owned enterprises (i.e. the China Railway 13 Bureau and the China Railway 19 Bureau) through invited tendering. Another state-owned enterprise, Dalian Modern Rail Transport Co. Ltd., will be in charge of their operations (Tsinghua University Transport Research Institute 2005).

One important feature of this scenario is that the bus services and the rail services are fragmented in themselves and between regular bus and rail services in 2013-2015 when Line 1 and Line 2 are opened to traffic. In large metropolitan areas the demand for public transit may be served by a system combining rail services on exclusive rights of way with bus services operating in mixed traffic. These rail and bus services should be integrated and coordinated as well as possible in order to minimize user costs while maximizing operator revenues with the lowest requirement for infrastructure investments. However, according to the interviews with the transit planners in Dalian, since there is still a lack of clear procedures established for integrated transit planning, rail planners did not take the existing bus network into consideration (in terms of physical routes, service frequency, and ticket) when making plans. Neither are the bus operators willing to adapt their bus routes and services to cater to the rail plan. Therefore, the bus services tend to compete for passengers with the rail services, rather than acting as feeders to rail.

### **5.5.3 Scenario C: Integrated transit system**

According to the status-quo and the future MRT plan, Dalian's urban transit system will consist of several modes in the coming years, including buses, streetcars, a trolleybus, a light rail and two metros. Unfortunately, coordination among different modes remains a challenging problem as scenario B shows. Difficulties arise when modifying the transit system on a physical level or when synchronizing timetables and ticket services on an operational level. Traditional transit network design intends to solve separately network-optimization problems for different transit modes based on static O-D information, with passenger assignment as a sub-problem, while ignoring intermodality and integrity issues.



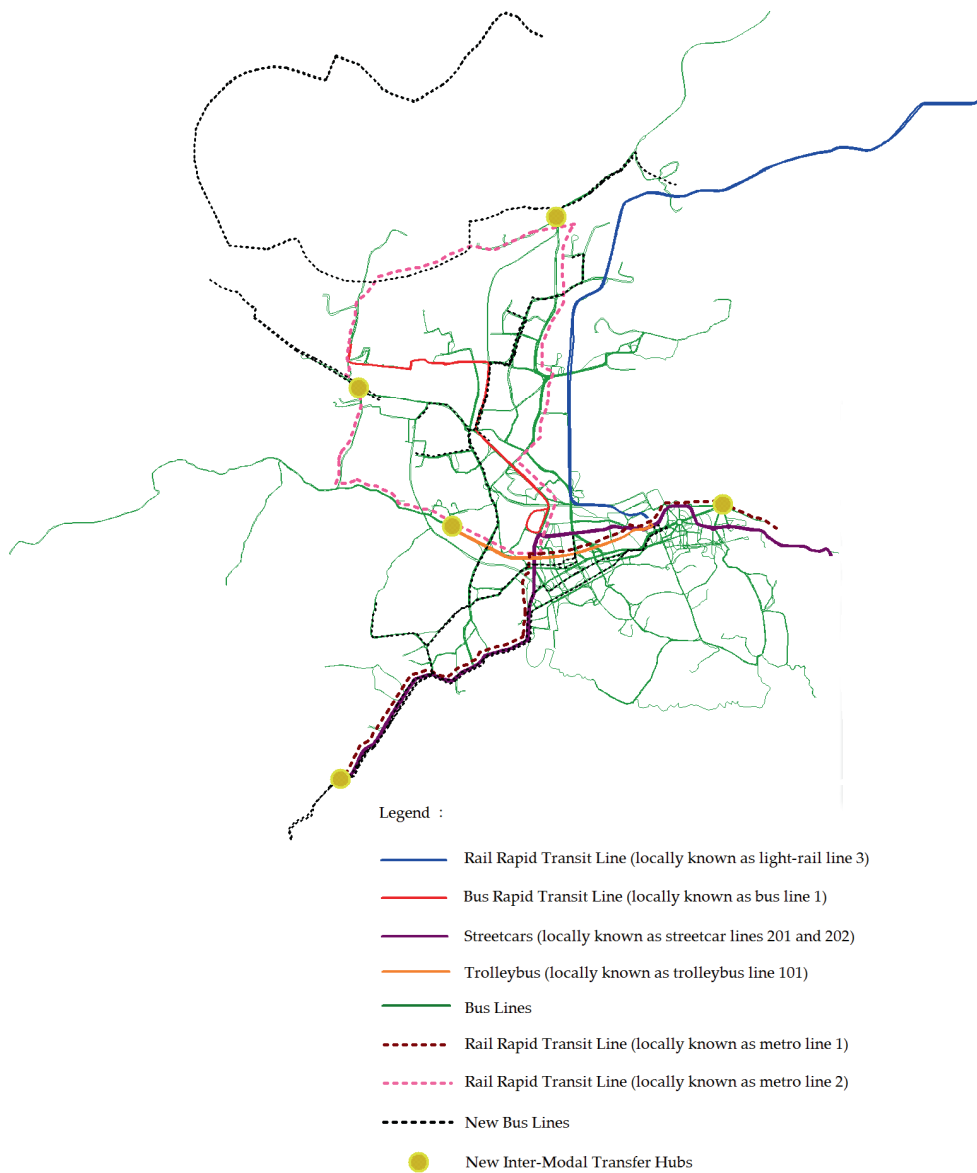


Figure 5.4 Scenario C: Integrated transit network

In August 2011, the phrase “integrated transit system” was officially launched by the Dalian municipal government by issuing the “Surface Transportation Adjustment Plan after the Metro Operation”. It aims at increasing the awareness of the need for coordination by adjusting the bus routes to link up with the rail-based rapid transit lines. The adjustment of bus routes is due to take place after the first and second metro lines are put into operation in 2013-2015. And the necessity of changing bus routes rather than modifying metro routes (or the localities of metro stations) is obvious,

because the construction of metros must be in accordance with the plan approved by the central government as early as 2008. In other words, any change associated with metro routes and stations is not allowed. The benefits of an integrated transit system would be that passengers' inter-modal transfers can be much easier and the total required social resources (e.g. number of bus vehicles, oil consumption, and road areas occupied) can be reduced to satisfy a given amount of traffic demand. Hence, studies on physical level integration have been carried out by the Transport Planning Institute at Dalian Maritime University, which was appointed for this job by the Dalian municipal government. In addition, recently, the phrase "post-NPM reforms" has been launched. Post-NPM reforms among other things are characterized by increased awareness of coordination and system integration (Koppenjan 2012). Within the Dalian local government, a study of the operational level integration is carried out: the 13 independent service providers will be organizationally restructured, and the Dalian Public Transportation Group is established with the authority to supervise and coordinate the providers. The "one-car-pass" policy will be implemented among the providers and certain routes will be adapted as well. Scenario C represents the condition where all the above mentioned reforms and readjustments have actually been implemented and are operational.

The adjustments are based on several planning principles: hubs are built at the terminals of metro lines and bus stops are moved closer to the hubs in order to facilitate transfer and evacuate passengers from metros quickly; harbor-type metro stations are constructed where land is available along the metro lines and the bus stops are shifted to the vicinity of the metro stations; furthermore, bus lines that have overlap rates of 90% with the metro lines are pragmatically cancelled and bus frequencies or vehicle numbers on the routes which overlap with the metro lines are appropriately reduced. Finally, some feeder lines are added where necessary to link up bus stops, the location of which cannot so easily be moved to the metro stations.

In line with these principles, the blueprint of the integrated transit network in Dalian will be like figure 5.4. Major adjustments include: 5 inter-modal transfer hubs will be built, which will cost 0.02 billion RMB; 8 feeder lines (i.e. new bus lines) will be added to the original bus network with a total length of around 111 km, connecting nearby important transport terminals (e.g. Harbin-Dalian HSR station and Jinzhou-Pulandian intercity rail station) and surface transit stops (e.g. the streetcar stops and bus stops); 7 bus lines (totaling about 38 km) with overlap rates over 90% with metros will be cancelled; for those bus lines with overlap rates lower than 90%, 159 vehicles will be cut down on 11 bus lines which run on the same routes as metro line 1, while 326 vehicles will be reduced on the bus lines associated with the metro line 2. These reduced vehicles, then, will be used on the new bus lines.

## 5.6. Results and Analysis

By running the model under the three different scenarios, we obtain the results on how Dalian residents choose car or transit as their travel mode, and on how transit passengers are assigned in the three transit network circumstances. The passenger assignment results are shown in appendix A. The calculation took about 30 min on a 3.00 GHz Pentium PC. The total assigned traffic flows give very reasonable results. We can see that in scenario B where metros are added, the Dalian residents make more trips than in scenario A (i.e. the status-quo), and this is evidenced by the increase in the trip numbers, from 81,200 to 89,200 on the densest routes, and from 5,200 to 8,400 on the lowest density routes. In scenario C the number of trips is slightly reduced (compared to scenario B): from 89,200 to 88,800 on the densest routes and from 8,400 to 4,900 on the least busy routes. After knowing how many journeys are made by car and by transit, and how passengers choose transit routes, we can calculate the system performance of each scenario. The performance of the transit system in Dalian is now measured by a series of indicators which represent the characteristics of the physical transit network, the utilities of transit users and operators, as well as the impact of the transit system on the entire society in terms of transit modal split, environmental pollution and land use effect (table 5.3).

Quite interestingly and surprisingly, although efforts for better system integration have been made by the Dalian government, a comparison of user utility reveals that there are few improvements in the quality level of transit services, even in Scenario C. Actually, the scores go in the opposite direction of what the policy analysts expected in the earliest comparisons over policy measures: the analysts expected that an improvement in system integration might increase service quality. As the figures show, users' average traveling time slightly goes up (0.463→0.571→0.579), and the expected number of transfers increases (0.633→0.999→1.061). The number of transfers is not reduced, but they are made more convenient for the passengers by constructing new building hubs in scenario C. So the passengers do not have to walk long distances as before. System integrity in terms of physical interconnection does not necessarily imply the reduction of transfer needs. Rather, it implies that the transfers go more smoothly and efficiently, and this probably even induces more transfers. The costs per trip thus also go up (1.633→1.999→2.061), while comfort and safety remain virtually unchanged.

However, there are financial gains for the service providers. For the providers, we can see from the comparison that in the status-quo scenario the transit companies are operating at a loss, mainly depending on the subsidies from the local government (e.g. in 2010 the municipality of Dalian provides 2.7 billion RMB to the providers). However, after system integration, this situation improves substantially: the expected daily income balance is about 100,000 RMB positive. This dramatically reduces the required subsidies providers require from the government. The Dalian municipal government therefore stands to gain from the changes in Scenario C, but largely in a financial way.

In addition, as indicated by the modeling results, there are gains for the government in terms of Dalian’s modal split. After fragmentation is lifted in the transit system, the share of public transport in the modal split rises from 43% to almost 49%. As a consequence, we obtain better results regarding the environmental and land use indicators: economic savings due to a reduction of auto emissions achieve some 450 thousand RMB per day, and land use density around transit stations is also increased from the current 44% to the future 69%.

Table 5.3 Comparisons over the system performance of scenarios A, B and C

Criteria		Scenario A	Scenario B	Scenario C
Transit network	Infrastructure length (km)	1200	1267.1	1339.9
	Density/Coverage (km/km <sup>2</sup> )	3.2	3.21	3.22
	Overlap factor	3.77	3.83	3.81
	New infrastructure costs (billion RMB)	0	28.70	28.72
Users	Average traveling time per passenger (hour)	0.463	0.571	0.579
	Expected number of transfers per trip	0.633	0.999	1.061
	Total passenger fees (RMB)	1.633	1.999	2.061
	Comfort	0.97	1.12	1.12
	Safety	0.923	0.923	0.923
Operators	Operation costs (RMB per day)	3575455	3905382	4122293
	Revenues (RMB per day)	3077249	4765513	5134176
Society	Transit modal split (%)	43.0	48.8	48.7
	Environmental impact (saved money per day due to the reduction of emissions, RMB)	0	44226.58	45671.53
	Land use impact (land use density around transit stops, %)	44.1	69.2	69.2

*Note: the calculation of the above criteria is explained in appendix B.*

It becomes less puzzling that there is no gain for users but financial and modal split gains for the government if we explain the results in the following way. The reasons leading to few improvements in service qualities are largely that there is an induced demand for traffic and need of transfers after the infrastructure has been expanded and systematically integrated, i.e. when supply increases in terms of infrastructure length and spatial coverage, more trips than before are generated. People who did not make trips start traveling, or people switch from car travel to transit travel, because people think transit service is more accessible and easier for transfer. But when the induced demand reaches at a certain level, the system approaches saturation again. This inevitably reduces the service quality level. However, from the social perspective, or seen from the perspective of the government, although service qualities have seen few improvements, the new situation is more attractive than the old one because more environmental and density benefits are achieved.

Finally, one question remains: do the modeling results matter? That is, do these analytical results have influence on the policy-making process? Attempting to impose policy analysis on decision-makers is not wise in China where little space is reserved for policy analysts in public decision-making. Acknowledging this fact the policy analysts, instead of providing a definite solution or policy option for the government, offer a number of different options for the future development of Dalian's urban transport system based on the modeling results. And it leaves the choice open to be made by the government. One is that the government simply accepts the fact that travel time cannot be reduced; travel becomes more expensive; comfort and safety do not go up, but money can be saved and a modal shift towards more transit use is realized. Therefore, some environmental and land use benefits can be expected. Another possibility is that the government re-invests this saved money into the gradual expansion of the public transport network. This could be a further expansion of the metro network, or a replacement of the regular bus lanes by Bus Rapid Transit (BRT). This is costly and it is conceivable that proponents of car use disagree with the large amount of urban road resources spent on BRTs. Hence this requires that the government requires a clear and solid vision concerning the development of exclusive rights-of-way for buses, and it should cultivate the application of solid strong policy analysis methods and honor their outcomes in decision processes. Furthermore, privatization and decentralization in China's institutional structure led to a decline in transit quality, and after the implementation of the mentioned "post-NPM strategies" in scenario C, performance levels may not go up again. Consequently, if the government still wishes service quality for users, institutional restructuring becomes imperative. This is, however, bound to lead to some form of "public monopoly", in which the government is the sole service provider. But the long-term consequences of such a choice are far-reaching and still uncertain in terms of efficiency and accountability. Last option is to have the government play the part of a regulator, needing to strengthen its contractual "guidance" of provider to impose coordination in some way: clear and measurable indicators associated with service quality have to be established in municipal guidance, and a stable subsidy mechanism needs to be established.

## 5.7. Conclusions

This chapter highlights the actor subsystem of Dalian from the policy analyst perspective by looking into the landscape in which policy analysts in Dalian operate and what analysis they have conducted for urban transport. This perspective covers two parameters in the actor subsystem, the role of policy analysts and the importance of policy analysis and analytical information. Table 5.4 gives a summary of the scores of Dalian on these two parameters. As indicated in the table, we can safely conclude that both the role of policy analysts and the importance of policy analysis in the planning

and decision-making process of urban transport in Dalian are generally weak. The professionals from the research institutes do not regard policy analysis as their primary mission. They do not view themselves as policy analysts. Rather, they behave like government contractors and must take into consideration the preferences of the government authority. In addition, they are well aware of the fact that their analyses will not impact or only impact slightly, on the generation of actual government policies and actions. Given such a mentality, the transport engineers will shun the effort to build up a comprehensive simulation model and to search for the best policy option. Instead, many assumptions are made to keep the model simple but still with the quality of giving acceptable results, and open policy options are proposed to the government.

Table 5.4 Scores of Dalian with respect to the actor parameters from the policy analyst perspective

PARAMETERS	CURRENT SCORES
<b>Parameters in the actor system from the policy analyst perspective</b>	
19 The role of policy analysts	At this moment, the policy analysts are only active in the very early part of the whole decision-making process, taking responsibilities of collecting data, building models and forecasting. Aside from policy analysis, the major task of the organizations, especially for those affiliated with universities, lies in education. Therefore, their principal mission is teaching and administrative responsibilities, rather than conducting policy analysis. As policy advisers, they are well aware of their weak influence on governmental thought and action, so they only play a role of generating workable policy options in a self-effacing and modest way. Here, they are neither problem solvers nor lobbyists in arguments. They do not show preferences or adhere to any specific policy option. Given such a mentality, when conducting analysis, the experts usually build mathematical models with the quality of being able to generate acceptable results. In other words, in the simulation process, many assumptions have been made, and the model has been simplified because of the difficulty of simulating every piece of the reality. This line of thinking and analyzing essentially goes against with what policy analysts should do: prudent and rigorous analysis and searching for the best solution.
29 The importance of policy analysis and analytical information	Although the development of public policy analysis first appeared as an American phenomenon and subsequently the specification has been extensively adopted in Canada and a growing number of European countries, the increasing complexity of large metropolises as well as urban transport in China since 1990s dramatically intensifies the government authorities' need for experts' analyses and analytical information. That is why many Chinese local governments started to incorporate policy analysis in the policy process, limited though, and to commission research institutes who have



technical knowledge and skills to conduct the analysis for urban transport. Therefore, policy analysis has indeed existed in the urban management in China. However, its importance is low partly because the above mentioned weak role of policy analysts, which gives rise to the concern of politicians to what extent the policy analyses are trustworthy and reflect the reality to the largest degree. It is also because of the fact that in China the policy analysts are government contractors commissioned by the local authority. They carry an advocative role, in which they dutifully assume the preferences of their client, i.e. the interests of the local government or the local leading officials, and have to constantly keep in touch with their client about the conformity of the analytical process and possible results with the political interests.

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# 6. A Legal Perspective

## 6.1. Introduction

In recent decades, China has undergone massive progress in the establishment and improvement of its legal framework for urban transport, an important purpose of which is to promote sustainable urban transport by reducing traffic demand through adjusting urban land use patterns, improving public transport service qualities and increasing modal split in public transport. Although far from perfect, the legal system provides the local authorities with effective guidance and statutory procedures to put urban development on a more sustainable and green pathway. However, real figures of Chinese cities show a different picture: private car ownership is rapidly growing and the city becomes more auto-dependent; people travel more frequently and longer than before; public transport user satisfaction remains low; and the modal split in public transport is deteriorating. This disparity triggers people to investigate whether, or to what extent, the decision-making and implementation process by local authorities with regard to urban transport complies with the legal guidelines and procedures. And this requires a better understanding of the reality of urban development and public transport, and the various organizations involved. To examine this problem in Dalian and to understand Dalian's actor subsystem from a legal perspective, we organize this chapter as follows: section 6.2 introduces the legal and organizational structures of public transport in Dalian; sections 6.3-6.5 examine the reality of Dalian in terms of urban land use and transport, public transport service delivery and modal split in public transport. In this way, we assess whether discrepancy exists between law and reality in Dalian. Finally, in section 6.6 we conclude as to where the disparity originates and what are the scores of Dalian with respect to the actor-subsystem parameters from the legal perspective.

## 6.2. Legal and Organizational Structures of Public Transport in Dalian

### 6.2.1 Legal framework

Basically, an urban transport system in China revolves around dealing with three types of issues: urban land use and traffic demand, transport operation (maintenance) and

management, and modal split. We explore and understand their legal foundations through gathering pieces of laws, statutes, regulations and policies at the central and local levels (figure 6.1).

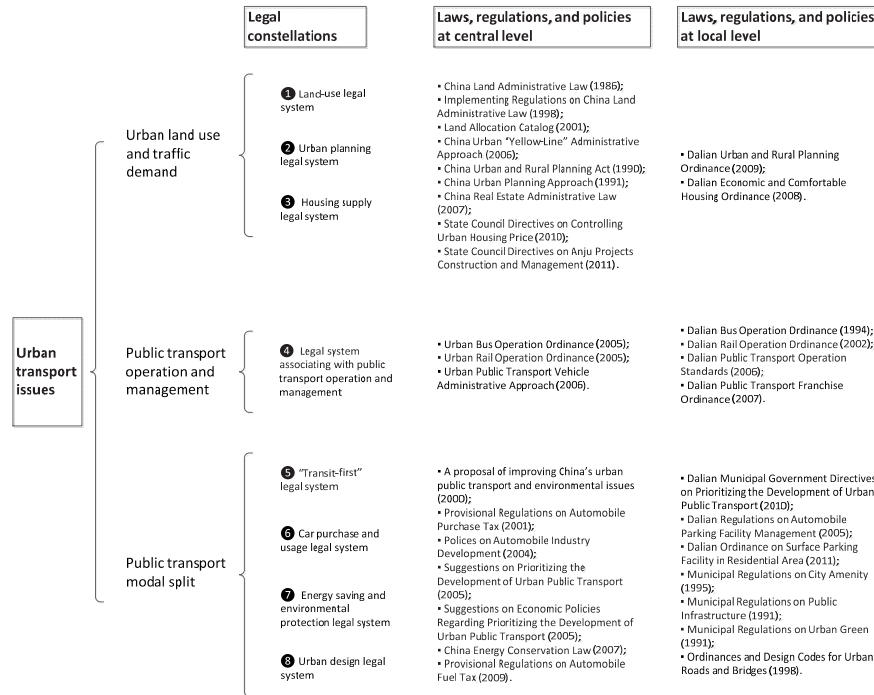


Figure 6.1 Legal framework of urban transport in Dalian

• **Legal components pertaining to urban land use and traffic demand**

Concerning the issue of traffic volumes, actually many factors have an impact on it, such as economic development, labor force participation, growth in population and the number of work places. Nonetheless, it is well documented, both theoretically and empirically, how planning of urban land use and development of urban housing supply originally affect the traffic demand. An underlying assumption is that land use, urban design and housing supply jointly set the background for individual travel behavior: transport is needed only when activities (e.g. working, shopping, going to school, etc.) at other locations attract trips. For instance, spatial separation of living, working, daily shopping and entertainment activities implies the need for travel, and the higher the level of separation, the longer trips will be. Therefore, legal systems of land use, urban planning and housing supply constitute the legal foundations for the traffic demand aspect of urban transport. When it comes to China, and we zoom in on Dalian, a wide range of laws, governmental directives and ordinances associated with urban land use, city planning and housing supply can be found.

As early as 1986, recognizing the rising urbanization and facing a severe challenge of gradual transformation of cultivated land to construction land, the central government promulgated the *Land Administrative Law* (NPC Standing Committee 1986). The Law states that, “frugally using every land parcel is the basic national policy, and thus land development must follow the principle of intensive use”. The Law also stipulates geographical boundaries of urban expansion by marking off/limiting a certain amount of land area for urban construction purposes. In 1998, *Implementing Regulations on the Land Administrative Law of China* was passed to consolidate and amend the legal procedures of land use planning and development, and at the same time to clarify the role of each governmental authority in land administration (Ministry of Land and Resources 1998). Thanks to this law and its implementing regulations, although China’s urban area sprawls, it largely grows on a dense basis. Compared to many European and American cities whose average population density is around 2,000 person/km<sup>2</sup>, the Chinese cities are much more densely populated with an average level of 6,000 person/km<sup>2</sup>. As of 2010, Dalian accommodated 3.6 million residents within an utilizable urban area of 389 km<sup>2</sup> (this area does not include mountains). Therefore, its population density reaches a level of 9,178 person/km<sup>2</sup>, making Dalian the 6<sup>th</sup> densest city in China after Shenzhen, Shanghai, Beijing, Tianjin and Shenyang. However, China did not pay much attention to the issue of land use diversity until the introduction of the *Land Allocation Catalog* in October 2001 (Ministry of Land and Resources 2001). This Catalog explicitly declares 19 types of land functions (e.g. residential, commercial, educational, medical, business, transport, and other public facilities, etc.), and sets the minimum amount of land to be allocated to each function. Regarding the land allocated to transport infrastructures in this Catalog, however, much emphasis is put on transport projects like airports, railway stations and expressways, while far less attention is given to preserve land for the urban transit system, resulting in the situation that buses do not have their exclusive right-of-way, and spaces of transit stations are so narrow and crowded that passengers always stand and wait for buses on the curbs of fast roads, and that buses are congested at stops when several buses simultaneously arrive. To address this problem, the central government approved the *Urban “Yellow-Line” Administrative Approach* in 2006 (Ministry of Housing and Urban-Rural Development 2006). This Approach expressly stipulates the amount of land in urban areas to be allocated to the public transport system, including dedicated lanes for regular and rapid buses, land for rapid rail stations, as well as land for bus bay stops.

China has also formally enacted laws and regulations regarding city planning and these regulations are now being adopted in Dalian. In 1990 the National People’s Congress approved the *City Planning Act* which is a major milestone in the history of city planning in China because it is the first to present a comprehensive multi-tier (master plan, district plans, and detailed construction plans) urban planning method, and it officially requires a co-planning of urban land use and transport, leading to a synergistic way of planning and development between land and transport infrastructures (NPC Standing Committee 1990). The following *China Urban Planning*

*Approach* was enacted in 1991 and revised in 2005 and specifically designed to consolidate the implementation of this Act (Ministry of Housing and Urban-Rural Development 1991). However, there are no independent national laws and regulations concerning the planning process of urban transport. Rather, urban transport planning is generally considered one component of city planning, in order to promote coordination and to build a co-development nexus between urban growth and urban transport development. This led to the official adoption of the Transit-Oriented Development (TOD) concept as an innovative city planning method in Dalian in 2005. And in 2009, in line with the national *City Planning Act* Dalian formulated the *Urban and Rural Planning Ordinance* for the purpose of specifying detailed procedures for urban planning and transport planning (Dalian Municipal People's Congress Standing Committee 2009). And it hopes this helps to place Dalian's urban expansion along the corridors of rapid transit system.

Less often mentioned but equally important, housing supply is also a factor influencing traffic volume in urban areas because the search of people for cheaper housing in the periphery due to housing unaffordability in central city inevitably triggers longer distance trips. But only in recent years has the central government initiated formal legislation to regulate housing supply, as well as the role of real estate developers. The *Real Estate Administrative Law of China* was introduced in 2007, stipulating that real estate development projects must follow the land allocation principles in the urban master plan and the detailed district plans, and that the development of real estate projects must be accompanied with the development of daily service facilities such as retails and transit stops (NPC Standing Committee 2007a). Furthermore, the State Council passed the *Directives on Controlling the Urban Housing Price* in 2010 (State Council Standing Committee 2010). And subsequently in 2011 it introduced the *Directives on Anju Projects (i.e. Economic and Comfortable Housing) Construction and Management* (State Council Standing Committee 2011). At the local level, Dalian's initiative was even earlier: it had the *Economic and Comfortable Housing Ordinance* in 2008 (Dalian Municipal People's Congress Standing Committee 2008). Based on this Ordinance, Dalian marks of a certain amount of land every year to build houses that are of high density, small, but enough to dwell, for low-income households.

- **Legal components pertaining to public transport operation and management**

Dalian's legal arrangements pertaining to public transport operation and management existed much earlier than those at the central level. Dalian municipal government introduced the *Bus Operation Ordinance* in 1994 when the regular buses dominated the roads and was the only mode of public transport. Later in 2002 when light-rail line 3 was completed, the Dalian government promulgated the *Rail Operation Ordinance*. Among tremendous details on service delivery procedures, both ordinances stress that transit operators should periodically examine and maintain the infrastructure, vehicles and other equipment to safeguard safety operations (Dalian Municipal People's Congress Standing Committee 1994; Dalian Municipal People's Congress Standing



Committee 2002). However, not until 2005 when the central government put forth the suggestions on prioritizing the development of public transport, it realized that China had no legal safeguards for service quality. It thus published the *Urban Bus Operation Ordinance* and the *Urban Rail Operation Ordinance* in 2005 and the *Urban Public Transport Vehicle Administrative Approach* in 2006. In conformity with these central government actions, Dalian issued the *Public Transport Operation Standards* in 2006 (Dalian Bureau of Transport 2006a). It advocates in a broad and general sense that service delivery should be safe and according to the timetable, that transit vehicles should be clean and seats should be comfortable, and that transit stops should be installed with striking signs, route maps and timetables, and lighting facilities. Nonetheless, no quantitative indicators or benchmarks are defined in the Standards. In addition, to increase competition and thus to improve service quality, Dalian issued the *Public Transport Franchise Ordinance* in 2007. It propagates that the selection of operators should be based on open and competitive tendering, and it also stipulates the required qualifications for potential bidders. In the Ordinance, a contracting procedure and contractual terms have been established (Dalian Bureau of Transport 2007).

- **Legal components pertaining to the modal split for public transport**

Facing the environmental crises in the Chinese large cities we discussed in the introductory chapter, the central government drew up a *Proposal of Improving China's Public Transport and Environment Issues* in 2000 and gained verbal agreements from a wide range of authorities (Ministry of Housing and Urban-Rural Development and Ministry of Environmental Protection 2000). In the following year 2001, therefore, the central government passed the *Provisional Regulations on Automobile Purchase Tax*, attempting to limit private car ownership (State Administration of Taxation 2001). In addition, the central government drew up two reports, *Suggestions on Prioritizing the Development of Urban Public Transport* and *Suggestions on Economic Policies Regarding Prioritizing the Development of Urban Public Transport*, which were officially published in 2005, promoting the "transit-first" principle in local management of urban transport (Ministry of Housing and Urban-Rural Development 2005). These Suggestions were further justified by the following energy policies. In 2007, China enacted the *Energy Conservation Law*, which stipulates in some of its articles that for every 5-years China needs to formulate a *Program for Energy Saving and Emission Reduction* (NPC Standing Committee 2007b). And in response to this program, in 2009 China published the *Provisional Regulations on Automobile Fuel Tax* (State Administration of Taxation 2009).

At the local level, only a few legal arrangements can be found on public transport, the car industry, energy savings and environmental protection, while a number of regulations are focused on urban design and city amenity which are also believed to play an important role in enhancing passenger attractiveness of public transport. There are many laws and regulations related to urban landscape design, street-view maintenance, open space construction and sidewalk management that emerged in the early 1990s. For instance, the *Regulations on the City Appearance of Dalian* which took

effect in 1995, limit street building design by requiring storefront retail on the ground floor with office and residential functions above, and stipulate that building types need to be consistent with the existing building patterns (Liaoning People's Congress Standing Committee 1995). Furthermore, there are the *Municipal Regulations on Public Infrastructure* and the *Regulations on Urban Green* which were both promulgated in late 1991. In these regulations, a certain minimum proportion of open space, public square and green area (including public art, sculpture and fountain) relative to the urban area is stipulated, and sidewalks are consistently required on all public streets. It also delineates different sidewalk zones to allocate space for plantings and street furniture (e.g. seating and bench), sidewalk lightening and vendors (Dalian Municipal People's Congress Standing Committee 1991; Liaoning People's Congress Standing Committee 1991). In addition, the *Ordinances and Design Codes for Urban Roads and Bridges of Dalian* establish standards for special paving (i.e. surface materials), street legibility, or other distinctive treatments such as pedestrian-only streets and covered walkways.

In line with the "transit-first" suggestions from the Center, Dalian officially published the *Directives on Prioritizing Public Transport* in 2010 and intended to keep the modal split at current levels even as the private car ownership increases (Dalian Municipal People's Government Office 2010). Along with the Directives, Dalian introduced regulations on the supply of parking facilities, including the *Regulation on Automobile Parking Facility Management in the Urban Area* and the *Ordinance on Surface Parking Facility in Residential Areas* because parking must be treated carefully so as not to become an impediment to pedestrians, and because the provision of ample free parking can help generate auto-dependent traffic. The former prescribes that off-street parking requirements should be reduced by time-restricted and metered on-street parking, while the latter emphasizes that private parking facilities should be underground, and should be unbundled from the sale or lease of residential units, in order to increase the efficient use of parking space of the developments and to reduce surface parking requirements in residential communities.

## **6.2.2 Statutory operating procedures**

In the wake of the progressive build-up of the legal framework for urban transport, the State Council introduced the *Outline of Law-Based Administrative Decision-Making* in 2004 in order to safeguard local government decisions and actions following the legal guidelines. Consequently, the Dalian municipal government, responding to the central decision, promulgated the *Provision on Major Administrative Decision-Making Procedures*, and statutorily adopted two major standard forms and procedures outlined by the central government: one related to the making of urban plans in which urban transport plan and land use plan are included, and another related to the selection of public transport operators.

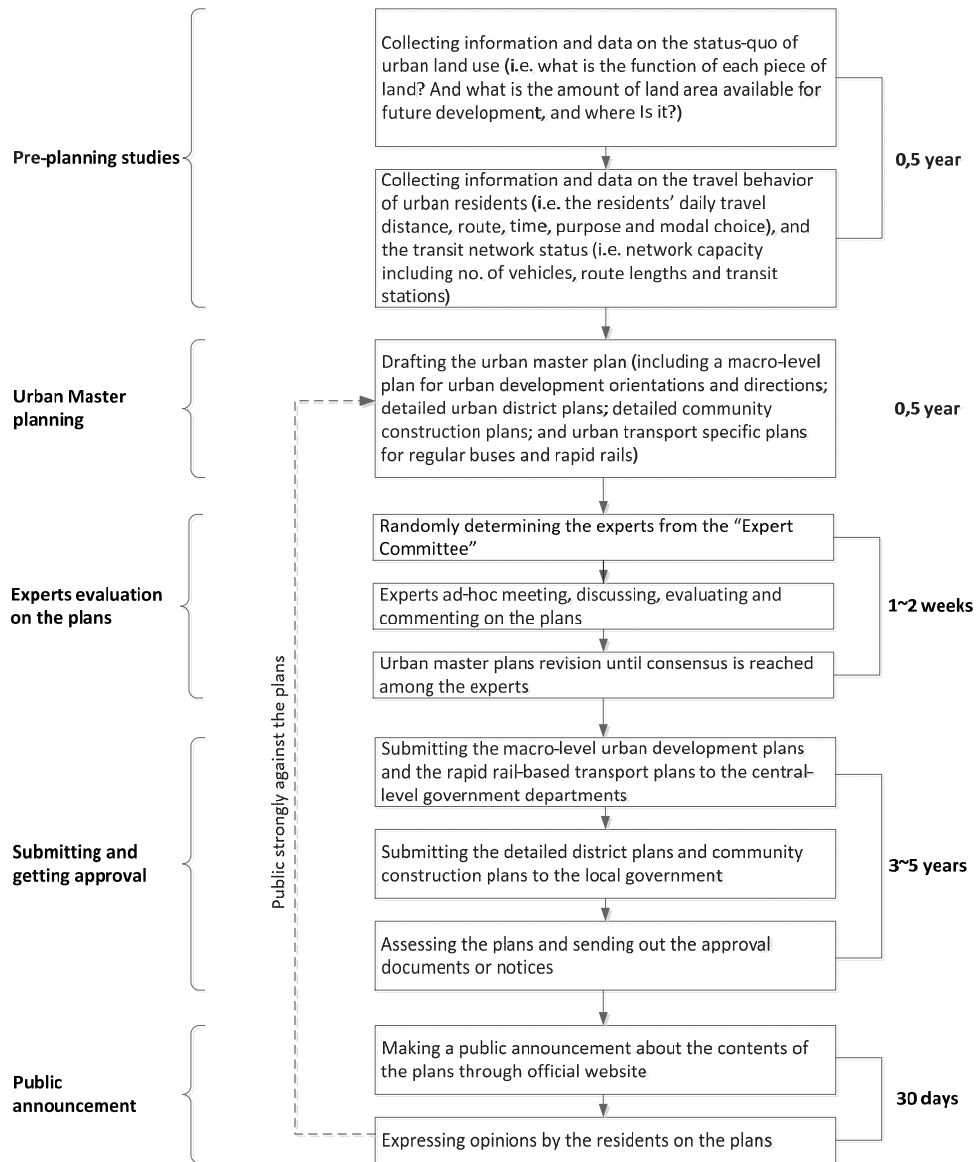


Figure 6.2 Decision-making procedures for urban master plans in Dalian

Figure 6.2 presents the procedures for urban master planning. The urban master plan (or urban comprehensive plan), required by the state for all cities, incorporates pre-set sustainable goals and is intended to alleviate the negative impact of urban sprawl and to manage urban development by focusing on balanced land use and transport infrastructure co-development. Therefore, the urban master plan is usually considered

by local governments a tool to resolve urban transport problems through carefully tuning the pattern of land use. The process of developing master plans is rigorous, comprehensive and deterministic, and it often includes a detailed spatial arrangement for the population, land use, transport infrastructures and other mega urban projects. In addition, it is a complicated and time-consuming process, touching almost all the government agencies and departments because master plans are embarked, developed, assessed, revised and implemented by municipalities who attempt to give an effective direction to urban growth, and it is approved by the central government. Apart from the input from national and local authorities, the process also includes active participation from planning and design institutes, experts of research centers and members of the public.

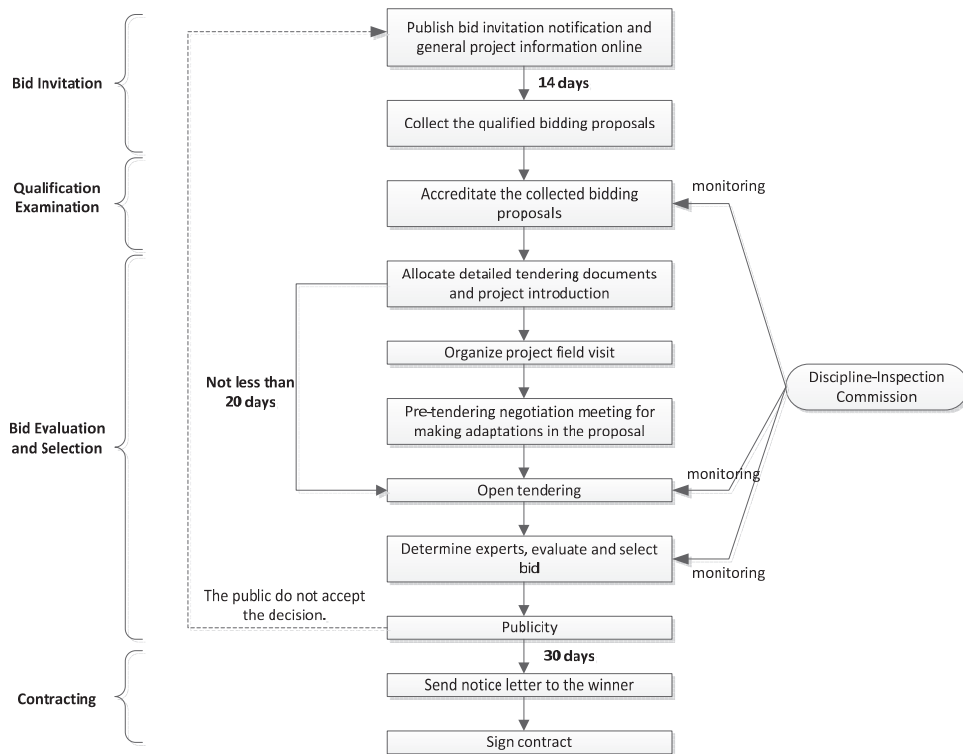


Figure 6.3 Tendering procedures for the selection of public transport operator in Dalian

Figure 6.3 shows the statutory procedures for the Dalian government to select public transport operators as well as to determine the service contracts. A detailed explanation on the procedures can be found in (Mu, de Jong et al. 2011). As articulated in Dalian's *Public Transport Franchise Ordinance*, the entire process emphasizes that the selection of the operator should be based on open and competitive tendering. In the service

contract to be established, service qualities, fares and subsidizing mechanisms should be clearly formulated. And it encourages the involvement of private operators.

### 6.2.3 Organizations and roles

The construction of the legal guidelines and procedures for urban transport has gradually marked the organizational shape of the urban transport sector in Dalian. Along with China's thorough reforms toward decentralization and deregulation in public service delivery, a multitude of organizational actors at the local level are involved in the planning and decision-making of urban land use and transport infrastructures (see table 6.1, a summary of the actors and their roles). Unlike before when the central government and its line ministries were the main actors sitting at the top, commanding and controlling the whole process of urban land use and transport service delivery, now it is the Dalian government that initiates and prepares plans, and manages and monitors the implementation of the plans. The central government, however, takes the responsibility of approving the plans through examining whether they are in line with the wider social and economic development directions. And the government at the provincial level plays a role in offering the local government support (e.g. documents review; provision of supporting letter) before submission for central approval.

Table 6.1 Organizational actors and their roles in urban transport

Actors	Roles
Municipal Level: <ul style="list-style-type: none"> <li>▪ Dalian Municipal Government (<b>DMG</b>)</li> <li>▪ Dalian Bureau of Urban Planning (<b>DBoUP</b>)</li> <li>▪ Dalian Urban Transport Planning Institute (<b>DUTPI</b>)</li> <li>▪ Dalian Urban Planning and Design Institute (<b>DUPDI</b>)</li> <li>▪ Dalian District Governments and Community Offices (<b>DDG</b>)</li> <li>▪ Dalian Transport Planning Institute (<b>DTPI</b>)</li> <li>▪ Dalian Bureau of Transport (<b>DBoT</b>)</li> <li>▪ Dalian Bureau of Land Resources and Housing (<b>DBoLRH</b>)</li> </ul>	Initiates new plans; breaks down the tasks and allocates each task to corresponding organizations. Makes urban master plan, district plans and detailed construction plans. Makes public transport plans. Manages urban landscape, greening, amenities, and regulates on the appearance of new buildings. Does surveys on residents' daily traffic patterns. Makes alternative transport plans for final decision. Manages and outsources public transport services. Provides subsidies for transit operators (!).
External actors working with municipal government:	

<ul style="list-style-type: none"> <li>▪ Transport Research Center – Tsinghua University (<b>TRC-TU</b>)</li> <li>▪ School of Transportation &amp; Logistics – Dalian University of Technology (<b>STL-DLUT</b>)</li> <li>▪ Land Use Survey Team (<b>LUST</b>)</li> <li>▪ Evaluation Committee (<b>EC</b>)</li> <li>▪ Public Transport Operator (<i>currently: Dalian Public Transport Operation Group – A Large Joint Venture of 13 Route Operators and 1 IC card operator</i>)</li> </ul>	<p>Provides expertise in transit network planning and design.</p> <p>Provides expertise in transit network planning and design, intelligent public transport in particular.</p> <p>Does surveys on the status-quo of urban land use.</p> <p>Comments and advises on the plans.</p> <p>Operates the public transport system.</p>
<p>Provincial Level:</p> <ul style="list-style-type: none"> <li>▪ Liaoning Provincial Government (<b>LPG</b>)</li> <li>▪ Liaoning Department of Housing and Urban-Rural Development (<b>LDoHURD</b>)</li>   <li>▪ Liaoning Department of Land and Resources (<b>LDoLR</b>)</li>   <li>▪ Liaoning Department of Transportation (<b>LDoT</b>)</li> </ul>	<p>Provides administrative support.</p> <p>Preliminary assessment of the validity of plans in the Liaoning development context and gives provincial approval before they are submitted to the central government.</p> <p>Preliminary assessment of the validity of the plans in terms of land use and gives provincial approval before they are submitted to the central government.</p> <p>Preliminary assessment of the validity of the urban transport plan.</p>
<p>Central Level:</p> <ul style="list-style-type: none"> <li>▪ Ministry of Housing and Urban-Rural Development (<b>MoHURD</b>)</li> <li>▪ Ministry of Land and Resources (<b>MoLR</b>)</li> <li>▪ Ministry of Environmental Protection (<b>MoEP</b>)</li> <li>▪ National Reform and Development Committee (<b>NRDC</b>)</li> <li>▪ State Council (<b>SC</b>)</li> </ul>	<p>Evaluates the validity of the proposed plans in terms of the scale and scope of urban development.</p> <p>Evaluates the validity of the proposed plans in terms of land use and resource consumption.</p> <p>Assesses the proposed plans' environmental impact.</p> <p>Examines whether the plans conform to the national reform and development directions/orientations.</p> <p>Examines the assessment reports of the plans from the line ministries and gives the final approvals.</p>

To summarize, in this section we have compiled the legal and regulatory provisions and procedures regarding urban transport in Dalian. Generally, we can see that Dalian has actively adopted those legal guidelines of the Center which advocate sustainable urban growth, transport development and environmental protection, in addition to which Dalian also develops and promulgates some directives and ordinances at the local level that supplement the central guidelines. Therefore, if we simply look at the legal framework, we can conclude at this point that though flaws still exist in the



legislation concerning space reserved for urban transit and mixed land use, the legal system for sustainable urban transport has made great progresses. Regarding the concern whether these legal guidelines are practically obeyed in the process of organizational implementation, we have to gain a better understanding of the urban realities in Dalian. Hence, in the following section, we examine the experience in Dalian with the development of urban land use and public transport infrastructures, the delivery of public transport services, and the promotion of public transport modal split. And we compare the realities with the legal guidelines, find the discrepancies, and examine the reasons.

## **6.3. Development Reality of Urban Land Use and Public Transport**

### **6.3.1 The co-planning of urban land use and rapid rail corridors**

In the 1990s and the early 2000s, administrative decentralization made the local state the leader in urban development, and decision-making was largely left to the local government, enterprises, and market-oriented developers in Dalian. In that period of neo-liberalism, the established land market in Dalian was almost fully responsive to market forces rather than to urban master plans. Planning was considered a bureaucratic constraint on economic growth. It was believed to be unable to catch up with the speed of urban development and thus soon became outdated. In addition, in that period Dalian did not apply the statutory procedures for urban planning, which deteriorated enthusiasm for planning further. In such circumstances, urban planning was not quite concerned with deliberate technical/physical feasibility studies, environmental assessments or social impact evaluations, but much attention is paid to a trade-off among the various land-related interest groups. Officials from the Dalian government, planning institutes and urban planning experts from universities and research centers pointed out that the previous urban land use plans as well as the urban transport plans lacked a solid scientific foundation. Plans were usually prepared in a very short period of time, around two or three months, only with some strategic actions rather than implementation details, careful comparisons among alternatives or any reflection of public interests through public participation were missing. They further revealed that Dalian's institutional landscape in terms of land use and transport planning can hardly be called coordinated. Over the years, the tasks in the planning procedures have been shaped separately by a multitude of agencies and authorities which often compete for the same limited resources, although there indeed existed some checks and balances when a couple of sub-plans were to be integrated. It has been clearly revealed by the transport planners in Dalian that any thought and information on land use planning was regarded as confidential by the Dalian Bureau of Urban

Planning, and thus the land use planners were reluctant to share the land use plan with transport planners. Transport plan was thus solely based on the traffic demand information obtained from conducting surveys, and thus the design of the transport network emerged separately from that of the land use plan.

Considering the above mentioned evidence which shows a long-lasting fragmented urban and transport planning context in Dalian, it is safe to say that Dalian's old administrative practice in making land use and transport plans did not match the legal principles articulated in the *City Planning Act* which requires coordinated land use and transport planning and development. However, the hand-in-hand arrival of the TOD concept and the decision-making procedures for urban planning in Dalian aroused the awareness of the planners concerning the importance of an integrated, pro-active and coordinated urban and transport planning. Since then, the municipal government organized land use planners and transport planners to draw up new urban development plans. In 2005, the *Plan for Mass Rapid Transit System (MRTP)* and the *Urban Land Use Plan (ULUP)* were drawn up in a coordinated way (figure 6.4).

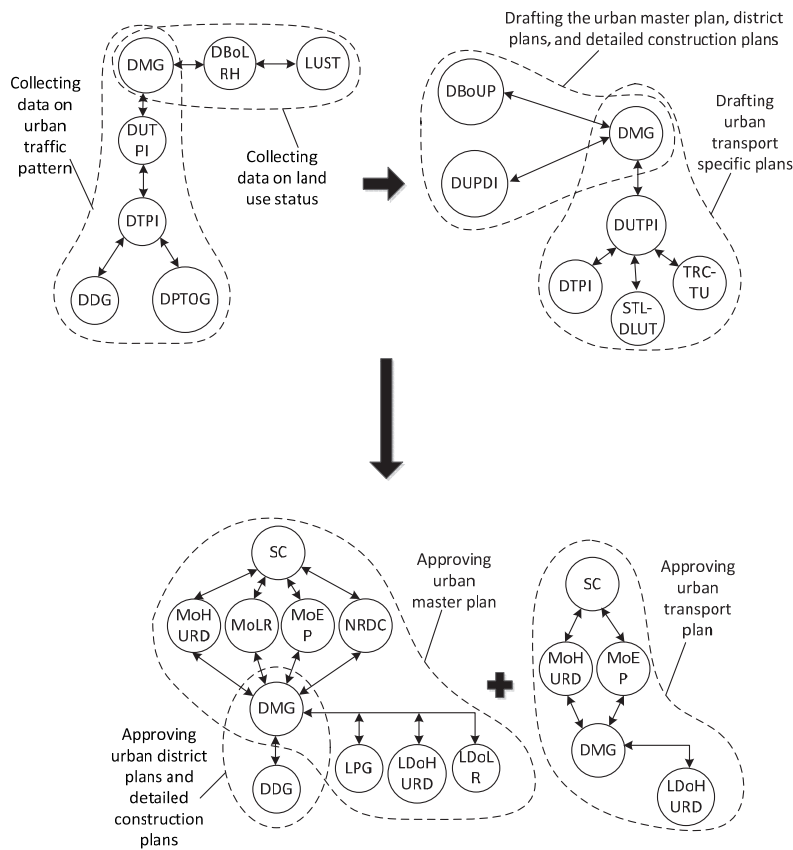


Figure 6.4 The decision-making process of urban transport plan and land use plan in Dalian

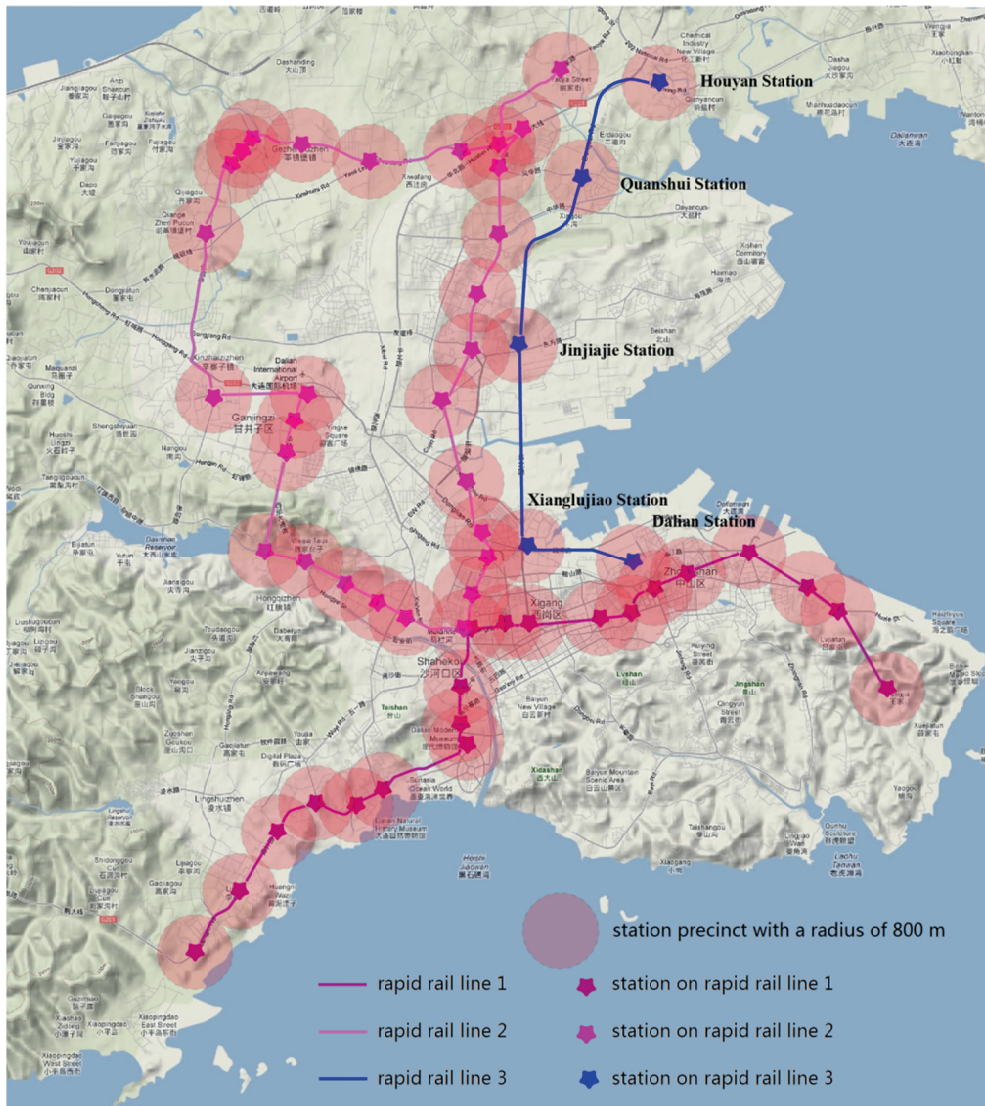


Figure 6.5 The co-planning of urban land use and rapid rail corridors in Dalian

In the MRTP, the short term plan (2006-2015) focuses on the metropolitan area of Dalian, consisting of some 70 km rail-based transit lines with 53 stations (figure 6.5). The first line is a backbone line running from west to east with a length of 20 km, connecting the High-Tech Zone to the central city where the CBD is located, and the second line is a circular line covering major commercial areas and residential communities in metropolitan Dalian with a length of 35 km. They are both currently under construction. The light-rail line 3 is the first rail-served rapid line in Dalian, even before the introduction of the MRTP. This line forms a 15-km, 5-station metro system

that was completed in 2002 and opened to traffic in 2003 at a cost of 2.4 billion RMB. It connects the city center (where the Dalian Railway Station is located) with the Dalian Economic and Technology Development Zone in the north. The mass rapid transit system in the short-term plan will then serve as the city's lifeline, linking residents to jobs, shopping centers and recreational offerings throughout the whole metropolitan area.

The ULUP, on the other hand, resonates with the MRTP in a highly coordinated way. It designs 53 station catchment areas on the rapid rail corridors (figure 6.5). A station catchment area, or a station precinct, is the surrounding area of a public transport station. It is a circle with the station at its center, and thus usually measured by radius. Although there is no common standard on the size of the area, Dalian uses 800 m as a radius which is considered the appropriate walking distance acceptable for pedestrians. The catchment areas partly traverse existing urban developments and partly undeveloped urban land. In existing areas, redevelopment opportunities were exploited to re-orient the land use toward the station. And in new areas, the Dalian municipal government and its planning organizations designed for new communities at each precinct to increase its accessibility, livability and economic opportunities. The revitalization and development process touched a variety of organizations and involved a series of issues concerning how to differentiate individual precincts, how to allocate land to different functions and how to ensure affordable housing supply along the rail corridors.

### **6.3.2 The development of station catchment areas**

It is known that station area development normally takes years, perhaps even decades, to unfold, with supportive policies (e.g. transport policies, land use policies, real estate development policies, residential and industrial relocation policies, etc.) acting as a catalyst for that development. Here, we will look at the five station catchment areas of the light-rail line 3 as the study areas, because these areas have undergone a 10-year construction and development since the light-rail opened to traffic in 2002 while the station precincts on other rapid rail lines are still not planned yet.

First of all, the development of the Dalian Station catchment area conformed to a place-node principle: as a primarily commercial place in the central city and as a node linking various transport modes. As figure 6.6 shows, the revitalized station area comprises the light-rail station with park-and-ride lots and adjacent to the railway station and the port, and consists of a high rate of commercial land use (around 60%), suggesting a station classification as "Commercial and Transportation Node". Compared to the area in 2001 when the light-rail had not been built yet, a decrease in land use diversity is visible. Originally, the place was mixed with residential, commercial and industrial uses, while after the introduction of the light-rail station, except for the port area which still retains its original characteristics, the area is mainly occupied by large shopping



malls, banking services, hotels, post offices, and recreational offerings with underground parking space. In the transformation process, real estate developers have never attempted to gain land to build residential apartments in this area because it is extremely expensive for land acquisition in the central city. This partly led to the centrifugal movement of people, and resulted in a reduction in land use diversity in the central area. Other changes include the construction of the park-and-ride facility and the creation of a large pedestrian plaza near the station. Pictures showing the building appearance and the station area streetscape can be found in appendix C. It can be seen from the revitalization that the Dalian Station has played an essential role in transforming the central city to a pure center of commerce and a node of multiple transport modes, rather than a residential and commercial mix.

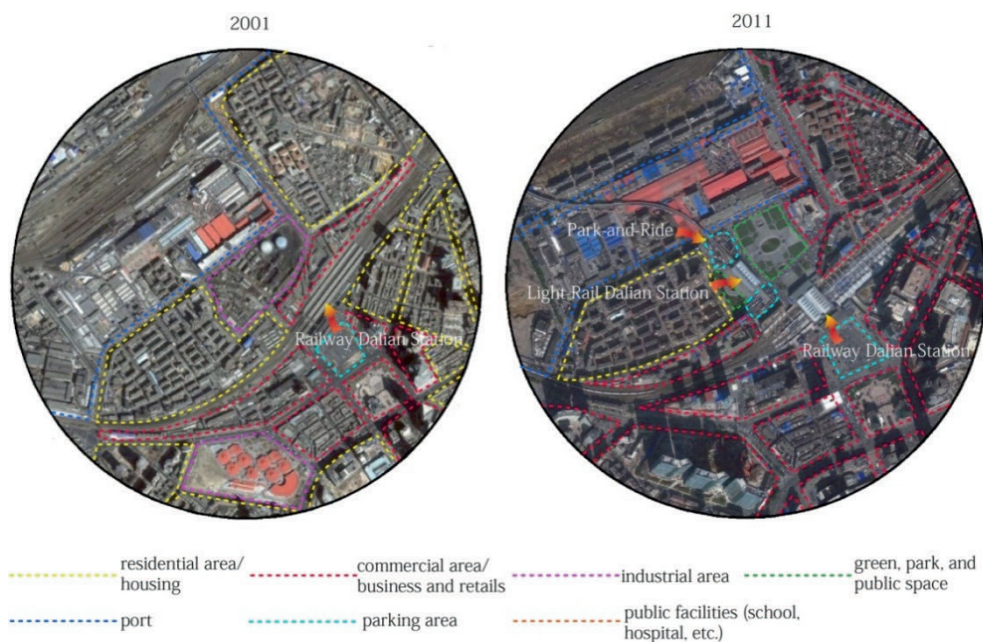


Figure 6.6 Dalian station catchment area development, 2001-2011

As for the Xianglujiao Station catchment area, it now consists of about 50% residential, 15% commercial, 15% port, 10% industrial, 5% public facilities and some green areas (figure 6.7). Among the current house occupiers, around 70% are median households with an average annual income of 12,000 RMB. These characteristics suggest that the Xianglujiao catchment area is a “Middle-Income Mixed-Use” community. However, when we look at this area in 2001 prior to the introduction of the light-rail, we can easily see that it was an area where residential areas were located with adjacent large state-owned manufacturing industries, with sporadic public facilities and retails/groceries. The redevelopment of this area thus resulted in many changes. First, the real estate developers took over many of the old industrial areas and replaced them with commercial and residential uses. Now, surrounding the Xianglujiao Station are

several land parcels of high-density apartment buildings and large shopping malls and supermarkets, allowing returning commuters to do their daily shopping on the way home. Second, the Xianglujiao station rests above a large, open and green space that did not exist before the light-rail, reflecting civic leisure activities. Third, this light-rail stop also shares space with a regular bus terminal, creating a rail-bus interface between this station catchment area and outlying residences. Fourth, situated right in the corner of the urban fast roads intersection, a moderate-scale park-and-ride facility is built next to the station for easing modal interchange. Although such a transformation led to a decline in industrial and employment rate in this area, it attracts more high-educated people and middle-income households due to the updated services and transport accessibility. Vivid pictures on the station area amenity can be found in appendix C.

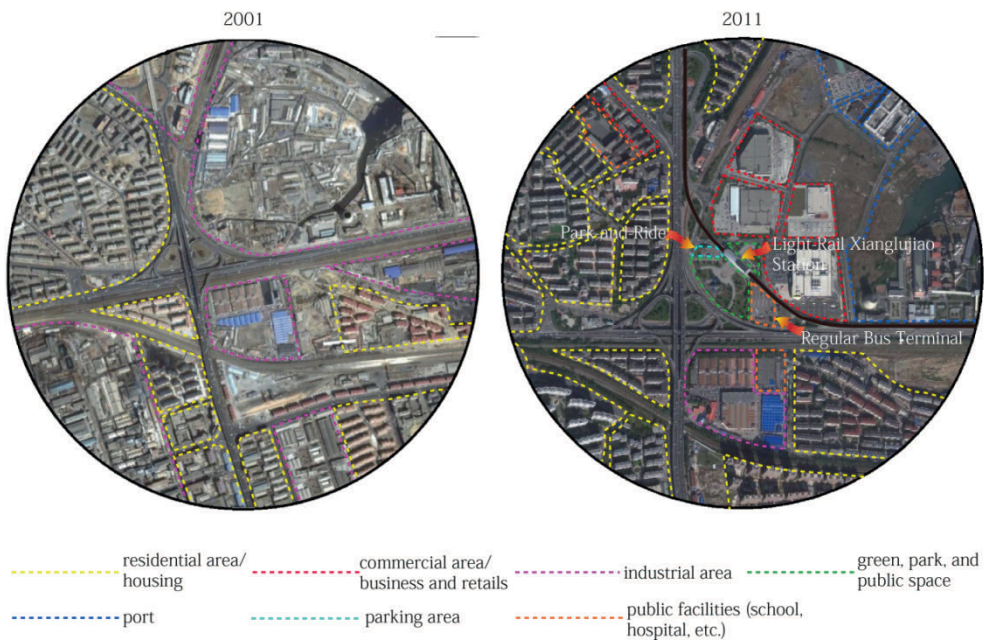


Figure 6.7 Xianglujiao station catchment area development, 2001-2011

Further away from downtown, the Jinjiajie Station catchment area retained most of its industrial land (i.e. the Dalian Iron and Steel Co., Ltd. and the Dalian Xigang Fuel Company sharing a high employment account, around 10,000), and some residential land was transformed into public facility functions, thus indicating that the Jinjiajie station area is an “Employment and Amenity Center” (figure 6.8). Rather than demolishing the old residential apartments, the revitalization of this station area basically focused on housing renovations and the improvement of the streetscape, greenery and park. The Dalian municipal government has once intended to ask for the real estate sector to carry out the revitalization work, but failed in finding any real estate developer willing to do this because of the low rate of return. As a result, the government tried to revitalize this area in-house with the aim to provide a wide array



of housing offerings that would appeal to increasingly diverse lifestyles and residential preferences (see pictures in appendix C). In the revitalization program, many public amenities such as schools and hospitals were added around the light-rail station. A wide (some 200 m) greenery buffer zone was built to separate the heavy industry area with the major residential area. In addition, a large Jinjiajie park was built just nearby the major residential blocks. The revitalization program proved to be effective in attracting new residents, the low-income households in particular. Compared to the year 2001 when there was no light-rail, there has been a remarkable upswing in residential as well as employment activities.

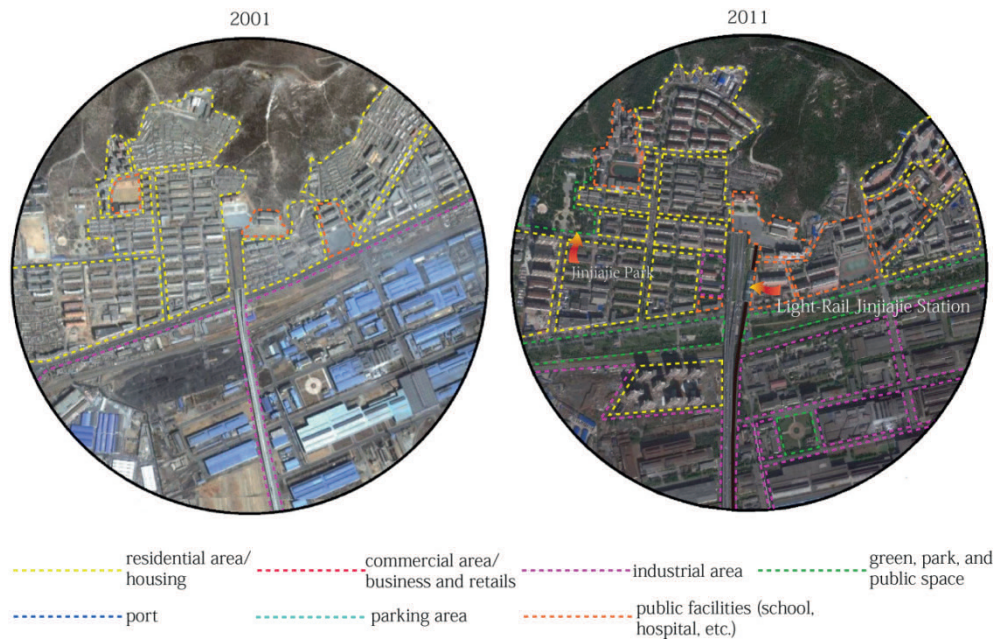


Figure 6.8 Jinjiajie station catchment area development, 2001-2011

A “High Population Rental” pattern of development was chosen for the Quanshui Station catchment area. It is one of Dalian’s more successful rail-served new neighborhoods. From its humble beginnings as a wasteland in 2001, the Quanshui station area has over the past decade emerged as one of Dalian’s principal residential blocks (figure 6.9). Presently, it is made up of 10 interlocking neighborhoods that orbit the light-rail station. Most span about 20,000 to 50,000 m<sup>2</sup> in size, contain some 2,000 to 4,000 dwelling units, and have one big shopping mall and two high schools. Not visible from the figure but from pictures in appendix C, most of the dwelling units on street sides are designed with retail spaces on the ground floor, and thus the neighborhoods are surrounded by many small shops and eateries. Nearly all the residential buildings in this area were built by the private real estate developers. The developers were interested in this station precinct because it was easy and cheap for them to gain the land of this area which was previously empty and not too far away from the center.

Although all the neighborhoods are designed with underground parking lots, a park-and-ride square was built just next to the light-rail station for temporary parking. In addition, a system of walkways was built linking neighborhood centers with the station, and therefore the pedestrian streams are separated from busy roads. The walkway system is well paved with color floor tiles, and adorned with interval landscaped small squares and play grounds.

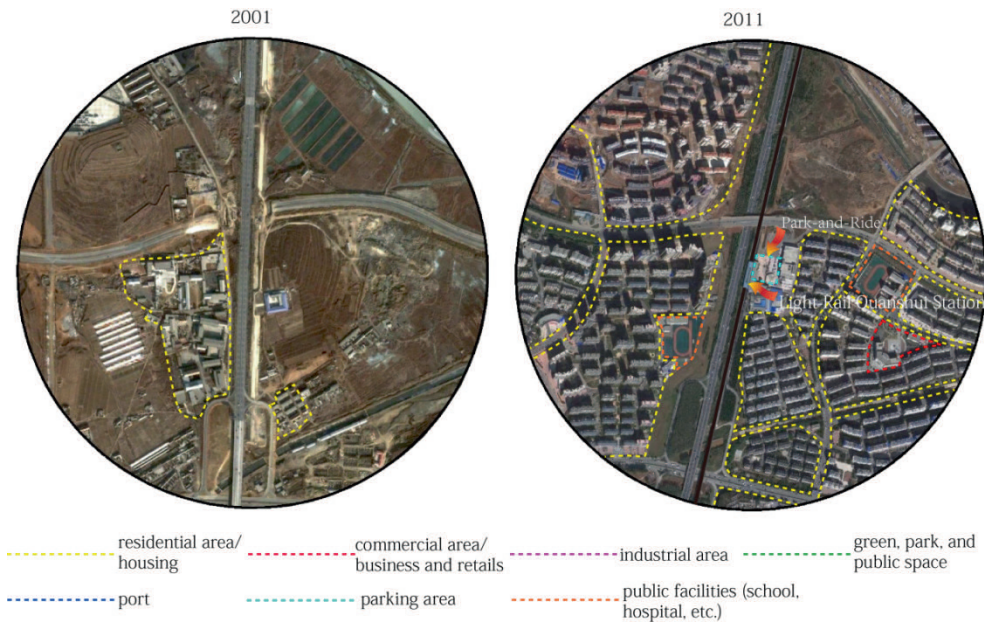


Figure 6.9 Quanshui station catchment area development, 2001-2011

Houyan Station is located at Dalian’s northern suburb. This station area contains residential neighborhoods with peasants and low-income households, and consists of some warehouses and light industry associated with the nearby expressways. These characteristics suggest this area of “Urban Poverty” with few amenities (see pictures in appendix C). As figure 6.10 shows, most of the original residential areas of the peasants (i.e. the low-rise ranch houses) retained the same features after the introduction of the light-rail station, which resonates with the central policy of reducing urban-rural inequality in terms of transport infrastructure by building rapid rail transit. And as a result, the peasants have easier access to other centers in the urban area to sell their agricultural products. Areas which were primarily wastelands in 2001 were sold to the industry for expansion substantially below the market value. And because suburban land is unattractive for commercial real estate developers, other vacant land was developed into Governmental Economic and Comfortable Houses (i.e. the *Anju* Projects) for low-income households. Other amenities like shopping centers, entertainment offerings, banks and hospitals are still underdeveloped in this station area.

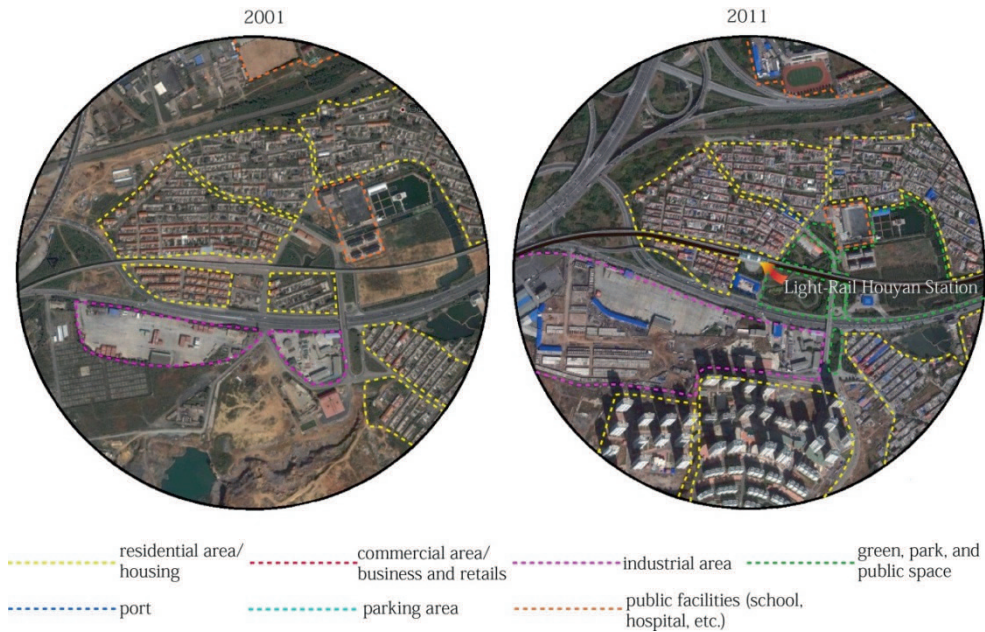


Figure 6.10 Houyan station catchment area development, 2001-2011

### 6.3.3 The discrepancy between the reality and the legal guidelines

From the above description, we can see that Dalian’s most recent planning practice has largely worked along the lines what the legal procedures prescribe, and it has adjusted from an uncoordinated to a more integrated and consistent program. Concerning the implementation reality, i.e. the actual appearance of the station catchment areas, it has also largely reflected the legal guidelines.

There are geographical variations in the five station precincts. The precincts thus take a variety of forms and individual station areas on the transit line serve different but complementary functions. Specifically, DMG, DBoUP, DUPUI, and DBoLRH have identified five different types of station areas of strategic planning: Commercial and Transportation Node; Middle-Income Mixed-Use; Employment and Amenity Center; High Population Rental; and Urban Poverty. Hence, each of the precincts has a unique land use mix, housing type, commercial/employment type and transit system function. By recalling the legal guidelines specified in the *City Planning Act* and the *Urban Planning Approach* of the Center, and the *Urban and Rural Planning Ordinance* of Dalian which stress that land use and public transport infrastructures should co-develop and be well synergized, we can say that the implementation reality of the station catchment areas has largely reflected these principles.

Closer examination of land use patterns in these areas reveals a high density form was applied by constructing intensive residential apartments, commercial buildings and industrial sites. Although the diversity was relatively reduced within station precincts, the major residential blocks were designed with scattered grocery stores, public facilities and open space. If we look at the whole transit corridor, we can see that the five precincts with different but supplementary functions show a diverse pattern of land use along the corridor. Therefore, we can safely conclude at this point that the land use practice also corresponds with the principles defined in the national *Land Administrative Law* and *Land Allocation Catalog* which stress the frugal and mixed use of every piece of land.

In addition, the precincts on the transit line provide a variety of housing types for different income level groups, eliminating the worry that less-affluent households are moved to places far away from transit services. These arrangements on housing supply, therefore, strongly comply with the *Real Estate Administrative Law*. And the development of the *Anju* projects in the Houyan Station areas resonate well with the national directives in the *Anju Projects Construction and Management*, as well as with Dalian's *Economic and Comfortable Housing Ordinance*, both of which emphasize that affordable housing is an important component of any transit-served communities.

## 6.4. Service Reality of Public Transport

### 6.4.1 The outsource of public transport

Although Dalian has the *Public Transport Franchise Ordinance* and the statutory procedures for the selection of public transport operator, both stipulating that the operator should be chosen through competitive and open tendering, it has in fact always appointed the Dalian Public Transport Operation Group (DPTOG) as the sole operator, monopolistically delivering all kinds of transit services, ranging from light-rail, BRT, streetcars, regular buses, to smart cards and vehicle advertising. Actually, DPTOG went through several reorganizations. Dating back to 1900s when the Japanese occupied the city, the Dalian Urban Transportation Co., Ltd. (DUT) was separated from the Manchuria Railway Co., Ltd. owned by the Japanese government to operate the streetcars. After the foundation of the People's Republic of China, the Chinese government took over the DUT and renamed it Dalian Transportation Company which in 1988 was then split up into mutually independent Bus Companies from No. 1 to No. 6, and a Streetcar Company. In 1987, the PTV was spontaneously established due to the increase in traffic demand and the inadequacy of bus capacities. At the end of the 20<sup>th</sup> century, along with the permission of foreign direct investment, three Hong Kong joint-ventures (GUANGZHONG, GANGHAO, and TONGHENG) were established offering regular bus services. In 2002 when the light-rail opened to traffic, JINMA was



established to serve rail-based transit routes (including the future metro lines). And later the JIETONG was formed to specially operate the BRT line. Until 2006 when the Dalian government initiated to merge all existing operators, these companies operated completely in isolation from others. However, after merging the operators into one large state-owned DPTOG, all the original operators became subcontractors/sub-operators, while they still ran the routes they served before. In other words, little progress in route and timetable optimization has been made in the following years: only 8 regular bus lines changed routes in late 2007 and 6 lines in early 2008. A larger proportion of the transit network still remains fragmented.

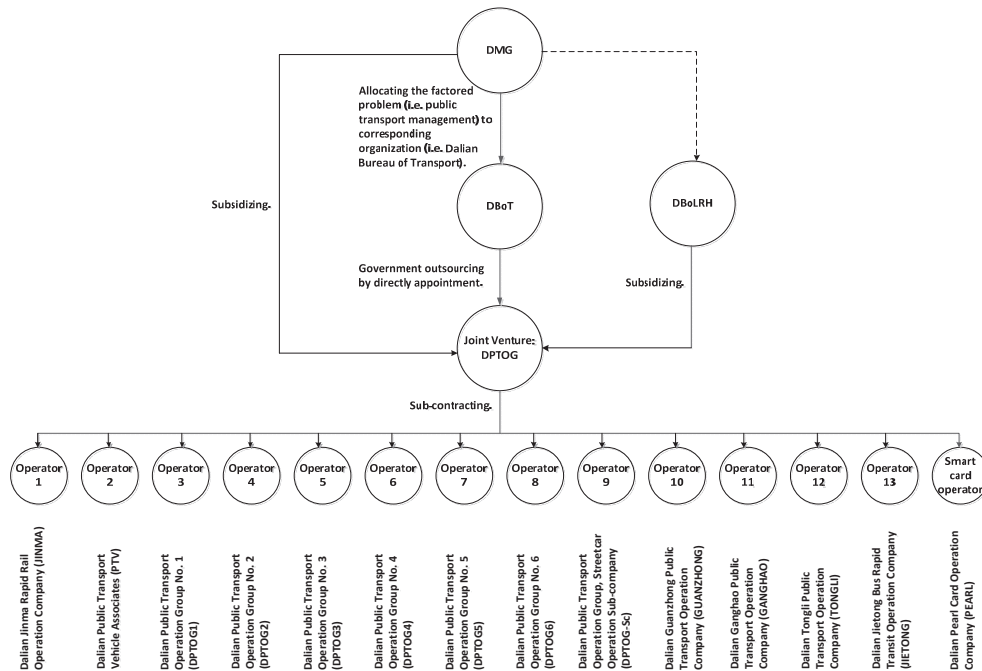


Figure 6.11 The outsource of public transport services in Dalian

The outsourcing structure is shown in figure 6.11. Traditionally, DMG gave the authority of urban transport management to DBoLRH. Due to the gradual shift of DBoLRH's organizational functions toward urban land and housing management, DMG detached the transport management responsibility from DBoLRH and granted it to DBoT. Therefore, it is now the DBoT that directly appoints the operator. However, while DBoT took over the management responsibility for public transport, the financing and subsidizing responsibilities for public transport remain within DBoLRH. And this has led to the problem that DBoLRH is no longer willing to subsidize public transport. Consequently, DPTOG has been striving for funding and subsidies from the government. Since the formal way of obtaining subsidies rarely works out, DPTOG often uses informal channels to obtain subsidies. This includes informal meetings and dinners. Because the top leaders of DPTOG are composed of individuals who formerly

worked in the transportation division of DMG, DBoT, and DBoLRH, the officials of these governmental organizations and the top leaders of the transit joint-venture know each other very well and thus they had countless quid-pro-quo relationships in the past. For example, the vice-mayor might ask the top leaders of DPTOG to increase several unplanned bus routes to serve a new residential neighborhood located in the periphery. Although the ridership of these routes is too low to make profits, DPTOG has to withstand this situation and seek subsidies. In many circumstances, DMG does not have adequate public budget to fund DPTOG, and thus it often uses the “land use rights” as an alternative. Once the promised subsidies cannot be given, officials in power will consult the leaders of DPTOG in informal channels about their willingness of accepting the using right of a land parcel instead of public funding. Normally, DPTOG will agree on this bargain because it can thus use the land for free to construct bus terminals, or to develop commercial activities like renting to retailers.

Even though DMG promises to provide funding, there is no formally established document concerning how much and when should be funded. In 2006 when DPTOG was established, there was a verbal agreement that DMG provides 83 million RMB per year for the compensation of the low ticket price (1 Yuan for cash holders and 0.95 Yuan for the Pearl Card holders) as well as the free tickets for elders and students, but actually this amount of money was not allocated every year, or at fixed times. Since 2008 when DPTOG began to buy new vehicles to replace the old ones (especially in 2011 when the Hybrid Energy Vehicle Program was introduced to reduce CO<sub>2</sub> emissions from buses), a negotiation on vehicle purchase subsidies was initiated between DPTOG and DMG, and now every year DMG has to provide 120 million RMB as an extra subsidy for new vehicle purchases. And as the oil price increases, there is a non-fixed amount of fuel subsidy (about 100 million RMB) offered by DMG. Therefore, DPTOG should receive about 300 million annual subsidies. However, this amount is completely unstable. For instance, in 2011 DMG provided DPTOG with 1.1 billion as the operational subsidies, which is a large amount compared to the past annual subsidies. The reason for offering this large amount of subsidy is that it is the time for DPTOG to repay the bank loan (appropriate 600 million) that was made when merging the multiple operators, and DMG must ensure that DPTOG does not go bankrupt.

Therefore, we can hardly say that Dalian’s transit operation is market-oriented. Rather, it is largely command-and-control based, and inherits characteristics of the top-down and state-centric approach: the source of transport infrastructure finance is mainly the public budget, and other tasks like operation and maintenance are assigned to a 100% state-owned enterprise. As a result, we can conclude that regarding the issue of operator selection Dalian’s practice has not worked out the way legal guidelines and procedures articulate.



## 6.4.2 The operation of public transport

Figure 6.12 shows the current jurisdictions of the transit operators of the Dalian metropolitan area. PTV's jurisdiction covers all Dalian's districts (dense in Zhongshan, Xigang, Shahekou, and sparse in Ganjingzi), thus containing substantial areas also served by DPTOG-1~5 and GUANZHONG. However, DPTOG-6, GANGHAO, TONGLI, and JIETONG touch some of the borders of PTV's service territory and extend the transit service to Dalian's northern suburban areas. As for JIETONG that operates the BRT, it physically connects with routes operated by DPTOG-1, DPTOG-Sc, and GUANZHONG. Regarding JINMA that runs the light rail, it only has a seamless connection with the jurisdiction area of DPTOG-5 that transfers passengers from the light-rail at its Jinjiajie Station to Dalian's southern mountainous areas. For PTV, DPTOG-1~2 and GUANZHONG, their jurisdictions 80% geographically overlap with one other, mainly serving Dalian's downtown areas. Where service territories of different operators touch or overlap with others it implies potential natural and/or artificial operator interdependencies.

One type of interdependency revolves around the issue of sharing roads and facilities between different operators. Except for the operators of the BRT, the LRT and the trams/streetcars that own exclusive right-of-way and specially built stops, the other operators of regular buses often share the same bus stop and use the same street: for instance, on the west-east corridors, PTV, DPTOG-1 and 2, and GUANZHONG use the Zhongshan Rd.; PTV and DPTOG-1 and 3 use the Gorky Rd. and the Victory Rd., while in the north-south direction, DPTOG-1~3 and GANGHAO use the Dongbei Rd. In the southern hilly areas, DPTOG-1 and 5, and GUANZHONG use the roads passing in valleys. Sharing transit stops and using the same roads create several problems. There is the potential for traffic congestion, and there is the matter of limited space at bus stops, as well as the mix of bus stops of various operators at the same curbside (figure 6.13). Taking the Huabei Rd. through which the BRT traverses as an example, there are four transit operators (JIETONG, TONGLI, DPTOG-3 and 4) that offer routes linking 2 railway stations, 5 schools, 7 shopping centers, 3 parks, 6 banks and 7 pharmacies. Some routes have a service frequency as high as 10 buses per peak hour. This leads to a total of 100-120 bus trips with mostly 12-18m-length vehicles entering a sharing bus stop at peak hours. These stopping activities of the buses cause severe congestion. And the outcome is that the travel time per passenger is remarkably increased due to the increase of the duration of buses jamming at the stop areas. Normally, the BRT buses stop for 3 minutes on average to load and unload passengers and then depart for the next station, while for regular buses that suffer from station area congestion, it often takes 8-10 minutes to depart after passenger boarding activities. Such congestion phenomena at bus stops seriously challenge bus punctuality: average bus delay has reached 35 minutes at busy stops according to the data in 2011.

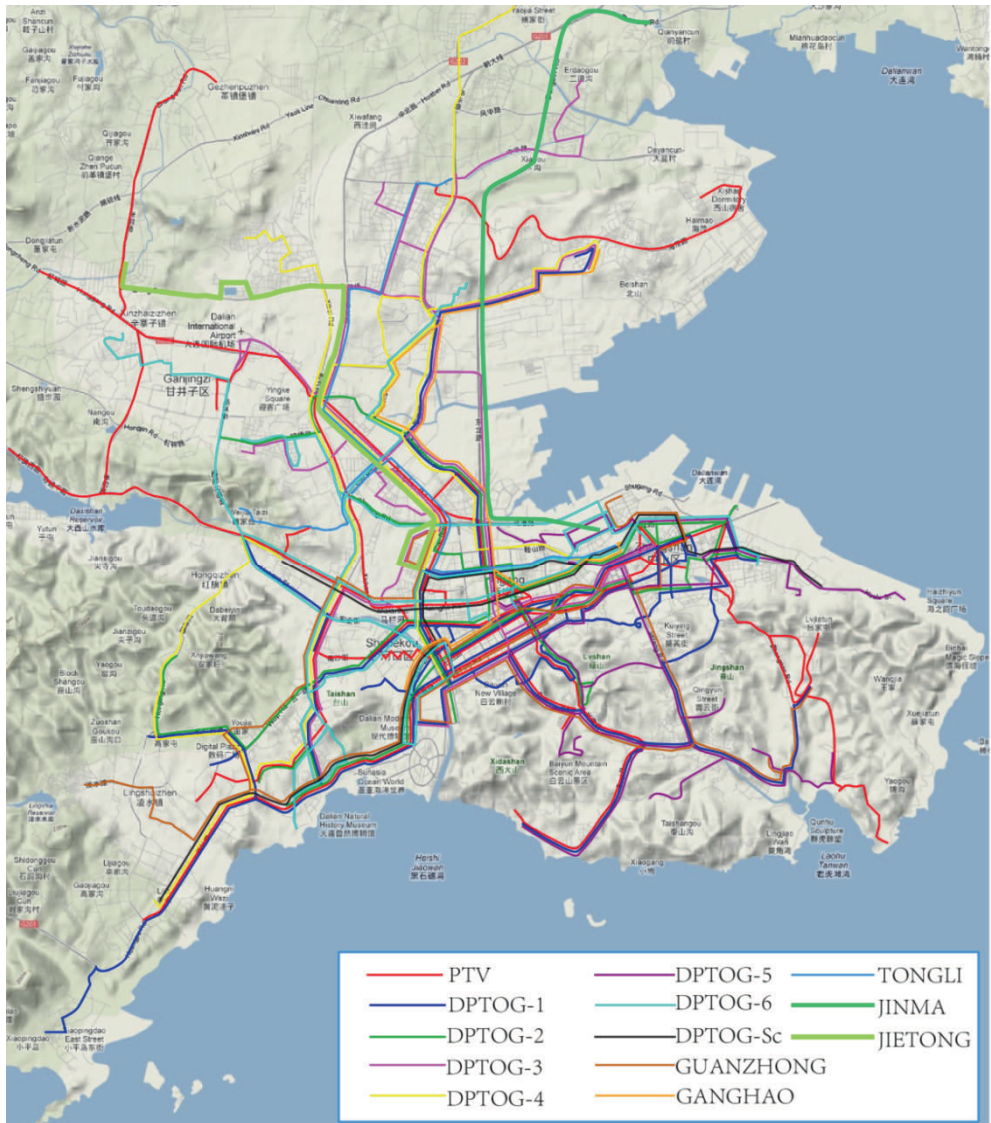


Figure 6.12 Jurisdictions of the public transit operators in Dalian



Figure 6.13 Exclusive right-of-way versus mixed right-of-way

To address the congestion problem caused by bus stopping activities, DMG has once planned to invest 3.5 billion RMB to re-build 170 traditional bus stops into bus bay stops (figure 6.14). Compared with the traditional bus stops at which buses from different routes (by different operators) randomly arrive in any order and passengers randomly waiting on the platform, without accurate information on the exact place the expecting bus would stop, the bus bay stops have relatively higher capacity to load and unload passengers. Although busses still arrive at random, they have their own designated space for stopping and independent bus signs; and they are less likely to hamper other buses as well as automobiles because more land around the stop is designated to create the bay areas. However, until the end of 2011, there are figures showing that no more than 10 traditional bus stops have been actually upgraded to bus



bay stops. And the reason for the original plan not to be completed was largely due to the failure of land acquisition for the construction of bay areas.

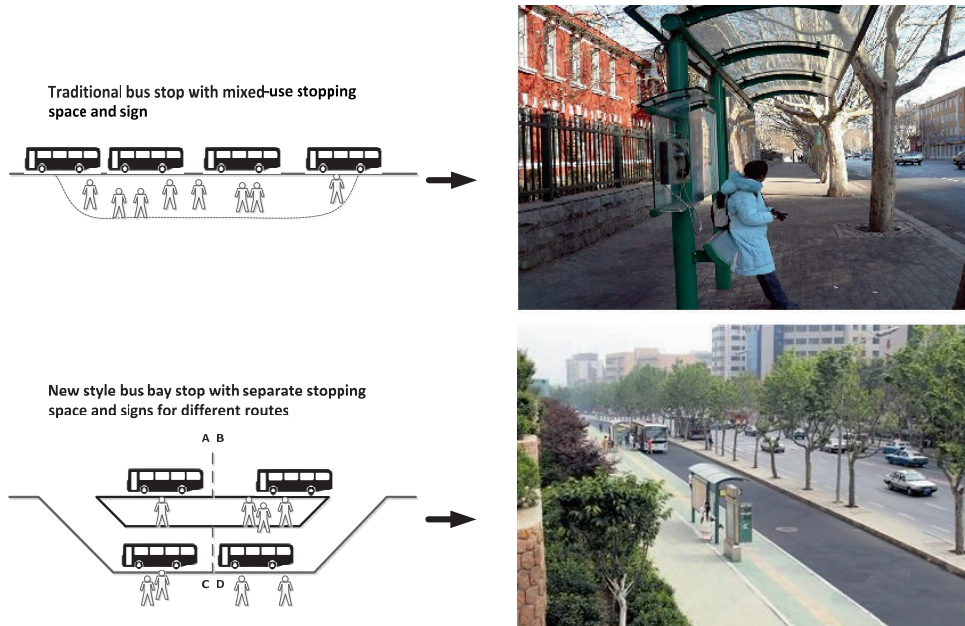


Figure 6.14 Traditional bus stop versus bus bay stop

Because no single operator's service territory encompasses all possible travel patterns originating or terminating within it, passengers make daily trips often consisting of more than one operator. The transfers necessitate relations among the operators: the routing of the bus lines and the physical locations of interchange points become problematic; and the payment problem such as joint fares also become an issue. How frequently should they run and at what schedules? Will the operators apply any signaling devices or other intelligent equipment to indicate other operators when they are about to arrive? As early as 2001 Dalian introduced the IC card, locally known as "the Pearl Card" to integrate ticketing, which has improved the convenience of fare payment as well as inter-modal transfer. Even so, transit services in Dalian are not "intelligent" enough. Routes and schedules are not flexible to serve dynamic traffic flows and do not provide passengers with individual travel information. In addition, travelers may be tired of, and abandon transit use due to the difficulties of intermodal transfer induced by physical disconnectedness between transit modes. Physical disconnection can be evidenced by the fact that the network layout of various transit modes is not designed in such a way that passenger transfer is safe, fast and seamless. Stops of regular buses are located far away from light-rail stations, BRT, or streetcars in Dalian, and there is a lack of short-distance connecting walking paths. Very often, people have to access bus stops or make transfers by walking across urban expressways. Alternatively, passengers who want transfer have to traverse through poor walkways,

unsafe or unmarked crossings. Figure 6.15 vividly illustrates this situation. This mediocre performance of the transit services is a consequence of improper design and inevitably affects passenger satisfaction and constitutes an important push factor, driving people towards growing car use.



Figure 6.15 Connectivity of different modes of public transit

A set of informal communications is identified between pairs of the operators that share streets and facilities, and that need collaboration to transfer passengers. Normally, these communications are done by making telephone calls between the controllers of the operation companies. For instance, PTV and DPTOG-1 use the same Zhongshan road and all the bus stops along the road, so often PTV's buses and DPTOG-1's buses

enter the bus stops simultaneously, causing congestion, or PTV's buses occupy all the stopping space while DPTOG-1's arriving buses have to stop in the middle of the road. To solve this problem, the controllers from the two companies negotiate on the phone and they agree to make an integral and staggered schedule. Another example comes from the informal bargaining between the managers of the companies of JINMA and DPTOG-5. These two companies have an important conjunction to transfer passengers from Dalian's southern mountainous areas at the light-rail's Xianglujiao Station to the northern suburbs. However, after Xianglujiao Station had been designed and built with the specific location, it appeared that the station was not conveniently accessible for bus passengers getting off from DPTOG-5 because of the existence of urban fast roads intercepting in-between. To deal with this problem, JINMA and DPTOG-5 made lots of bargaining efforts either through telephone calls or informal meetings: JINMA wanted DPTOG-5 to relocate its bus stop, while DPTOG-5 was not willing to do this because of the induced costs and suggested JINMA to add interchange coaches. After a temporary stalemate, their parent company leaders mediated and JINMA was willing to transfer the using right of one land parcel around the light-rail station to DPTOG-5 so that a bus terminal can be built for a large volume of unloading passengers of the light rail.

### **6.4.3 The discrepancy between the reality and the legal guidelines**

From the above evidence, we can safely draw the conclusion that there is considerable discrepancy between the legal guidelines in terms of public transport operation and the reality of public transport delivery in Dalian. The discrepancy partly lies in the ignorance of the statutory procedures for outsourcing public transport services. In contrast to open and competitive tendering, the selection of the public transport operator in Dalian has always been in favor of large state-owned enterprises. This also goes against the principles articulated in *the Public Transport Franchise Ordinance* of Dalian which explains clearly that the public transport operator should be selected from a number of qualified operation companies, public and private-owned included. Dalian's disparity between the legal guidelines and the reality is caused by several reasons. The most apparent one is that there are very few qualified operators, so even open tendering was organized; it was highly likely that few bidders would attend. Also, as pointed out by Mu, de Jong et al. (2011), private involvement in transport service delivery cannot often promise service continuity and quality given the fact that there is insufficient prior knowledge and experience with private participation in public infrastructures. In such circumstances, state-owned enterprises prove more reliable for governments because they cannot go bankrupt or simply terminate contracts even in the situation that they run at a loss and thus completely depend on limited and unstable government subsidies. However, the downside of setting up more contracts with state-owned enterprises on basis of close invitation is the emergence of problematic accountability and efficiency, because private sector partners are generally



assumed to be more motivated to make optimal use of the facilities to maximize return on investment. And this leads to the discrepancy between the required quality levels of service defined in the ordinances and the actual qualities of service delivery.

In comparison to the *Bus and Rail Operation Ordinances* of Dalian and the *Urban Bus and Rail Operation Ordinances* of the Center that generally demand safe, punctual, comfortable and intelligent operation of public transport, Dalian's experience has not been a class example in fulfilling these requirements. For the rapid transit projects with exclusive right-of-way these qualities can largely be safeguarded. However, for regular buses which share roads with automobiles and compete for facilities themselves their performance is still problematic. While the safety indicator can be ensured, the punctuality, comfort and intelligence cannot: there is no provision of comprehensive and reliable travel and transfer information such as routing, schedules and fares at bus stops; buses are often delayed because of the road congestion and the bus congestion at stopping areas so that punctuality cannot be safeguarded; the bus system is hardly coordinated given the fact that the jurisdictions of different operators overlap and lack effective physical connections at the interfaces. All in all, we can conclude that the reality of public transport operation does not appear to be what one would expect from the legal guidelines and procedures.

## **6.5. The Reality of the Modal Split**

### **6.5.1 The deterioration of public transport modal split**

From the early twenty-first century on mass transit has been struggling to compete with the private automobile in China, and its market share of urban travel has been rapidly eroding in many of its metropolises (Ng and Schipper 2006; John 2012). In Beijing, where the transit network can be considered "extensive and developed" in comparison with other Chinese cities, just less than 30% of all person trips were made by transit in 2005, down from 70% in 1975 (Sit 1996; Song 2008; Jiang and Han 2009). Shanghai is even worse: modal split figures fell from 76% in 1975 and 52% in 1995 to 19% in 2005 (Shanghai Urban Transport Planning Institute 2005; Jiang and Han 2009; Hao, Wang et al. 2011). Nationwide, 64% of commutes were done by transit in 1985; by 2005, this share had fallen to 26% (Jiang and Han 2009). However, although in this period the role of transit declined in many Chinese metropolises, ridership figures for transit's market in Dalian remained almost flat: 74% in 1975 and 68% in 2005 (figures 6.16 and 6.17). Therefore, until 2005 Dalian was a hallmark of achievement for public transport among its peers.

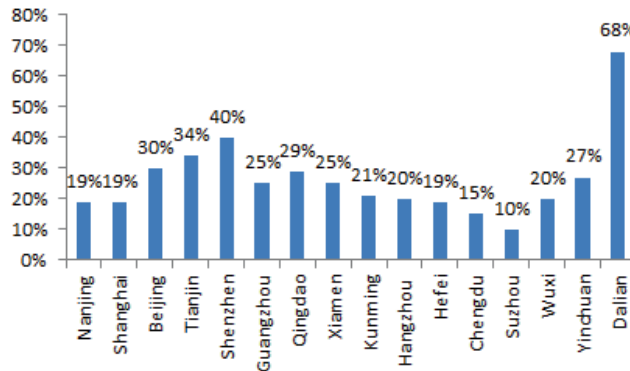


Figure 6.16 Dalian had a higher public transport modal split among major Chinese cities, 2005 (Jiang and Han 2009)

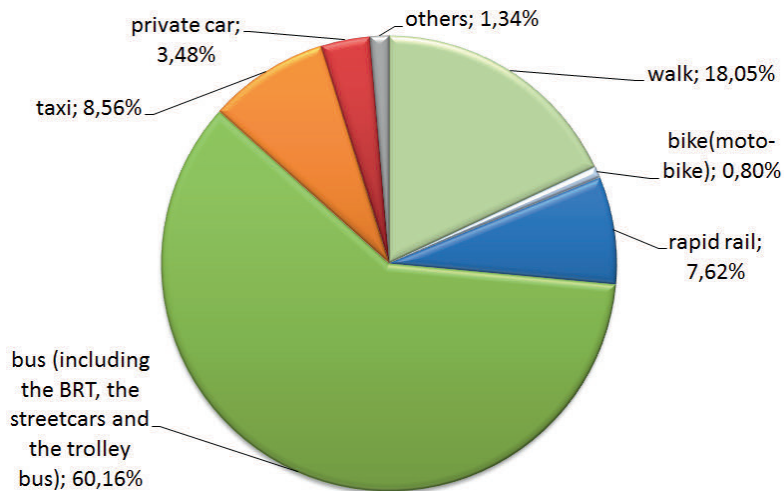


Figure 6.17 Modal split ridership in Dalian, 2005 (Dalian University of Technology 2005)

Dalian owes its good tradition in the use of public transport partly to good urban design in terms of architecture styles and city landscape. Historically, most of today's downtown area and the port were developed and heavily fortified by the Russians with classical and baroque style architecture and cobweb fashioned street networks. And it was further enlarged and modernized by the Japanese with Japanese architecture and grid-pattern streets. After the unconditional surrender of Japan in 1945, China made Dalian into a major shipbuilding center. And in the 1990s the city benefited enormously from the promulgated *Municipal Regulations on Public Infrastructure (1991)*, *Regulations on Urban Green (1991)*, *Ordinances and Design Codes for Urban Roads and Bridges of Dalian (1991)*, and *Regulations on the City Appearance of Dalian (1995)*, which, among other things, set street standards, banned motorcycles, built large areas for walking paths, emphasized urban greening, created large, lush parks in the city's many traffic circles

and generally built very attractive architecture. In addition, much of Dalian's interesting and attractive Japanese and Russian architectural heritage was preserved. With historical architecture and a modern attractive urban environment, Dalian was thus ranked ninth in the "2010 Report for Chinese Cities Competitiveness" and its degree of aesthetic quality was ranked eighth. Therefore, it is unsurprising that Dalian became a relatively propitious city in terms of architectural aesthetics, public space and pedestrian friendliness. These advantages consequently contributed to the high share of public transport in its modal split. Because of this, Dalian was awarded the title "Environmental Protection Model City" by the state council in 1997; and in 2001 it was listed under the "Environmentally-Friendly Global 500" by the United Nations, and granted the "China Habitat Environment Award" by the Chinese Ministry of Construction.

However, partly because of the motorization process in Dalian since the late twenty-first century (see section 4.3 in chapter 4) and partly because of the above described mediocre service qualities of public transport, Dalian's position in the favorable public transport modal split has deteriorated. Its modal split in 2011 is around 40% for public transport, compared to 68% in 2005. Although this level of public transport modal split is still higher than the nationwide average level (20% in large cities and 10% in small and medium-sized cities), it is eroding. And this alarming trend has prompted some observers to warn that Dalian is losing its good tradition in using public transport, and that something needs to be done if Dalian still wants to remain an environment-friendly city and a comfortable living habitat.

## **6.5.2 Parking and public transport modal split**

Facing the downward trend of public transport modal split, Dalian has once tried to restrain such a decline by applying the central transit-first policies. As one component, Dalian imposes the automobile purchase tax and the fuel tax as articulated in the central *Provisional Regulations on Automobile Purchase Tax* and *Provisional Regulations on Automobile Fuel Tax*. However, car owners have become insensitive to these cost levels as their personal disposable income increases. Given this fact, as well as the fact that car industry is now playing an important role in promoting local GDP growth and thus limiting car purchase goes against the interest of the municipal government, the transit-first policy in Dalian thus gives up car purchasing restriction policies (for instance, the plate auctioning strategy applied in Shanghai and the license-plate lottery strategy adopted by Beijing). However, Dalian has once pinned the hope of rescuing the modal split on regulating automobile parking, and that is why it published the regulations and the ordinance on parking facility management as we introduced in the legal framework. It focused on parking because the Dalian Municipal Government and its Bureau of Transport have invested billions of public money on the public transport system that capture only a decreasing fraction of the trips the Dalian people make every day. While there are a multitude of reasons why people do not use transit (such

as the increasing private car ownership, inconvenient transfers, long waiting time at bus stops), the primary reason in the government's opinion is that many of the transit stations/stops are linked to residential communities by walking paths full of off-street parking and a sea of surface parking is one of the greatest barriers to walking. It impresses upon the pedestrian the domination of the automobile. It also uses valuable land that could be used for creating an attractive living or recreation environment. In principle, parking should be oriented away from the pedestrian realm, behind buildings or preferably underground. And the provision of ample and cheap parking is considered an obstacle to get people out of cars and use public transit.



Figure 6.18 Off-street and surface parking in Dalian

However, the practice of managing car parking in Dalian does not work as legislated and expected. Off-street parking and surface parking in residential areas are still



everywhere (figure 6.18). One of the reasons is that the old residential buildings are not designed with underground parking space. While people living in these buildings own cars, they have to park on the surface areas of the neighborhoods. And these parking places are usually free. Although in some neighborhoods measures such as installing fences at the edges of the neighborhoods and equipping “boom barriers” with walking paths and traffic circles are implemented, auto drivers still find ways to encroach the pedestrian realm. Other reasons are the illegal usage of the sidewalk as parking lots by roadside retailers, shops, banks, and organizations like hospitals, companies and even governmental offices for their clients and employees. And there is no effective investigation on such parking behavior by the municipality. More significantly, in early 2012 the municipal government legalized 31 large off-street parking areas, and in later 2012 it plans to legalize 30 other off-street parking space, totaling around 6,000 m<sup>2</sup> previously designed for pedestrian use. Despite the fact that these legalized parking lots are charged, the parking cost, 4 to 6 Yuan per hour, is not sensitive enough to encourage people not to drive. In recent reports (Peninsula Morning News 2009; Dalian Daily 2012), it is stated that parking currently covers about 25% of the downtown area, 16% of the industrial areas studied, 57% of commercial areas analyzed and 40% of the residential areas examined. And in an extrapolation to the whole metropolitan area it has been assessed that parking has covered about 30% of the city, compared to about 6% in the past. And according to the latest statistics, the number of large-scale parking lots in Dalian has increased from dozens in 1990s to twenty thousand nowadays.

### **6.5.3 The discrepancy between the reality and the legal guidelines**

Dalian’s developmental reality pertaining to the public transport modal split can hardly be called legally consistent. Even though we found that Dalian shows some favorable conditions as regards a modal split more favorable for public transport, especially those dating back to its aesthetic historical urban architectures and successful stories in preserving its downtown area and creating beautiful cityscapes in the contemporary era, Dalian’s current urban context in managing car purchase and usage presents problematic records. Indeed, Dalian adopted the policies of imposing car purchasing tax and fuel tax, which is in line with the central promulgated legal guidelines in terms of prioritizing public transport. However, those costs are no longer effective as people become wealthier. In addition, the Dalian government failed to introduce constraining policies on car purchase because it regards the car industry as one of the pillars sustaining local economic growth.

As the government would not like to restrict car purchase, it tried to limit car use through regulating parking and it hoped that by clearing off-street parking and the surface parking in residential areas it would reduce auto-dependent travel on the one hand, and on the other hand, increase the livability of the neighborhoods and the

quality of the walking environment. However, there is a great disparity between the reality of parking activities in the metropolitan area and the parking regulations. Urban footpaths, sidewalks, and open areas in residential communities are still occupied by cars. Not only has inspection on illegal parking not been exercised by the municipality, but the government has also been trying to legalize off-street parking. This strongly goes against the parking management regulations. As a consequence, it is easy to imagine the negative externalities of surface parking. Its direct influence would be damage to Dalian's beautiful urban landscape. This is not only because land used for parking is not available as open space, thus reducing the areas for recreation and leisure activities, but also because parking lots are often unsightly. Therefore, all these effects will heavily weaken Dalian's original aesthetic landscape, thus furthering driving people to avoid walking or taking transit.

## 6.6. Conclusions

In this chapter, we have studied the legal guidelines and procedures for the development of urban transport on the one hand, and on the other hand we examined the development realities of urban transport in Dalian. The pile of the legal and regulatory provisions are generally sustainability oriented, with an increasing emphasis on the synergy between land use and transport, energy conservation, environmental protection and the prioritization of public transport in recent years. In spite of the progress, flaws still exist in national legislation in guiding a mixed urban land development. In addition, space reserved in legislation for urban transit still remains problematic. Apart from this, a careful examination of the evidence presented above underscores a mixed picture for Dalian, which shows the compliance of the legal guidelines and procedures in the process of actual organizational implementation, and simultaneously some disparities between the legal framework and the reality.

Thanks to the guidelines and procedures, we witness some positive organizational results. The revitalization and development of the station catchment areas along the light-rail line is believed to be sustainable, or transit-oriented: each station precinct is designed with its own identity and different but complemented combination of land functions and housing supply along this corridor. This development reality is thus highly responsive to the legal components pertaining to the co-planning of land use and public transport. And it sets standards and models for the development of the station catchment areas on other rapid rail corridors. However, there still exist some flaws in the areas of public transport service provision and management: the service delivery hardly realizes convenient and seamless transfer or intelligent operation; the administration still holds problems in providing stabilized subsidies and applying competitive tendering in the selection of operators. This is mostly subjected to China's previous and long-term planned economic regime that resulted in an unsound market



environment where competition and contracting experience is lacking. Moreover, the reality with conserving the high market share of public transport also shows an unfavorable score in Dalian. This is largely due to the weaknesses the local government exhibits in restricting car purchase and usage, and in firmly determining to improve transit riding environment and service qualities.

Given this evidence, in table 6.2 we present the scores of Dalian with respect to the actor-subsystem parameters from the legal perspective. Although most development realities in Dalian comply with only some of the legal guidelines and procedures, hope still exists because Dalian is currently only in the early stages of a sustainability and transit-oriented implementation learning curve. Progress up this curve will be definitely gradual, but experience in many other fields has shown that economic, social and ecological developments can be implemented quite swiftly in China. Curiosity to learn from and willingness to compete with what are considered foreign or domestic benchmarks are immense. This mentality may help make possible what seems nigh impossible now. In our case, then, much will depend upon the construction of effective supervision mechanisms in the legal system. And when the central government issues nationwide laws and regulations on sustainable urban transport that are accepted by the local governments, the central government should put more efforts in checking out whether the local authorities really implement the policies in practice or they are merely implemented in rhetoric way.

Table 6.2 Scores of Dalian with respect to the actor parameters from the legal perspective

PARAMETERS	CURRENT SCORES
<b>Parameters in the actor system from the legal perspective</b>	
20 The role of the central government	From a legal perspective, central government has a moderate role in influencing urban programs and local government actions. Although the central government has been able to draft and enact national laws, regulations and policies, and to set up the statutory operating procedures in order to guide urban decisions and actions. It lacks efficient law enforcement and monitoring measures partly due to the large territory of China and thus high transaction costs of checking and detecting every piece of work taking place in urban areas. However, central government does have impact on the approval of large and significant urban projects. Apart from that, it affects urban projects by appropriating central budgets.
21 The role of provincial governments	The provincial government has little impact on urban policies and municipal government actions. It acts as a mediator between the central government and the municipal government, or say, a broker of the municipal government to gain central support and approval.

22 The role of municipal governments	<p>The municipal government has a major role in directing urban development and construction. It promulgates urban policies and ordinances in order to respond the central instructions and directives, but it is unnecessary for the municipal government to really implement these local ordinances. Instead, the municipal government filters the central directives and chooses those that do not go against the development and revitalization of the urban economy. For those central policies that may hinder local economic growth, the municipal government will omit their existence and stick to the pro-growth policy measures. And this leads to the discrepancies between the legal prescriptions and the urban development realities. In addition, the municipal government also plays roles in outsourcing and regulating public transport services, and providing subsidies to public transport.</p>
23 The role of district governments	<p>The district government has little impact on the development of urban areas. It only takes the responsibility of assisting the research institutes and land survey groups to collect data concerning resident's traffic patterns and the status of land use.</p>
25 The role of land owners	<p>Land owners play a significant role in urban planning and urban transformation. Unlike societies where land is privately owned, in China land is owned by government. Any individual or organization only has the using right of the land spanning from 50 to 70 years. Due to decentralization, the municipal government has been the urban land owner and has the right to determine the functions of the land parcels. The effects are two-faceted. Positively, in the process of urban land use transformation, land redesign and acquisition has no longer become an obstacle. That is the reason for the successful transformations of the station catchment areas along the light rail transit. Negatively, it is possible for the municipal government to act as a landlord, leasing the land at a high price and increasing governmental revenues, which then leads to unaffordable housing especially near transit stations.</p>
27 The role of transport infrastructure providers	<p>In theory, the transport infrastructure providers have significant impact on service qualities and good service qualities contribute to a higher level of modal split of public transport and thus influence mobility patterns. In practice, however, the public transport providers in Dalian have a low impact on the level of service qualities not only because they depend on government subsidies which is non-fixed, but also because a central organization that can coordinate services of different transport modes or improve interconnection between various jurisdictions is lacking.</p>

28 The role of real estate developers/housing providers

The real estate developers in Dalian did not play a favorable role in shaping the distribution of residential apartments that are good for urban mobility or a mixture of housing types for different income-level households. The real estate sector is completely profit-driven, and has never focused on wider social sustainable responsibilities. The housing developers do not invest in the central city because land is expensive; they also do not invest in the area of the urban edge because the housing price would be very low; they do not invest in any revitalization or public housing programs because profit is low; however, they do invest in the areas not too far removed from the center and on those cheap in acquisition. For public housing programs and revitalization jobs, it is the municipal government that fulfills such responsibility by using public money.

30 The importance of legal procedures

The importance of legal procedures in influencing urban planning and decision-making showed a bleak picture. It can be seen that the legal prescriptions concerning the co-planning and coordination of urban land use and urban transport indeed plays a big part in adjusting the city-transport planning practice in the station catchment areas in Dalian from uncoordinated to a more integrated and consistent program. The variety forms of station precincts and the light rail system became the principal device to achieve Dalian's vision of transit served town development. Such a co-development of rail-served urban communities and new neighborhoods and the rail system, therefore, set the stage for a powerful transit-land use nexus. However, the legal prescriptions play a weak role in directing the delivery of public transport services and in improving the modal split in public transport. The service provider is chosen through convenience, rather than by competitive tendering. The overall service qualities of public transport do not reach the quality levels articulated in the operation ordinances. And the reality of increasing parking space, especially on-street parking, goes against the legally prescribed transit first principles and is further detrimental to modal split in public transport.

31 The concentration of city-planning tasks

The concentration of the tasks in urban master planning is low. The planning tasks are unbundled to different urban sectors like land use, water, transport, sewage, and telecommunications, which separately draw up segmented plans. And then the municipal government takes the responsibility to integrate them into a master plan. As for the tasks for land use and urban transport planning, they are more integrated and concentrated than others by requiring co-planning and checking for balance among land planners and transport designers.

32 The concentration of urban transport planning and operation tasks

The concentration of urban transport planning is low, while the concentration of public transport operation is at the medium level. To the former, the planning of urban fast roads, street networks, bus routes and stations, and rapid rail lines and rail stations are unbundled to different planning institutes, and there is no independent authority taking care of the integration of these transport systems. This leads to the low level of intermodality and causes problematic accessibility of transit stations. In addition, few road areas are appropriated to bus dedicated lanes. To the latter, although public transport services are allocated to 13 operators, interoperability has been improved by introducing the IC-card. Moreover, informal communications between different operators exist for coordinating passenger transfers. And there is one large joint venture sitting at the top coordinating and regulating services.

33 The level of competition in contractor selection for transport service delivery

The level of competition in public transport service delivery is extremely low. The service provider is a large state-owned enterprise, DPTOG, who has delivered the service since the existence of public transport in the city. It is the only contractor candidate in Dalian. Tendering for public transport service never takes place. And the contract for service almost automatically goes to DPTOG.

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# 7. A Political Perspective

## 7.1. Introduction

China's fiscal decentralization has given the leading officials at the provincial and municipal levels unprecedented room and freedom in the utilization of public money and the determination on the city's development patterns. However, China's political centralization in the control over personnel management in government and the party hierarchy, almost automatically encourages the officials to take decisions and actions that are centrally inclined, which adds more weight to local officials' political achievement records. Driven by the two forces, officials are driven to use public money and resources to initiate policies and projects that lack scientific proof but are beneficial for their personal prestige (Lin and Liu 2000; Jin, Qian et al. 2005; Li and Zhou 2005; Liu, Sun et al. 2006). Naturally, people have the impression that such political achievement projects are ineffective or inefficient, and the performance of these projects often fails to match the forecasts in the plan. However, this image deserves scrutiny when we find some projects where the original purpose of benefiting personal political careers still end up showing favorable societal results. Consequently, although some tremendous failures have been reported, not all large projects with political purposes have failed. Therefore, this chapter unveils the reasons that constitute the success and the failure of the political achievement projects, given the fact that completely eradicating them is impossible in China's urban political context. We rely on the political perspective of decision-making described in chapter 2, and thus the structure of this chapter is organized as follows: section 7.2 introduces China's political system, providing a general picture on how political decision-making takes place in China and where the decision-making power lies; section 7.3 zooms in on the urban politics, revolving around three interlocking issues: the shifting patterns of urban politics in China; the changing cadre evaluation system; and the emergence of political achievement projects. Embedded in such a background of urban politics, sections 7.4 and 7.5 investigate and analyze two contrasting public transport projects in Dalian, both being suspected as political achievement projects, but one coming out successfully while another failed; through analyzing the empirical evidence provided in the preceding sections, in section 7.6 we draw conclusions as to what makes a difference to the political achievement projects, and we present the scores of Dalian with respect to the actor-subsystem parameters from the political perspective.

## 7.2. Chinese Politics

Although many books and research papers have introduced Chinese politics, some going back to the imperial period while others focus on the rise of the Chinese Communist Party (CCP) and its consolidation of power from revolution through reform (Lieberthal 2004; Dumbaugh and Martin 2009; Joseph 2010; Shambaugh 2010), foreign scholars have felt that politics in China is a mystery, and even for the Chinese, many people have only a smattering of knowledge on the nation's political system. Therefore, before we look at the political decision-making within urban areas and the decision practice associated with large transport projects, first of all we have to study what the political decision-making looks like in the center for the reason that the party and the state are intimately intertwined at all territorial levels in China. Such an ambiguous relationship causes confusion as to where decision-making power truly lies.

China's political system consists of two hierarchies: the party and the government. They largely duplicate themselves at each of the territorial levels: the center, the provinces, the cities and the counties, so this section outlines the structure of the center in some detail while the provincial and municipal levels are dealt with more briefly. First, the structure of the CCP at the national level is presented in figure 7.1<sup>4</sup>. In ascending order of political power in decision-making, the major party organs include the *National Party Congress*, the *Central Committee*, the *Politburo*, and the *Politburo Standing Committee*. Besides, there is a *Secretariat* under the administration of the Politburo, taking responsibilities of coordinating the party's daily businesses and supervising the executive organs of the Central Committee. And in parallel with the Central Committee, there is the *Commission for Discipline Inspection* which plays a crucial role in monitoring the power abuse activities, and the *Military Commission* which controls the whole national armed forces.

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<sup>4</sup> The figure of the structure of the CCP and the functions of the organs are derived from the Xinhua archived information at the Xinhua News Agency which is the official press agency of China (<http://203.192.6.89/xhs/>).



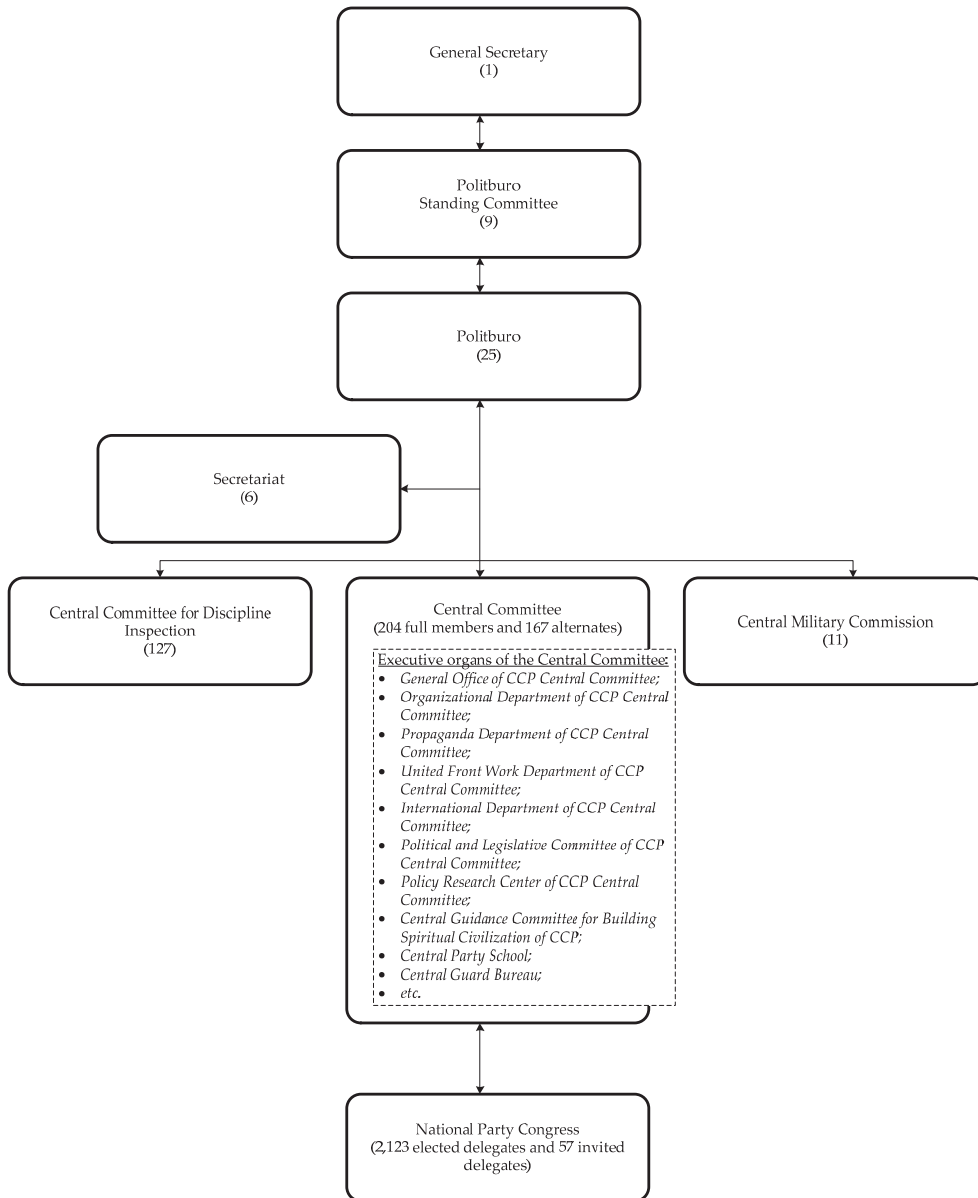


Figure 7.1 The structure of the Chinese Communist Party

The National Party Congress, which convenes for two weeks once every five years, is the most important political meeting in China, and has the largest membership, over two thousand delegates primarily from China's provincial administrations, ministries and commissions of the central government, large state-owned enterprises, major banks, the People's Liberation Army, and the People's Armed Police. Main contents of the Congress are national policy debates and the need to reach a consensus among the

delegates. During the past several decades, each Congress has put forward one or more central political tasks for the country's development, for instance, the proposal of the economic reforms in 1978 Congress (Chung 1977); the consolidation of the reform effort in 1982 (Chung 1983; Acharya 1985); the legislation in favor of the private ownership in 1987; the promotion of market-oriented development in 1992 (Young 1992; Deshpande 1993); the restructuring of the state-owned enterprises in 1997 (Lau 1999); the permission of private entrepreneurs to join the CCP in 2002 (Bhattacharjea 2003; Goldstein 2003; Wang 2003); and the emphasis of sustainable economic development in 2007 (Ploberger 2011). Apart from the abovementioned national reforms, in principle the Congress also elects the Central Committee and the Central Commission for Discipline Inspection. And then the Central Committee elects the Politburo, the Politburo Standing Committee and the General Secretary of the CCP. However, in practice the electoral process is top down rather than bottom up. Members of the higher party organs guide the selection of members of the lower-level committees (Li 2010).

With regard to the Central Committee which is composed of about two hundred members, it convenes more frequently than the National Party Congress, once or twice a year. In these meetings (locally called plenary sessions), members always hold substantive positions elsewhere and are provided with opportunities to present various socio-economic and industrial development situations and statistics, to discuss the problematic issues, and to announce new policy initiatives as well as major personnel appointments. It is worth mentioning that at plenary sessions policy and personnel proposals are only raised but not decided. In other words, at plenary sessions the Chinese party leadership produces working reports which show trends and prospects in various social, industrial and economic sectors. These reports are to be presented in the National People's Congress to gain approval from the various people's delegates. Although these reports never fail and candidates nominated by the party are rarely refused by the National People's Congress, the votes are no longer unanimous<sup>5</sup>.

The Politburo, also functioning as a committee with a much smaller number of members, forms the top power elite and is considered the command headquarter of the party. Membership of the Politburo is not a full-time job. Among the 25 members of the current Politburo, 7 come from the party organizations, 10 from government organizations like ministries and central commissions, 2 from the military and 6 from provincial-level administrations. Therefore, some of these people as powerful party members concurrently hold several government positions. For example, some important government positions, such as the mayors of Shanghai and Beijing, as well as the governor of Guangdong, bring with them almost automatic membership in the Politburo (Steiner 1959; Guo 2001; Li 2010). Above the Politburo is its Standing Committee which is made up of 9 truly powerful elite people. They work and live in

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<sup>5</sup> This information is extracted from the official website of the National People's Congress of China: [http://www.npc.gov.cn/englishnpc/about/node\\_2842.htm](http://www.npc.gov.cn/englishnpc/about/node_2842.htm).

Zhongnanhai (an area in central Beijing, opposite the Forbidden City, which serves as the central headquarters of the CCP and the State Council), and meet more frequently, about once a week, but their meetings as well as the contents of their meetings are not made public. These people receive a number of special privileges and have access to inside information on the party affairs (Lieberthal 2004). In addition to the party positions, these people always take important government positions such as the Premier of the State Council and the Chairman of the National People’s Congress. The decisions taken by the Politburo Standing Committee focus on significant national issues and the decision-making mechanism is voting.

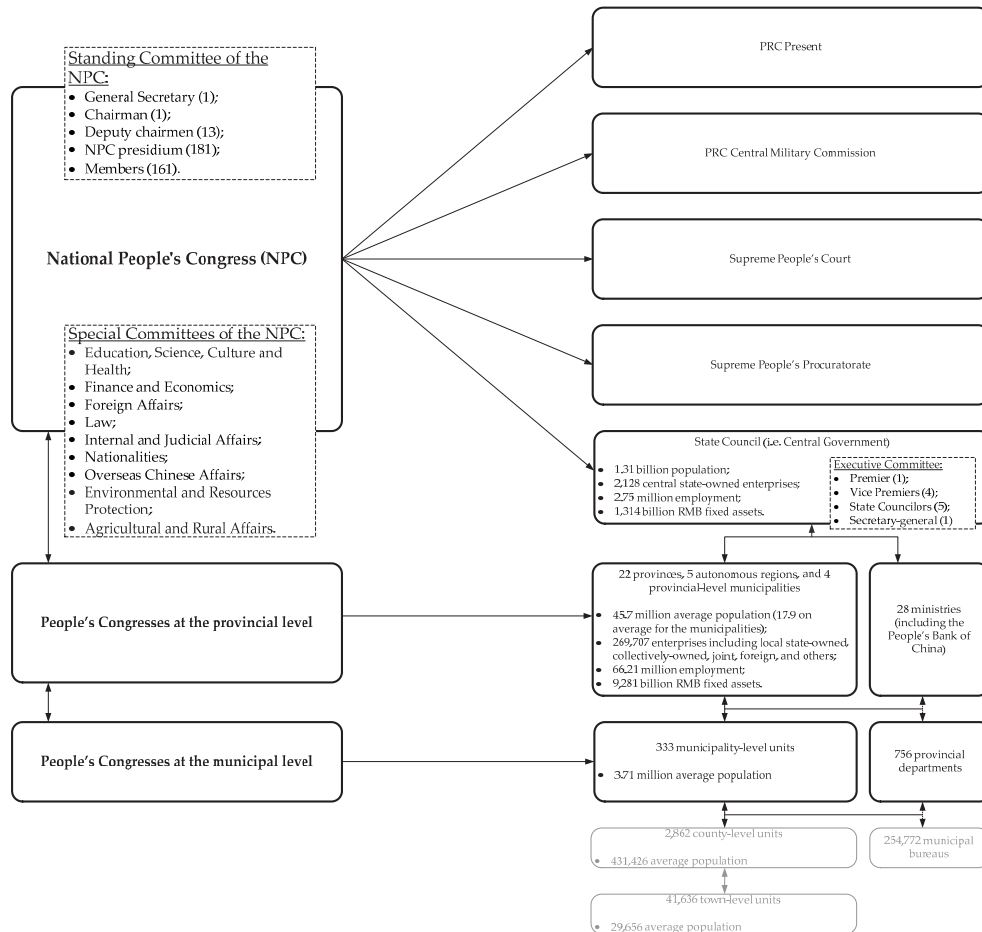


Figure 7.2 The structure of the Chinese government

On the government side, the basic structure was adopted since 1950s but many changes have taken place afterwards in terms of both horizontal and vertical allocation of

responsibility and power between the government departments (figure 7.2<sup>6</sup>). Similar to the National Party Congress that elects the party leaders every five years, the National People's Congress (NPC) has a paramount role in electing the state leadership (the president and the premier) in a meeting that follows the National Party Congress. The NPC convenes about two weeks in every March with around three thousand delegates, during which these people's delegates discuss the working reports compiled by the party leadership, and approve laws and legislative regulations. Nowadays, with the rise of the internet and growing attention from the media (including foreign reporters), the NPC has moved away from its previous role as a symbolic but powerless rubber-stamp legislature and has become a forum or venue for debating policy differences between different parts of the party, the government, and various groups of the society (O'Brien 1990; The Economist 2012; Wu 2012). Therefore, its significance in determining the adoption of specific policies has been largely improved, and the people's deputies are increasingly given more say. That is to say, although the CCP still controls the NPC to a large extent, the NPC as an important organ on the government side has been gradually gaining power in making decisions. When the NPC is not in session, it provides for most of its power to be exercised by its Standing Committee on a daily basis.

Chosen by the NPC, the State Council serves as the "cabinet" in the Chinese political system. It is headed by 1 premier, and composed by 4 vice premiers, 5 state councilors and 1 secretary-general (not the same as the general secretary of the CCP but a secretary in charge of the Council's day-to-day businesses). There is no party position in the Council, but all the Council members concurrently are also party members. Under the direct administration of the State Council are 28 ministries (including the National Development and Reform Committee and the People's Bank of China), and 22 provinces, 5 autonomous regions (Inner Mongolia, Guangxi, Tibet, Ningxia, and Xinjiang), as well as 4 provincial-level municipalities (Beijing, Shanghai, Tianjin, and Chongqing).

For the ministries, they have their own vertical bureaucratic hierarchies with departments and offices at each subordinate territorial level. Nonetheless, the ministries are only responsible for allocating state budget to the subordinate departments, while it is the provincial governments that administrate the provincial departments. At present, unlike the State Council, the ministries have been set up with party positions and normally the secretary on the party side and the minister on the government side are the same person. Among the current 28 ministers, all but two belong to the CCP (the exceptions are the minister of science and technology, Wang Gang, who is a member of the China Zhi Gong Party and the minister of health, Chen Zhu, who is independent).

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<sup>6</sup> The figure of the organizational structure of the Chinese government and the functions of the departments are derived from the official website of the central government of China: [http://www.gov.cn/gjg/2005-08/28/content\\_27083.htm](http://www.gov.cn/gjg/2005-08/28/content_27083.htm).

Provinces hold the same rank as ministries; they are the major government organs of the State Council dealing with regional affairs. Provinces vary a lot in size, wealth, topography, population, dialect, and culture. Provinces are crucial actors in the Chinese political system. All major construction projects and enterprises of the center need active provincial cooperation in mobilizing resources and support, and the richer provinces are the major source of the central financial system. Differing from ministries, however, the secretary and the governor at the provincial level are often taken by two persons. The secretary on the party side takes responsibility of propagating and monitoring the party ideologies and managing personnel in the province, while the governor is responsible for making decisions in economic and industrial development. In addition, the provincial secretary and governor are posts that most of China's top national leaders have experienced. All nine members of the current Politburo Standing Committee served as provincial party secretaries or governors prior to their promotion to the central decision-making elite. And there has seen a substantial increase in the proportion of the Politburo members who have provincial leadership experience (Li 2008). Such a large representation of top officials with provincial administrative experience not only reflects the growing power and influence of provincial-level politicians in decision-making, but also illustrates the central attempt to promote regional economic strength and competition as indicators for promotion among provincial leaders (Li 2002).

Regarding cities, they share the same set of party and government structures as the provinces. The secretary of the city has the power over personnel management, while the mayor holds decision-making power over general issues of urban development. As we will introduce in the next section on urban politics, China's economic reforms have increasingly made cities the key organs for the rapid growth (Hurst 2006). Very often, national policies such as the development of the Special Economic Zones, the construction of the Three Gorges Dam Project, and the construction of large airports as well as major transportation hubs, for example, require cooperation among municipal governments (Lieberthal and Oksenberg 1988; Huang 1999). Other national policies on important urban issues such as sustainable urban transport development are implemented in a different way in each municipality, with the city government making the decisions on how to turn national principles into actual programs.

So far, as we can see, both the party and the government of China have complex structures and what makes things even more complicated are the intricate and intertwined relationships between the two hierarchies in terms of decision-making power. From the above description, we can observe several important characteristics of the political system in contemporary China. First, party positions are embedded in almost every government organization. The "secretaries" as the party leaders play a role in guiding all governmental actions on the right ideological track. Second, the party holds the power to make all of the country's personnel arrangements, no matter how important the positions are. Such firm control over government officials' career paths is considered an effective way to exert influence on decision-making. Third, the

party still holds the power to make national significant decisions. And fourth, notwithstanding the party's leading decision-making role, many provincial and municipal decisions concerning economic development strategies, industrial development plans, and various public policies are actually taken by the government organizations, not the CCP. Especially in urban areas, almost all city development programs and policies are decided and implemented by local government. Finally, no matter how free and autonomous the government organizations are in their decision-making, it is apparent that a large majority of the government officials are CCP members, which means that they, after all, tend to follow the party's principles and ideologies.

## **7.3. Chinese Urban Politics**

In this section, we look at China's urban politics which sets the background of the Dalian municipal government making decisions on large urban transport projects. It first describes the shifting pattern of urban politics from central planning and local submission to power devolution and local autonomy. In the decentralized pattern of urban politics, China's cadre evaluation system for local officials determines the career path and the promotion of the officials. Finally, this section discusses how the officials make decisions on large urban projects that are believed to be political achievement projects.

### **7.3.1 The shifting urban politics**

Prior to China's economic reforms, the Soviet model of central planning shaped the relationship between the central government and the local governments, and largely formed the picture of urban politics (figure 7.3). The central authority exerted direct administrative command and control over local governments through several channels: the physical planning of production and construction; the centralized collection and allocation of materials and resources; and the budgetary control of revenues and expenditures. For the fiscal system in particular, it is best described as "unified revenue collection and unified spending". Basically, the provincial governments collected almost 90% revenues generated from within the province, which include taxes and profits from state-owned enterprises; then the central government drew a plan of spending for each province and some large cities. This system was informally called "eating from one big pot" which captured the essence of the central planning scheme. Urban politics, under such a system, mainly focused on carrying out the tasks allocated from the center. Local leaders and officials were not incentivized to promote the local economy because they could not retain the revenues anyway, and for a long time they were not accustomed to make decisions. In addition, the sense of responsibility and



accountability of local officials became problematic for the reason that the city would be allocated with a certain amount of money no matter how much they generated. The urban politics, to a large extent, can be described as obedient and competition was absent. However, the vertical control limits but does not totally deprive local governments of their freedom to take initiatives. On the one hand, local officials made efforts to fulfill or even over-fulfill targets handed down from above. On the other hand, they may hold private agendas in city development that are inconsistent with central goals. In dividing the resources between fulfilling the mandates from the center and channeling them into their own agendas, local leaders had to balance carefully.

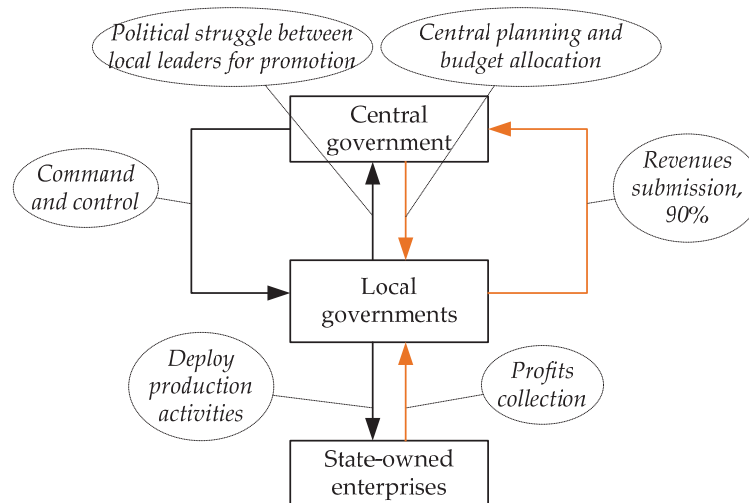


Figure 7.3 Urban politics in central-planning China

In contrast to the central planning system, China instituted economic reforms in 1978, which are socialist market-oriented, mainly consisting of the decentralization of the fiscal system and thus the devolution of planning and decision-making power from the central government to the local governments (Lin and Liu 2000; Jin, Qian et al. 2005; Xu 2011). Fiscal decentralization, through the devolution of power to local governments, has often been hailed as a reform that brings governments closer to the people, and as a result induces local politicians to implement the wishes of local residents. In addition, the introduction of the fiscal reforms gave a signal of credibly ensuring the autonomy of local governments. The new system is informally called “eating from separate kitchens”, under which “central revenues” is defined to include direct tax and profit levied from state-owned enterprises supervised by the central government. All other revenues fall under local accounts (figure 7.4). On average, local revenue has accounted for about 70% of total government budgetary revenues since the reform. Dramatically incentivized by the freedom of physical planning and construction, using money generated by the cities themselves, the local leaders have actively engaged in promoting local economic growth, increasing the local budget, and thus investing in

large-scale urban amenities and infrastructures (Herrmann-Pillath and Feng 2004). The reforms have strengths and weaknesses. Obviously, the strengths lie in China's rapid economic growth and urban modernism, as well as the fast expansion and improvement of public infrastructures. The weaknesses, however, include various aspects such as intensified regional disparity, regional protectionism, severe cross-regional competition, scattered development of urban areas, environmental problems resulting from the pro-growth activities and even the problem of corruption. Even so, in the new pattern of urban politics, cities are compelled to learn to become entrepreneurial in order to generate local revenues as much as possible and to compete with other cities for resources, elite people, and investment. The recent notions of "planning for a competitive city", "urban governance for an entrepreneurial city" and "the creation of a local enterprise state" have demonstrated the rearrangement of local government preoccupations (Kang 2006; Yin, Zhang et al. 2006). Consequently, urban politics is revolving around how to fill the local government's coffer on the one hand, and on the other hand, how to make the city attractive and visible for investors.

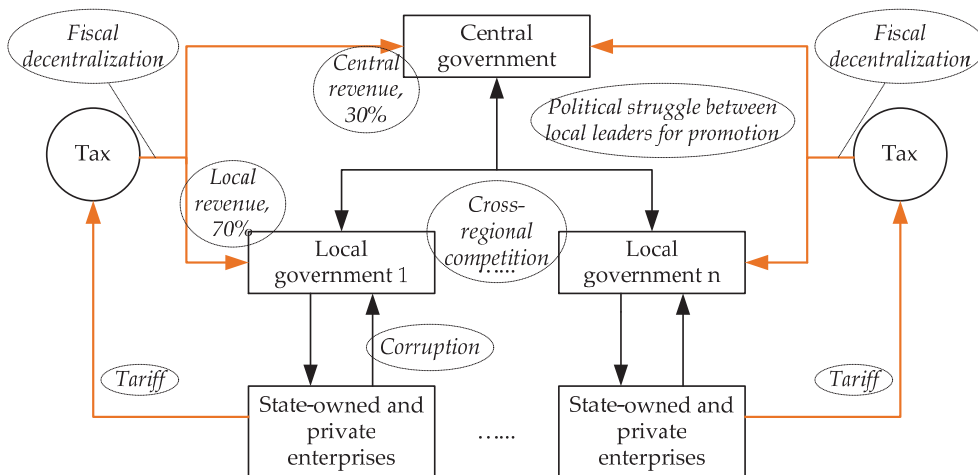


Figure 7.4 Urban politics in reform China

### 7.3.2 The cadre evaluation system in reformed China

Unlike the fiscal system which has been largely decentralized, China's political system is still centralized through the Communist Party's control over the future career paths of subnational key officials (e.g. provincial governors and municipal mayors) (Burns 1994; Huang 2002; Chan 2004; Liu, Sun et al. 2006). The personnel control by the Communist Party is considered an effective tool to influence decision-making activities and governmental actions at the local level, given the underlying assumption of most local officials being "political climbers" (Downs 1993). Under this assumption, the typical behavior of local politicians is to maximize their own power, income, and

prestige, and the main channel they can achieve their ambition is to be promoted to a higher rank within the hierarchy. Then, the most important issue for local leaders who are intent on career advancement is to know how the cadre evaluation system works.

Accompanied by the shifting environment of urban politics, China's cadre evaluation system on local officials has been also altered with regard to the evaluation criteria. Traditionally, political loyalty was the most important criterion for promotion in socialist China (Lee 1992). Another criterion was related to the local leaders' performance of fulfilling the tasks and targets assigned by the central government. Basically, the local leaders express their political loyalty in several ways. For example, they totally and absolutely follow an order without questioning the correctness and adequacy of its objective and content. In such a case, contradictory opinions are never expressed. In addition to ingratiating themselves to the party, this loyalty enables local leaders to avoid the pressure of making decisions and the fear of being blamed for decisions that are proved wrong afterwards. If the first kind of loyal government leaders are risk-avoiders, then the second kind are risk-takers with a stronger stress on personal political career ambition. In contrast to the politicians who just follow orders and avoid the need for critical thinking and questioning, the risk-taking politicians express their loyalty through proposing solutions to (pressing) problems in order to raise the attention from the higher level government and thus to gain promotion opportunities.

Although political loyalty still remains important in assessing the promotion of local leaders, however, in the reform stage of China, there is ample evidence suggesting that the criterion of political loyalty has given way to regional economic growth and other competence-related indicators. For instance, disregarding factors such as the local leaders' personal connections to the central government, academic researchers find a significantly positive correlation between the likelihood of promotion and the average GDP growth rates based on the turnover data of top regional leaders during 1979-2002 (Chen 2005; Li and Zhou 2005). Normally, the evidence on economic performance among peer cities can be compared in government reports and statistical yearbooks, which contain detailed information on the relative rankings on cities' development progress, ranging from GDP growth, to industrial output, to amounts of FDI, to miles of road constructed, to throughputs of airports, and to lengths of metros. And the way in which local leaders promote economic growth mainly consists of the following channels: heavily investing in large infrastructure projects; making every effort to attract investments; and selling the land use rights to real estate developers for commercial development (Deng 2005; Lichtenberg and Ding 2009).

However, this is not to say that nowadays local leaders totally depend on economic growth rates as the only springboard for promotion. Of course, there are other indicators the center may consider for a promotion. And these indicators gain in weight compared to economic indicators for evaluating local leaders' performance and achievement in their tenure periods. This trend can be evidenced by the downward

modulation on the national target of the annual economic growth rate by the State Council (from 8.5% in 2005, to 8% in 2010, and to 7.5% in 2012). In addition, China is trying to add environmental indicators to evaluate local officials: local GDP figures will be offset by the equivalents of pollution to generate the so called “green” GDP (Xinhua News Agency 2004). Moreover, China has set the standard of PM<sub>2.5</sub> for detecting urban air quality in the 2012 National People’s Congress, which shows governmental attention shifting from economic development to environmental protection. According to a handbook issued by the party, the achievement of economic development accounts for 60-70% of the evaluation of local officials, while other aspects together account for the rest. Currently, aside from the large weight of economic performance assigned by the evaluation system, social stability is commonly believed to be a paramount factor measuring the quality of local leaders’ governance. By way of illustration, an occurrence of large-scale demonstration and petition in a region will definitely ruin the political career of its leaders, no matter how much local economic growth they have achieved. Therefore, the cadre evaluation system in reforming China rewards the promotion of local leaders on the condition that social stability is not in jeopardy (Liu, Sun et al. 2006).

Moreover, competition between leading officials at the same level, such as provincial level and municipal level, is an essential part of the cadre management system in China. Here, it is worthwhile to clarify the reason for the emergence of severe political competition. On the one hand, unlike managers of enterprises or politicians in western societies, Chinese government officials have few employment options outside the internal political labor market, especially for those who have been working in the government for a long time. In other words, if a local leader is separated from the political hierarchy, it is hard for him or her to find a job elsewhere. This effect, coupled with the huge difference in terms of personal benefits between holding power and relinquishing the position, greatly reinforces incentives for Chinese officials to make any effort to stay in power. On the other hand, since 1982 when the CCP officially abolished lifetime appointment of local officials and introduced a mandatory retirement system, both provincial and municipal leaders are required to retire and thus to hand over their power at the age of 65 if they are not promoted to higher positions in the central government. Driven by the motives that most local leaders intend to seize power as long as possible, they have been attempting to strengthen their competitiveness relative to other leaders at the same level, and to be promoted to the central-level party or government positions. In recent years, local leaders have found some effective, and central approbatory competition strategies. One of them is adopting innovative conceptions and using creative policies, either domestic generated or foreign transferred, that can attract attention of the central government. Usually, the new conceptions and ideas are proposed by the local think-tank to the leaders. Examples in the field of urban transport can be the concept of developing mass rapid transit systems (e.g. the BRT project, and the LRT project) to solve the congested urban traffic; various traffic calming policies such as congestion pricing; transit-oriented

development as a new planning method to tame the rapid urbanization and motorization, and so on. If one local leader is the first to initiate the concept which has not been recognized by other peer leaders, then he would gain much weight in his political record and future promotion opportunity. As a consequence, the implementation of these concepts will always necessitate some government actions and initiate some large projects. And these projects are often disparagingly referred to as political achievement projects, or prestige projects.

### **7.3.3 The emergence of political achievement projects**

Under the above mentioned environment of urban politics where local government has considerable autonomy in public spending and local leaders feel great pressure to promote local economic growth and increase their personal competitiveness by building up magnificent political records, the emergence of political achievement projects is very likely. Political achievement projects refer to public construction projects derived from political decision-making, without scientific proof or real cost-benefit analysis. Usually, these achievement projects are large, costly, eye-catching, and public. Examples that have been identified by the Chinese media include expressways, high-speed rails, airports, urban rapid rails, various development zones, and luxurious parks in urban areas, as well as some rural infrastructure construction projects in the countryside (Jian 2004; Long 2004; Ma 2004; Duan and Wang 2006). Western scholars also witnessed the existence of such prestige projects especially in 1980s and the early 1990s. They are defined as pioneering or innovative, large-scale projects which are primarily concerned with the harnessing and creation of economic growth. And in general the prestige projects are targeted at encouraging and attracting large-scale private investment, generating additional economic growth at the city level and changing the outside perceptions of business decision-makers and potential visitors. In addition, there are some flagship developments (e.g. the convention centers, festival market-places and sports and leisure facilities) as a variation of the prestige projects that are small-scale and whose purpose is to change local perceptions about the locality (Loftman and Nevin 1996). Unlike societies in which strict policy analysis and technocratic guidance play a stronger role relative to political power-play, and thus policy analysts and engineers have a substantial professional role to play in the decision-making process in China policy analysts operate in settings where political players set the parameters for the activities of the knowledge producers. The primary role of analysts is to legitimate or justify, in scientific and technical terms, policy decisions made by the real power holders. Policy analysts, although they are a source of scientific and technical justification, are expendable, and they often serve as convenient scapegoats for policies that fail.

Apart from weak policy analysis, another factor sowing the seeds for achievement projects is that the political players are able to mobilize project funding. Basically, there are two financing approaches. One is through attracting private investments (i.e. the

public-private partnership) and the other totally depends on the government budget (or bank loans to local government). Regarding the former, there are rarely political achievement projects because the private investors evaluate the projects on their own in terms of rates of return. But there are also cases where private players invest in projects based on preferential policies offered by the government but afterwards go bankrupt as a consequence of poor returns (e.g. lower traffic demand than estimated). As for the latter approach, because the banks (including the Construction Bank of China; the Agricultural Bank of China; the Industrial and Commercial Bank of China; the Communication Bank of China; and the Bank of China) are state-owned and their branches are under the direct control of local governments, it is very easy for the local government to obtain loans and to realize the achievement projects. It often occurs that the loans are granted based on the informal communications between the local leader and the bank president who know each other very well and are tied by personal connections. And the mortgage is the guarantee provided by the local government itself. Due to a lot of loans granted to such achievement projects that lack scientific proof and thus experience problematic investment returns, for a long time banks have had a large amount of dead loans. For instance, in Heilongjiang province the dead loans have accounted for about 95% of total loans for transport projects. And in the Sichuan province, the proportion of dead loans for transport projects is around 54%. The incumbent local leaders are incentivized to make large amounts of loans for their achievement projects because when the repayment date expires they have been rotated to other cities or have been promoted to a higher level in the hierarchy, while it is the responsibility of the next incumbent to return the loans.

Currently, in China there are no effective ways and formalized standards to detect what public projects are political achievement ones. And formal legislation precluding such political activities at the expense of public interests is meager. However, the logical implication could be the use of rigorous ex-ante cost benefit, cost effectiveness or multi-criteria analyses and a reduction in politicization and officials "wheeling and dealing" with each other. The realism of this expectation of "enhanced rigor" strongly depends, however, on the institutional requirements set for the planning procedure and decision-making process. If much emphasis is placed on the merits of analytical studies as a basis for project selection and limiting the production of biased information, this effect might indeed occur. For that to occur, incentives are needed to ensure that most relevant decision-making aspects have been considered. At the current stage in the evolution of this approach, however, local governments still attach little value to systematic policy analysis, while China's central government assesses funding eligibility for large public projects. Metro projects, for instance, have four relatively generic variables: urban annual GDP should exceed 100 billion RMB; urban population should be more than 3 million; projects should be established with a definite financing approach; and for transport projects in particular the forecasting single-direction demand should exceed 30 thousand passengers per hour. As for the light rail projects, for example, the requirements on the variables are 60 billion RMB annual GDP, 1.5



million urban population, and 10 thousand passengers per hour for traffic demand respectively, which are lower than the requirements for metro construction.

To sum up this section, we can conclude that under the shifting environment of the Chinese urban politics local officials have been given the decision-making power on how to spend the local budget and on how to develop the city. In the wake of such changing patterns of urban politics, the Chinese approach of evaluating the performance of local officials has also altered from the original party loyalty, obedience and task fulfillment, to the ability of promoting local economic growth and most recently the innovative ability in solving urban problems, such as adoption of new concepts in urban areas. Consequently, it is very likely that local leaders put forward projects that are pro-growth but environmentally unfriendly, or flagship concepts that are innovative and creative but lack careful deliberation of their validity and local applicability.

## **7.4. Dalian LRT-3**

In this section and the section that follows we study two mega urban transport projects in Dalian. One is the third light rail transit line (LRT-3), and the other is the first bus rapid transit line (BRT-1). We chose the two projects as illustrations of urban prestige projects for several reasons. Both projects played roles in the leading officials' achievement of strong political performance. The manipulation of feasibility studies in the preparation and forecasting stage and the stagnant feature of operation and maintenance have once led people to question them as political achievement projects. In addition, we chose them because they are urban transport projects in Dalian, construction of which requires enormous investment and realization of which is supposed to have significant impact on urban transport. Also, these two projects have been in operation for several years, so it is easy to evaluate their success or failure with service performance information. As to other large transit projects in Dalian, they are under the planning and construction phases, so we cannot examine or judge their performance yet.

### **7.4.1 The political context of the LRT-3**

As we already saw in the previous chapters, the LRT-3 is the first rapid rail transit system in Dalian. Its first-phase construction plan has a length of 15 km, connecting the Economic and Technology Development Zone in the northern area of the city, a place not well-served by buses, with the downtown commercial center as well as the Dalian railway station where multiple urban transport modes converge. The line extends northwards to the Golden Pebble Beach, which is a national-level holiday resort. The political decision-making process of this project, from its conception, ridership forecast,

feasibility study, financing, central approval and finally to operation, is the result of wielding power and using personal connections by the city mayor, also the secretary, Bo Xilai. Before reporting the decision-making details, first we have to address the issue concerning the political circumstance in Dalian during the tenure of Mr. Bo.

Bo was a suave and prominent Chinese politician. His political career seemed safe because he is one of the princelings and his father was one of the Mao Zedong's longest-serving and most loyal lieutenants (Simpson 2012). But he was recently dismissed from the posts of the government and the party in 2012 due to the Wang Lijun Incident. The leadership style of Bo Xilai is believed as "propagandistic", "ruthless" and "arrogant" by his subordinates and the city officials, academics, journalists and other professionals. The New York Times once wrote that: "although Bo was possessed of prodigious charisma and deep intelligence and had also mastered the image-messaging and strategic use of public money, these qualities were offset by an insatiable ambition and studied indifference to the wrecked lives that littered his path to power"<sup>7</sup>. His undisputed talents helped him to climb to the Politburo of the political hierarchy, but his ruthlessness and greedy desire for power made him fall thoroughly from the political hierarchy.

After graduating from Peking University and the China Academy of Social Sciences, to avoid allegations of nepotism, he decided to start his political career from one of the most underdeveloped counties in China, the Jin county in Liaoning province, which is at the very bottom of the political hierarchy. Bo thus became the secretary of Jin county as his first party position in 1984. Then after one year he was given more party positions: the secretary of the Jinzhou district of Dalian and the secretary of Dalian's Economic and Technology Development Zone. In 1988, he was promoted to the Standing Committee of the CCP Dalian Municipal Committee, the city's top decision-making body. Then, in 1990 he became the vice-mayor of Dalian which is a government position, and meanwhile he became the deputy secretary of Dalian Municipal Party Committee as a party position. He took over the post of acting-mayor of Dalian in 1992 and full mayor in 1993. He was elected as the deputy secretary of the CCP Dalian Municipal Committee in 1995, the city's second-in-command. In 1998, Bo was re-elected full mayor of Dalian, and later in 1999 he served as the secretary of the CCP Dalian Municipal Committee, the city's top political figure and first-in-command.<sup>8</sup>

In addition to his casual image in the media, sense of humor, and a shift away from the normally decorous nature of Chinese politics, his rise to fame came from his position as the mayor of Dalian from 1992 to 2002, a crucial time in the city's phenomenal growth into a modern and green metropolis. Among other things, he banned motorcycles, built

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<sup>7</sup> The description is extracted from an article on the New York Times, written by Michael Wines, with a title of "In rise and fall of China's Bo Xilai, an arc of ruthlessness". Retrieved 25/05/2012.

<sup>8</sup> The information of this paragraph on Bo's biographical notes is derived from the Xinhua archived information at the Xinhua News Agency ([http://news.xinhuanet.com/ziliao/2002-02/21/content\\_285068.htm](http://news.xinhuanet.com/ziliao/2002-02/21/content_285068.htm)), and the Wikipedia ([http://en.wikipedia.org/wiki/Bo\\_Xilai](http://en.wikipedia.org/wiki/Bo_Xilai)).

large areas for walking paths, emphasized urban greening, created large, lush parks and city squares in many traffic circles and generally built very attractive architecture (Chen, Dong et al. 2008; Song 2009). Besides, he played a key role as an advocate of developing large transport infrastructures. In the early 1990s the Shenyang-Dalian Expressway was built, becoming China's first expressway; and in the late 1990s the LRT-3 was built, becoming the first rail-served rapid transit system in Northeast China. Due to tremendous changes in the urban landscape and substantial improvements in transport infrastructures, Dalian had a very good overall reputation, its tourism industry flourished, and it attracted enormous foreign direct investment which in turn drove the local economy forward. During these developments, there was no doubt that Bo was a strongly committed person, and his personal commitment to the infrastructure development and his political power to achieve policy goals played a significant role in Dalian's city governance in 1990s (Shin 2004). However, despite economic growth and remarkable improvements on per capita GDP, Bo's tenure in Dalian has been criticized because of his excessive attention on aesthetic development projects and prestige programs <sup>9</sup>.

Because of his achievements in Dalian in terms of attracting investment and promoting economic growth (according to Bo, it is because of his ability of dealing with/negotiating with foreign investors and trade organizations), Bo was appointed Minister of Commerce in 2003 when Hu Jintao succeeded Jiang Zemin as President, and ended Bo's almost 20 years' service as a local official. Concurrently, Bo started his membership of the Central Politburo during the 16<sup>th</sup> (2002-2007) and the 17<sup>th</sup> (2007-2012) National Party Congresses, and he was considered a likely candidate for promotion to the Standing Committee of the Politburo of the CCP in the 18<sup>th</sup> (2012-2017) National Party Congress. During his term in the Ministry of Commerce, his daily schedule was dominated with receiving foreign guests and dignitaries, and China has seen a continued growth in foreign investment <sup>10</sup>. After the 17<sup>th</sup> Party Congress, Bo was rotated to Chongqing as the city's secretary and mayor. His move from Northeast to Southwest of China was another dramatic change for Bo in his political career to gain experience in governing one of the four provincial-level municipalities. In Chongqing, Bo was committed to fight against the city's organized crime (i.e. mafia). Besides, he brought forward the "Chongqing Model of Governance", which mainly includes the political ideologies of statism and populism (Cui 2011; Huang 2011; Su 2011). With all of these efforts, Bo made no secret of his desire to enter the Standing Committee of the Central Politburo during the 18<sup>th</sup> Party Congress in autumn 2012 when the General Secretary Hu Jintao will be replaced by Xi Jinping, the Premier Wen Jiabao will be

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<sup>9</sup> This information is derived from the comment "The Worry of the Square Construction in Urban Areas" of the Chinese Economy Alert Weekly (2001) vol. 41. Also available online: <http://www.people.com.cn/GB/paper1631/4574/509149.html>. Retrieved 28/05/2012.

<sup>10</sup> This information is mainly derived from the official website of the Ministry of Commerce of China, reporting Bo's daily routines and important activities as the Minister of commerce (<http://boxilai.mofcom.gov.cn/>).

replaced by the Vice-Premier Li Keqiang, and the seven other members are expected to retire. Such a reshuffle of the top elite group gave much room for the ambitious Bo to re-enter a political position in the national core leadership. However, his political career came to an abrupt end with the Wang Lijun incident, in which his top lieutenant went to the US consulate in Chengdu and allegedly sought political asylum. In this fallout, the Hu-Wen government decided to remove Bo from his party and government posts of Chongqing.<sup>11</sup>

#### 7.4.2 Three rounds of traffic demand forecasting<sup>12</sup>

The LRT-3 is one of the large transport infrastructure projects during Bo's tenure in Dalian, which plays an important role in Bo's enhancement of his political record and fame in city governance. Early in the late 1980s when Bo was the secretary of Dalian's Economic and Technology Development Zone, he had in his mind the construction of a rapid transit line with a large passenger capacity linking the Zone to the central city. However, until the latter half the 1990s when he became the mayor and the secretary of Dalian and thus held the supreme decision-making power, Bo initiated his plan to build light rail. At that time, although he did not gain much support from other government officials who believed a low traffic demand on this line, Bo still insisted on the project and routinely commissioned the Transport Research Center at Tsinghua University to undertake a traffic demand forecasting exercise. The objective of the forecast was to verify the rationality of this project to be put on the policy agenda.

Since the experts from the Transport Research Center did not intend to discuss whether the decision was right or wrong and wanted to be neutral, the forecasting result was disappointing because it showed an extremely low traffic demand which did not justify the investment of this project. As a result, the experts advised to abandon this project. Otherwise, like many other transport projects with huge demand overestimation, station platforms would be too long only for very short trains; cars would be idly

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<sup>11</sup> This information is completely derived from a number of online multimedia, reporting the development of the Chongqing Model, the Wang Lijun incident, and the central response to the incident (Wikipedia: [http://en.wikipedia.org/wiki/Wang\\_Lijun\\_incident](http://en.wikipedia.org/wiki/Wang_Lijun_incident); Netease News (Wangyi News): <http://news.163.com/special/wanglijunshijian/>; Phoenix Information (Fenghuangwang Zixun): [http://news.ifeng.com/mainland/special/2012lianghui/detail\\_2012\\_03/14/13190351\\_0.shtml](http://news.ifeng.com/mainland/special/2012lianghui/detail_2012_03/14/13190351_0.shtml); Sina News Center: <http://news.sina.com.cn/c/2012-03-15/084224119095.shtml>; and <http://news.sina.com.cn/c/2012-03-14/140924114436.shtml>).

All the information (including Su's book on the Chongqing model) does not mean the author's position or view of point.

<sup>12</sup> This information on the detailed process of traffic demand forecasting on the LRT-3 project in Dalian cannot be found in any published material, while the author obtained this information through face-to-face interviews as well as internet instant messaging with the experts from the Transport Research Center at Tsinghua University and the engineers from the Transport Planning Institute at Dalian Maritime University.

parked in the garage because there is no need for them; large terminals would be wasteful; and the project company would end up with financial trouble. Even so, after Bo read the report, he pointed out that the forecasts were inaccurate because the forecast-makers used the time of decision (i.e. the year of 1997) as the base year for forecasting, and this was wrong and should be replaced by the year of operation as the base year (around 2003 and 2004). Due to this reason, the Transport Research Center made a second round.

Using the opening year as the base year of forecasting would definitely ramp up the traffic demand because from 1997 to 2003 not only the urban population but also urban traffic demand would rise. However, the forecasts were still lower than the requirement defined by the central government for urban light-rail project approval. Therefore, Bo rejected the report again, and gave further instructions on how to revise the report. He suggested that this light rail line does not end at the Economic and Technology Development Zone, but extends further to Dalian’s Golden Pebble Beach which won the certificate as national-level holiday resort and which would attract a large amount of tourists not only from Dalian but also from other Chinese cities. Thus, the demand forecasts which only focused on the internal traffic generated by the Dalian citizens, was inaccurate. They should also include the demand induced by tourists coming to Dalian, transferring to the light-rail from the railway station, and then on to the Beach. Following this suggestion, the planners made a third round which finally reached the required ridership levels.

Table 7.1 Traffic demand forecasting of the LRT-3

Forecasting items/years		2004	2007	2014	2029
Ridership (number of passengers)	Ridership per hour	10,371	12,697	21,283	30,780
	Ridership per year	45,426,728	55,613,443	93,217,499	134,817,507
Travel distance per passenger per year (m)		24,127	24,616	23,678	24,063
Modal split for the light rail (%)		4.98%	5.59%	7.99%	8.41%

One month later a 70 page report prepared by the Transport Research Center was delivered to the mayor. A week later the government announced to start this project. During that intervening week negotiations occurred at Dalian’s highest political bodies. The discussions included the mayor and a variety of leaders from different government departments such as the transport bureau and the urban planning bureau, for instance. When we did the interviews with the experts who conducted the forecasting tasks at Tsinghua University, we have been told that the first- and second- round forecasting reports had been destructed since they were rejected, so detailed data on the predicted ridership could never be available. But fortunately, due to our personal connections, we obtained the traffic demand prediction of the third round forecasting (table 7.1) (Transport Research Center at Tsinghua University and Dalian RRT Construction Headquarter 2010). As we can see, compared to the ridership requirement by central government for light-rail project approval (i.e. 10,000 passengers per hour for light rail

projects), the third-round forecasting result, 10,371 passengers per hour, exactly meets the requirement. In addition, there would be a rapid growth in ridership in the following years, and the ridership and modal split of the light-rail also show a very promising future for the projects' viability. With the final estimates, the project entered into the next step, feasibility study.

### 7.4.3 Feasibility study and central approval<sup>13</sup>

Regarding the feasibility study, it is the basis for urban rail projects to demonstrate their technical, economic and environmental validity, and thus to apply for central approval, to gain the environmental permit for construction, to justify the occupation of land resources and to borrow money from banks. In China, there are a few organizations (state-owned research institutes and private engineering consulting firms) that have the qualification of doing feasibility studies for urban rail projects. One of them is the Third Railway Survey and Design Institute Group Corporation (TRSDI) under the direct control of China's Ministry of Railways. It was founded in 1953, and now it is ranking among China's best firms of its kind in terms of overall strength. Its past experience mainly lies in the study of the Chinese high-speed rail and passenger dedicated lines, large-scale multi-modal hubs, and the urban rail projects in Beijing, Tianjin, Shanghai, Shenzhen, Shenyang, and Dalian. Here we introduce TRSDI not only because it made the feasibility study for Dalian's LRT-3, but also because it concurrently carries an important responsibility, or delegated power to approve rail-based projects on behalf of the central government. In other words, TRSDI has a dual-role: the professional role of compiling feasibility studies for rail-based transport projects, and simultaneously it has the power to approve these studies generated by themselves. All the municipal governments are well aware of that, and therefore almost all the urban rail projects have been seeking TRSDI to do the feasibility studies because it would largely increase the likelihood of the project to be approved. Dalian also used this trick. As a result, TRSDI has become popular and almost a monopolist for carrying out feasibility studies for local governments that attempt to build rapid rail transit. For this reason, TRSDI has been overloaded with contracts and tasks of conducting studies and compiling reports, leading to the review process to become very slow and sluggish. And according to the information obtained from interviews, TRSDI does not really carry out detailed, project-specific studies. Rather, they usually use a template of a feasibility study report and change corresponding information for different projects.

Having contracted with TRSDI for the feasibility study of the LRT-3, Bo felt secure about the project's final approval. However, it would still take a long time until Dalian could officially obtain approval, and Bo could not wait any longer because he was very

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<sup>13</sup> This information on the processes of feasibility study and central approval for the LRT-3 project in Dalian has never been published. Here the evidence in this sub-section was collected by the author through doing interviews with the engineers at Dalian Maritime University.



eager to realize the project during his tenure and make his performance record stronger. Therefore, he put a lot effort to push this project forward. First, he talked to the branches of China's major state-owned banks in Dalian and due to his personal influence the banks were willing to provide loans only on the condition of a letter of guarantee from the Dalian municipal government. Successfully finalizing the sources of project funds, he then organized to establish a project company, JINMA, responsible for the construction and the operation of this line. In late 2002 when the project was almost completed, Dalian had not received the project approval yet. The project company was anxious because without approval the project could not enter into operation. Thus, the manager of JINMA reported this situation to Bo and suggested him to contact TRSDI. At this moment (around the early of 2003), fortunately, Bo was promoted to Beijing as the Minister of Commerce and gained proximity with the Minister of Railways who has enormous influence on the decision-making of TRSDI. Due to the intervention from the Minister of Railways, the LRT-3 was activated again and TRSDI speeded up the process of its approval. In March 2003, Dalian finally received the central approved documents, and in May 2003, the line was open to traffic.

#### **7.4.4 Ridership increases and what constitutes the success of the LRT-3**

In the early days of its operation, the project has experienced an extremely low traffic demand. There were only a few passengers in each car during peak hours, and most of the seats remained idle. This project thus has been once criticized as a political achievement project, although this has not been proved officially. JINMA, running at a loss, reported this issue to the Dalian government and tried to find some solutions. Finally, consensus was achieved: on the JINMA side, it was acceptable to increase the departure interval from 5 minutes to 10 minutes, and on the government side, in addition to an increase in the operation subsidies, land development along the LRT-3 was given priority on Dalian's policy agenda and listed under the most recent urban construction plans (we have already seen the land development results in the station precincts in chapter 6). Here, it is worth mentioning that the LRT-3 project was a political product under Bo's government, so normally it was hard to gain political support from the next government in charge of other people because in most circumstances the new mayor (i.e. Mr. Xia Deren who succeeded Bo Xilai) might have introduced new plans for public spending as well as urban development arrangements. However, in the case of Dalian's LRT-3, although its promoter Bo had left for Beijing as the Minister of Commerce, the follow-up land resource and public funds have been devoted, allocated to this project to ensure its survival. The reason might be the close personal relationship between Bo and Xia, which is to be discussed in next section, which played a role in offering the project a relatively stable political environment.

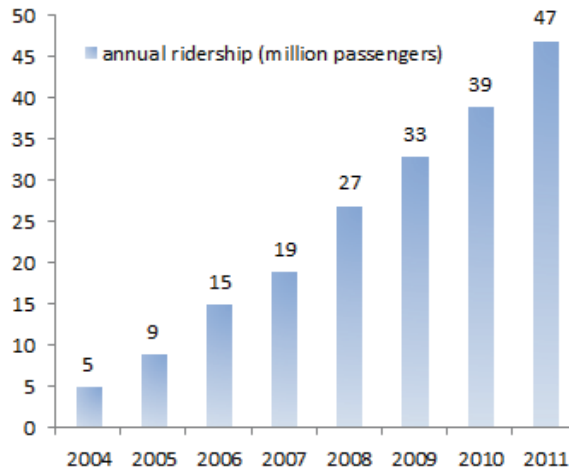


Figure 7.5 Annual ridership increase of the LRT-3

In the wake of land development around the station catchment areas which contained the construction and revitalization of residential blocks, commercial buildings, public facilities and some light-industrial factories, both people and jobs have been gradually moved to the areas along the light-rail. And this line has become the major travel mode for people who live or work in the place between the holiday resort and the central city. Consequently, it has seen a rapid increase in transit ridership, from some 5 million passengers per year in 2004 to about 47 million in 2011, with an annual growth rate of almost 20% (figure 7.5) (Peninsula Morning News 2011). Facing such an increase in ridership, JINMA recovered the 5-minute departure interval in 2007. And in 2010 when the average passenger load ratio reached more than 90% during peak hours, JINMA organized the rail experts to re-design the vehicle control system and improved the frequency from 12 to 15 trains per hour. And this adjustment increased the overall capacity by 25%. Moreover, in 2011 the frequency was adjusted again from 15 to 20 trains per hour, and the capacity was enhanced by 33%. In addition, all the stations on this line have been enlarged and updated with more waiting space and advanced platform amenities (figure 7.6). This expansion project is expected to be completed by the end of 2012 (Dalian Daily 2011). Therefore, although the LRT-3 project was accused of being a political achievement project and experienced a low ridership, its rapid increase in passenger volumes in recent years and the overall good service quality (no accident occurred, punctuality, and flexible in adjusting frequency) have demonstrated its success. Justified by the success of the LRT-3, Dalian has made more investment in rail transit construction. Metros 1 and 2 are almost complete and will be open to the public in 2013. And metros 4 and 5 are currently in their early stages of construction with the scheduled completion date in 2016. Therefore, it can be seen that the rail-based transit system is flourishing in Dalian, and it will become the principal device to set the stage for Dalian to achieve its sustainable mobility mission.



Figure 7.6 Stations and amenities of the LRT-3

What constitutes the success of the LRT-3? We can see that the role of Chinese experts is rather weak, thus leading to great inaccuracy in the analysis and forecasting process of decision making. Their weakness is institutionally embedded. After the founding of the People's Republic of China, the country established several official research institutes and centers within government agencies. Therefore, for decades the research institutes have served as analytical bodies with certain affiliations to government departments and they completely depend on government funds. The primary mission of the researchers was to support the party and the government's policy process through propaganda and providing theoretical interpretation of legitimacy. Such a long-standing, political-dependent role of the Chinese experts has caused them gradually to lose their professional ethics and skills. Hence, nowadays when they are allowed to provide neutral analysis on a policy or a government action, they are hardly capable of doing so. Conversely, in the analysis process or in the process of making forecasts, their customary mentality is to wait for political guidance. In this circumstance, the quality of political instruction becomes crucially important. And this requires the leaders holding some idiosyncratic features such as boldness, imagination and dynamism, which can make a difference to the quality of policy analysis. In addition, we observed that even though the project has prestige-building characteristics, it can end up being successful if the leader can find ways to make it viable. And this would touch many auxiliary policy areas or other government departments. To raise

the external support, sometimes the leader's personal connections (i.e. *guanxi*) also play an important role. As the case demonstrates, the personalized relationships and connections between individual leaders, whereby mutual favors and duties are exchanged with the aim of obtaining long-term benefits, are used to facilitate the project's assessment and approval.

## 7.5. Dalian BRT-1

### 7.5.1 The political context of the BRT-1

As Bo Xilai was promoted to Beijing, Mr. Xia Deren succeeded Bo as the mayor of Dalian in 2003 and later in 2009 he was also appointed to the position of secretary of the city. Unlike Bo who was born in a political family and had personal connections with various leaders of different government departments, Xia used to be a scholar in economics, graduating from Dongbei University of Finance (DUF) (located in Dalian) and then working at this university as a professor and in 1996 as the president of the university.<sup>14</sup> During his presidential term at the university, he was consulted by Bo's private secretary concerning an opportunity of Bo obtaining a Ph.D. degree from his university and he agreed. Therefore, he granted a Ph.D. diploma to Bo based on different evaluation criteria from regular Ph.D. students, and built a close personal relationship with Bo. When Bo left for Beijing, Xia was thus recommended to succeed. As a result, Xia's transfer from a scholar to a politician was largely due to Bo's guidance and support.

The BRT project in Dalian was one of the large transport projects approved by Xia. In 2004 when Xia experienced his early period of tenure, Dalian's five-year urban transport plan was expiring and required revision. Routinely, Xia appointed the experts of the Transport Research Institute at Dalian Maritime University to carry out a new round of urban transport studies and to propose new planning options. Originally, Xia did not expect much conceptual innovation on the management of urban transport, while what he thought was largely to follow the transport plan in Bo's government which emphasized the development of rail-based transit system. However, in a seminar of 2005 where the experts reported the transport development options to Xia, they brought forward the BRT concept and presented a lot of foreign experience with adopting BRT (Yang and Zhao 2006). Further explaining that the BRT adoption in China only appeared in Beijing and Hangzhou at that moment, and the investment requirement of BRT was much lower than that of metro and did not require central approval, Xia showed great interest and approved the plan on the spot. On the one

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<sup>14</sup> The brief information on Xia's biographical notes is derived from the official website of the Central People's Government of China ([http://www.gov.cn/rsrm/2009-05/18/content\\_1317808.htm](http://www.gov.cn/rsrm/2009-05/18/content_1317808.htm)).

hand, he thought that BRT is cheap so the local budget is adequate in making the investment, and thus he does not have to mobilize the loans from banks as Bo did for the light rail, and on the other hand the BRT concept is relatively a new and creative concept in China, and Dalian's adoption of this concept would be a flagship in the trend of sustainable transport development in China and the first BRT city in the Northeastern region of China. This leading position in using innovative and sustainable concept in managing urban transport would apparently increase the weight of his political record and benefit his reputation and likelihood to get future promotion.<sup>15</sup>

Indeed, when the first BRT line in Dalian was completed and opened to traffic in 2008, it caused a sensation as a "revolutionary" type of public transport development. It applies rail-like infrastructure and operations to bus systems while offering high service levels, large-capacity buses that are well equipped with inter-vehicle facilities, segregated right-of-ways, and some station-like platforms. The project became a model (Du 2008). Once a time, many public officials from other Chinese cities that also intended to implement BRT visited Dalian to gain experience. All at once, the BRT project in Dalian provided Xia who does not have much political background with popularity among his political counterparts and earned him a reputational image of "using less while producing more" for urban transport (Peninsula Morning News 2008). Partly due to such political achievement, in 2009 Xia was promoted to the secretary of Dalian that is the first-in-command as a party position.

After the promotion, however, it seemed that Xia attempted to abandon sustainable development as a core value in the management of Dalian while preferring a pro-growth path in the course of city development. The abandonment of sustainable development could be evidenced by the termination of the other BRT lines in the plan (although these BRT lines were not officially cancelled, they have been set aside for a long period without them being pushed forward anymore), resulting in the situation that a decreasing number of people use the BRT-1 because it did not develop into a network (we will introduce this situation in more detail in the next sub-section). Another evidence is the introduction of the PX (p-xylene) project in the city. The PX project (which was once rejected by the Xiamen government) is a chemical joint venture between the Dalian government and a private company Fujia, which brings to the city a huge amount of investment, but which is highly polluting and whose production is highly dangerous with toxic chemicals proliferation.

In 2011, typhoon Muifa struck Dalian city, breaching one of the factory's protective dykes. The breach highlighted the risk of a future storm causing a breach in the factory's storage tanks, flooding the city with the highly toxic chemical. This event was widely reported by the national and local media and became known by Dalian citizens.

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<sup>15</sup> This information on the process of the generation of the BRT concept in Dalian and the on-the-spot styled decision-making on the adoption of this concept is obtained from doing interviews with the engineers at Dalian Maritime University.



In 14 August 2011, therefore, tens of thousands of Dalian people launched a public protest in the People's Square to protest against the PX project built in Dalian. After central government intervention, the Dalian government agreed to move the factory out of the city, to an industrial park on Xizhong Island. This event, which threatened social stability, ruined Xia's future political life to a certain extent. And after the suppression of this event, Xia was transferred to the Liaoning province as the vice-secretary, while leaving the positions of Dalian mayor and secretary, which seemed as an equal-rank transfer but actually was a political demotion.<sup>16</sup>

### 7.5.2 The entire BRT plan in Dalian and its realization

Over the past decade, because of the difficulties in raising project funds and the sluggish process of central approval for metros, many large Chinese cities (in order of appearance: Beijing, Hangzhou, Dalian, Changzhou, Zhengzhou, Jinan, Hefei, Kunming, Xiamen, Guangzhou, Chongqing and Urumqi) have considered investing in BRT systems in congested urban corridors, running on largely segregated lanes, as a much lower investment requirement alternative to either underground metros or suburban railways and as being more effective than regular buses (Hidalgo 2009). However, except for Jinan that has built a relatively large-scale BRT network of 8 lines, totaling around 160 km, most of the cities only have one or two pilot BRT lines with a length ranging from 10 km to 20 km in operation while the construction of the remaining lines in the planned BRT network has been set aside due to a variety of reasons (e.g. car user protest, or difficulties in land acquisition for road widening) (Meng 2010). Dalian's development of BRT has just fallen into this awkward situation. As soon as Xia approved the BRT idea as the central scheme in the new urban transport plan of Dalian, the experts started to design the BRT routes with techniques of traffic engineering and forecasting. The entire BRT plan is shown in figure 7.7 (Dalian Bureau of Transport 2006b). There were two phases to complete Dalian's BRT system: one short-term development phase during 2006-2010 with a length of around 60 km BRT routes to be built; and another long-term phase during 2010-2020 with planned BRT routes of some 100 km. As can be seen from the figure, the short-term plan mainly covers the southern urbanized areas of Dalian and resolves the congestion problem on the major trunk roads, while the long-term plan is designed to guide the city's further sprawl to the north and connects the urban regions with the rural areas. The

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<sup>16</sup> This information on the PX project development in Dalian and the public protest on this project is gathered from a variety of online multimedia, including the reports from: BBC News, Asia-Pacific Session: <http://www.bbc.co.uk/news/world-asia-pacific-14520438>; FT Chinese Network: <http://www.ftchinese.com/story/001040123>; Xinhua News: [http://news.xinhuanet.com/2011-08/10/c\\_121837851.htm](http://news.xinhuanet.com/2011-08/10/c_121837851.htm); Dalian Daily: [http://dl.cnr.cn/jrdl/201112/t20111209\\_508903313.shtml](http://dl.cnr.cn/jrdl/201112/t20111209_508903313.shtml); and Life Week: <http://www.lifeweek.com.cn/2011/0826/34723.shtml>.



investment requirement for the entire plan is presented in table 7.2. And this amount only constitutes to about 5% of the money that is required to build metros of equal length.



Figure 7.7 The short-term and long-term plan for BRT in Dalian

Table 7.2 Short-term BRT investment requirement in Dalian

Line	Length (km)	Investment (million RMB)
BRT-1	13.1	372.51
BRT-2	12.6	15.25
BRT-3	9.8	54.94
BRT-4	10.1	33.79
BRT-5	10.2	711.53

*Note: The investments differ remarkably for different lines because some lines require land acquisition while others do not.*

Although the BRT plan seemed promising, not only because it cost less but also because it did not require central approval so development could be fast. Dalian, in the past seven years since the introduction of the BRT concept, only has one BRT line implemented. The performance of this line will be discussed later. However, here we focus on the reasons why the remaining four lines could not be put into practice. The reasons are diverse, some officially reported while others are rumors. First, regarding the BRT-2 and BRT-3 projects, their routes show overlap with those of the trams. Initially, the Dalian government attempted to stop the trams while converting the road surface to BRTs, which was strongly opposed by the tram operator, arguing that the tram is a Dalian tradition since the Japanese occupation, and although it is not speedy, it has exclusive right-of-way and a relatively large passenger capacity. As a result, the second and third BRT lines have not been carried out. As for the BRT-4, it was designed to run on the Gorky Rd. and the Zhongshan Rd., both of which are almost in the central city and single-direction roads with limited road space. Considering the impossibility of obtaining extra land to widen these roads, the government intended to convert 50% of the auto lanes into BRT lanes. And this intention was blocked by protest from the car users who claim that the two roads have already seriously congested and such a conversion would cause even more traffic jam. Such resistance led the government to give up the plan. With regard to the BRT-5, originally it seemed easier to implement than the lines 2, 3 and 4 because there was no protest from the existing operators or the car users. However, the road along this route is too narrow and to build BRT it must be expanded by acquiring land from roadside house owners. The budget for the land acquisition is in place, but the residents preferred not cash in on their houses or to move. Consequently, the implementation of the BRT-5 was also stopped. The above mentioned reasons are officially published on government websites or in the local media. There are also unproven rumors: people who advocate the BRT scheme accused the weak political will as the reason for the failure of other BRT lines. With the first BRT line built and operated in 2008, Dalian became the third BRT city in China after Beijing and Hangzhou, and Xia has gained the expected political reputation. Therefore, the political motivation to push the following-up lines has been largely reduced.<sup>17</sup>

### **7.5.3 BRT marginalized and what constitutes the failure of the BRT-1**

Facing the difficulties of mobilizing land resources and obtaining public support, and the political will gradually faded away, Dalian's BRT development stagnated, and the BRT plan has since existed in name only. In such a desolate BRT environment, although

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<sup>17</sup> This information on the reasons for the failure of the BRT projects in Dalian is collected from doing interviews with the engineers at Dalian Maritime University, the planners from Dalian Urban Planning Institute, and the policy-makers from Liaoning Department of Construction and the Dalian Bureau of Transport.

the BRT-1 project was successfully constructed by segregating right-of-ways, its performance is poor. First, the target of the BRT plan was to increase public transport modal split by at least 8% within the first two years operation. However, because the BRT-1 project alone did not constitute a network and its coverage was quite limited, the actual modal split did not see much increase, and the growth targets became meaningless. In addition, the government's resolve to invest in BRT weakened further in late 2009 in the wake of Dalian's metros 1 and 2 being approved by the central government and subsequently constructed. Therefore, the Dalian government scrapped the "8%" growth target of the BRT modal split, and it pinned its hope on the metros.

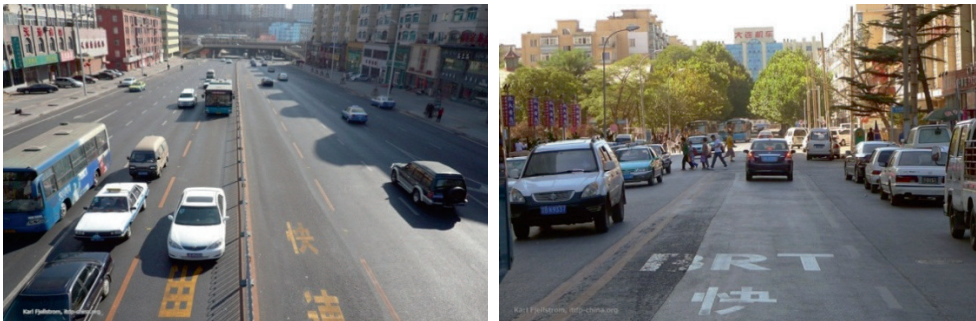
Moreover, when closely scrutinizing the infrastructure conditions of the BRT-1 in Dalian, we can find numerous problematic aspects in its operation and maintenance. It is expected that BRT emulates the performance and amenity characteristics of a modern rail-based transit system but at a fraction of the cost, and therefore, it at least requires *Special Running Ways* (e.g. reserved lanes on freeways or bus-only roads), *Special Stations* (e.g. higher-quality stations than regular bus stops, including platforms, more significant forms of shelter, information systems and other seating and lighting amenities), and *Intelligent Transport Systems* (e.g. the installation of technologies including automatic vehicle location systems, passenger information systems, and transit preferential treatment systems at signalized intersections). For more advanced requirements, it also includes *Higher-Quality Vehicles* (e.g. clean, hybrid-powered, and distinctive BRT dedicated vehicles for image building and branding) and *Higher-Quality Service Patterns* (e.g. high frequency and low fare). In contrast, Dalian's BRT infrastructure (see the vivid pictures in figure 7.8) is far from fulfilling these requirements (Yao, Chen et al. 2007). It did not apply the intelligent transport system: there is no real-time traffic information offered to passengers at stations, and there is no signal priority system at intersections. In addition, the BRT lanes were not effectively segregated from the auto lanes since there are no fences along many sections of the BRT routes, leading to the situation of cars encroaching on BRT lanes and thus the BRT vehicles running in mixed traffic. Due to these reasons, several serious traffic accidents have occurred between BRT buses and private autos in Dalian, leading more than 20 BRT buses to incur damage. Furthermore, the road surface conditions for BRT are poor due to a lack of maintenance of the cracks, sink and breakages. Concerning the BRT stations in Dalian, their conditions are not propitious either: some BRT stations have been cancelled, while some have been converted into regular bus stops. We can safely conclude that the BRT has been marginalized and the prospect of BRT is bleak in Dalian. Its image has been severely damaged, and it is unlikely to regain the trust of residents.

What constitutes the failure of the BRT-1? Unlike the LRT-3 project whose proposal was brought forward by the politician, Dalian's BRT plan was first initiated by transport experts after thoroughly analyzing foreign experience and lessons with adopting BRT and Dalian's local transport circumstances. Therefore, we can say that the experts in this case played a relatively positive role. However, the efforts taken by the political

side players were rather limited. When the construction of the BRT lanes touched upon many interest groups including the tram operator, the land users and car drivers, Xia failed in advocating the benefits that BRT brings. The disparity between the entire BRT plan and the actual realization is thus a reflection of government compromises. These compromises further bring to light the important role of determined leadership and strong political will in accomplishing the BRT plan. Therefore, if political competition is an important source to initiate public transport projects in China, then gaining political championship and political drive is crucial to the acceptance and the achievement of the large transport projects, especially when land acquisition is involved.



Note: BRT does not have light priority; and many BRT lanes are not equipped with fences.



Note: Cars encroach on BRT lanes, resulting in BRT vehicles in the mixed traffic.



Note: BRT lanes lack maintenance and the road surface conditions are poor.





Note: BRT is marginalized: some BRT stations are cancelled, and some are converted to regular bus stops.

Figure 7.8 The BRT-1 marginalized and poor performance  
 (sources of the pictures: Institute for Transportation & Development Policy: [www.itdp.org/](http://www.itdp.org/))

## 7.6. Conclusions

Based on the empirical evidence and discussions provided in the preceding sections, table 7.3 presents the scores of Dalian in terms of the city parameters in the actor subsystem from the political perspective. Having teased out the two hierarchies of China's political system and provided an overview of the urban politics in the reform period of China, it is clear that for urban transport problems it is the local government that takes decisions while the party largely plays a role in checking whether the governments follow the right ideological track. Secondly, it is clear for us that under fiscal decentralization political achievement projects in China cannot be eradicated, given the fact that measures concerning how to distinguish such projects from others do not exist and the role of experts is weak. The fruits of these projects are bitter in most circumstances, considering that their main function seems to help politicians accumulate political prestige. Often they suffer from bleak operation and poor maintenance. However, the results may also be sweet considering a large amount of resources and money are mobilized for the projects by powerful politicians, and without whom these projects cannot be realized in the first place. Therefore, this challenges people's conventional image that prestige projects always fail. What makes a difference, then, is due to a number of aspects and factors. The most commonly understood one is the dysfunctional role of the Chinese policy analysts. Other factors touch the politicians' personalities and idiosyncratic considerations, requiring that in some situations vision, boldness as well as personal ties and links are important in supplementing the course of weak expert analysis and in mobilizing scarce resources, funding, and external support. In addition, the strong political will and decisive leadership also contribute to the takeoff and continuity of the projects.

Table 7.3 Scores of Dalian with respect to the actor parameters from the political perspective

PARAMETERS	CURRENT SCORES
<b>Parameters in the actor system from the political perspective</b>	
24 The role of politicians	<p>The local politicians play a decisive role in steering urban planning and decision-making. Although top political elites have not been involved in daily decision-making on urban issues as China started to apply the policy analysis principles for addressing urban problems, and to gradually establish legal procedures for directing urban planning, the role of the urban leaders lies mostly in key policy formulation. They have a decisive influence in “bringing initiatives”, “establishing priorities” and “searching for a synthesis of goals that seemed irreconcilable”. The strong influential power of political elites in urban decision-making has advantages and disadvantages. For some urban leaders who have rich experience and are good sensors of urban policy windows for urban development, it is good for them to determine whether a particular policy will be decided. However, it also causes problems: the urban leaders are likely to strengthen their personal political prestige by proposing urban programs through using public resources.</p>
26 The role of investors (e.g. banks)	<p>The investors have a large impact on the achievement of urban programs because usually public funds are insufficient to finance large urban projects. In Dalian, as well as many other Chinese cities, as private finance is still limited due to the absence of strong private parties, state-owned banks become the main source of project finance. As investors, the banks do not evaluate the projects in terms of their rate of return. What they need is a letter from the urban leader as a government guarantee. This not only gives rise to the problem of a high debt level of the urban government, but also raises the level of dead loans in the banks.</p>
34 The criteria of cadre evaluation	<p>The criteria for evaluating the local leading officials have a decisive influence on the preferences of the officials on certain policy measures, and thus have a large impact on the direction towards which the city develops. By and large, the current development pattern in urban areas in China mirrors its evaluation criteria. And the city may change within a rather short period in line with the shift of the emphasis in the evaluation criteria.</p>



35 The level of acceptance of power-play

The level of acceptance of power-play is very high in the urban decision-making process. Citizens as less powerful members of the urban society accept and expect to a large extent that power is distributed unequally and that the powerful members such as the leader of the city exercise power and take decisions on his own, acting as a dictator. In addition, that also means that it is taken for granted by powerful leaders and presidents of large banks that power-play is inevitable and cannot be weeded out of urban decision-making.

36 The importance of personal networks

Personal networks play a large role in mobilizing support and resources for the initiation and implementation of urban policies. This parameter relates to the role of politicians. The politicians who have strong personal networks are usually more powerful and influential than those without personal connections, despite the fact that they have the same formal political rank/position. Extensively using personal networks has both pros and cons for urban development. The pros lie in the fact that the city is able to compete for more support and resources than others either from the central government or from some external investors, and thus to push forward urban programs. The cons, however, are that many political prestige urban projects require enormous public money and occupy large amounts of urban land that are spent unwisely in some cases.

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# 8. Planning TOD in Complex Urban Systems

## 8.1. Introduction

We started our research by embracing the idea that cities are *par excellence* complex and self-organizing systems. This property of cities requires that we have to make an endeavor to search a new approach for the study of cities and urbanism. The framework established in chapter 2 provides us with such an approach, in which cities can be understood via 36 parameters and these parameters can be practically investigated via 3 decision-making perspectives. In the preceding chapters, therefore, Dalian city is examined by applying the framework and every parameter is scored with current urban practices. However, can our empirical data of the urban reality be of any use for the attempt at deliberate intervention of TOD in self-organizing urban systems? The general answer among practitioners of self-organization would be yes because the self-organization is a theory about complexity and in an age of high complexity it can help us guide our actions and teach us how to control the complexity of our chaotic urban phenomena, how to look upon their behavior, plan their future and thus tame them. But how? This chapter intends to synthesize our findings, search for a cure to the complex urban problems and pave the way for the realization of TOD. In section 8.2, we recap the theoretical assumption “cities as complex systems”; we rethink the scientific debate concerning artificial design versus spontaneous change in urban evolution; and we clarify how we apply our conceptual model of cities. Section 8.3 argues that TOD can be stimulated if its conditions are fulfilled through changing parameter scores. Dalian’s fulfillment of the TOD conditions is examined; and the TOD conditions’ dependence on the parameters is explored. In section 8.4, therefore, we ask which parameters are the right ones to pick up, to influence, and thus to stimulate TOD. We answer this question by putting forward a typology of parameters based on the ordering-enclaved and the fast-slow dimensions. And we conclude that the ordering-fast parameters are the right ones to pick up for intervention. After choosing the right parameters, we illustrate in section 8.5 what the consequences would be on other parameter scores if the ordering-fast parameters are changed with deliberate intervention. And what does it mean for the stimulation of TOD? Finally section 8.6 concludes as to how to plan TOD in complex urban systems.

## 8.2. Recapping “Cities as Complex Systems”

### 8.2.1 Complexity and city evolution

In the beginning of this book we embraced the theoretical assumption of cities as complex systems. That is because since the 1950s and the 1960s, cities have been considered complex systems with the rise of complexity theory. Cities are complex mainly for the following reasons. First, they encompass multiple subsystems that interact and coevolve to influence the dynamics of the urban systems as a whole. Therefore, complex cities are adaptive in the sense that their subsystems have the capacity to change and learn from experience. Second, they are synergetic: their components are so numerous and these components are interconnected in a nonlinear fashion by a complex network of feedback loops. Both negative (damping) and positive (amplifying) feedbacks are key ingredients of complex urban systems. In addition, they are dissipative: complex cities are open systems in which sufficient flows of energy, people and materials are constantly taking place through their boundaries with their environments. Such a dissipative process of energy, people and matter presents an urban situation in which the system components are all varying simultaneously and in subtly interconnected ways. As a result, the systems are able to self-organize, which in turn challenges the concept of deliberate intervention in urban areas based on forecast and comprehensive plans.

Scientific attitudes towards city evolution reflect two contrasting schools of thought: deliberate design and self-organization, or spontaneous evolution. On one side of the debate, there is an ideology platform: not only that science cannot control society and its environment, but that it should not attempt to do so. Let society and its self-organizing product, the city, be what they have come to be: uncontrollable, unpredictable and unplannable. Let urban planners, designers and policy-makers make them more so by removing all interventions that have been imposed. On the other side of the debate, science, by its capacity to explain the past and the present and on the basis of these to predict the future, will provide the proper means for a planned intervention and control.

Our view concerning this debate is as follows. On the face of it the former vision sounds highly desirable and creative: an ever evolving city that is able to manage itself in the best way, so any planning efforts of artificial intervention can be eliminated, or at least minimized. However, this sounds like a straightforward conclusion but it is not as simple as it may sound. Urban and regional planning as both practice and discipline mainly originated from so called “market failure”, the inability of the “invisible hand of the market” to cope with the most dramatic industrial revolution, or the urban revolution of modernism. Such market failure in the case of cities thus refers to public goods and externalities, and it provides the rationale for public intervention and

planning. Unfortunately, most of the modern urban planning practices have also failed to solve urban problems and control cities by means of the scientific method and rational planning. Therefore, to our understanding, both views are indispensable. Spontaneous evolution does not imply the elimination of deliberate design, and design is not the exact opposite of self-organization.

## 8.2.2 City evolution by branching right parameters

What does complexity, as described above, mean in terms of deliberate design? Deliberate design, in the context of complexity theory, means influencing and directing the process of urban evolution from one state to another. A greater insight into the properties and the behavior features of complex systems leads to improved insight into the feasibility of directing the evolution. Therefore, in complex cities, deliberate design can be carried out by adopting a system approach, i.e. looking at and managing cities at the system level, because unintended side effects and adverse boomerang effects can only be recognized at the system level. This does not mean bypassing the problem of causalities within the systems, but the understanding of the interactions and causalities between system parameters is also important because emergent properties might be hidden or offset at a higher scale level (e.g. the system level) but already emerge and are observable at a lower scale level (e.g. the subsystem or the parameter level). Therefore, it implies that when designers attempt to intervene and to change the system, simply enacting a policy is impossible. This results in a shift to meta-levels: from policy to conditions to parameters. That means, changing the scores of certain parameters may lead to favorable conditions under which the policy can be implemented and realized.

However, in complex urban systems, the possibilities of changing parameter scores are quite limited because design activities are only viable in certain circumstances. For instance, design for fundamental change is only possible during significant urban turbulence because such turbulence might provide urban planners with a great policy window to reshape the urban configuration. Without turbulence that is strong enough to arouse urban chaos, design is only possible by picking up the right moments and right elements in the process of urban evolution. Therefore, it is crucial to select the right parameters as the entry points of artificial intervention that may arouse system-level changes through their causalities with other parameters.

Once the right parameters are determined, how to change their scores? Here, progressive and step-by-step decision-making is believed to be more effective and realistic for complex urban problems. This is what Lindblom (1959) referred as "*The Science of Muddling Through*". The basic ideas in the science of complex cities, to use other phrases such as *branch decision-making* or *branch intervention*, refers to the inability and impossibility to make fully informed urban plans or fundamental policy changes in complex cities, not only because it is difficult to clarify and compare

alternative policies in advance due to the limited rationality of the decision-makers and planners, but also because it is highly likely to cause conflicts between the lumpy policy initiatives and the city's self-organizing regularities, and accordingly to result in ineffectiveness of the policy introduced (Johnston, Low et al. 2012). Therefore, the branching method is incremental and even nudging, but far-reaching. And it is only possible for urban design to pick out the right parameters and then change these through remedial policies and measures (Burgess 1927).

### **8.3. Fulfilling TOD Conditions via Changing Parameter Scores**

Through the above recap of "cities as complex systems", we are aware of the fact that changing the scores of certain parameters may lead to favorable conditions under which TOD can be implemented and realized. Therefore, this section aims at two things: the examination of Dalian's fulfillment of the TOD conditions and the exploration of each condition's dependence on the parameters.

#### **8.3.1 Dalian's fulfillment of the TOD conditions**

To fulfill the TOD conditions so that TOD can be stimulated in an urban system, one has to examine to what extent the city's circumstance has met the conditions. Here, three results are roughly possible: one, the city has already self-organized in such a way that is almost congruent with what TOD entails; two, some aspects of the self-organizing city are promising for TOD while others are not; three, the entire situation of the city which runs on the self-organizing trajectory is far from the environment that TOD requires. As for the first, people actually do not have to do anything but leave the city as it is. Regarding the second and the third, it then needs deliberate intervention for those conditions that are not fulfilled yet.

In light of this, we have compared Dalian's situation with the conditions for effective TOD that we have established in chapter 3 (table 8.1). A close reading of the evidence presented in the case study chapters 4 through 7 and the table provided below underscores the potential benefits that could accrue from successful adoption of TOD, but simultaneously that TOD can only be significant in future urban planning and developments if the decision-makers could manage those unmet conditions. As table 8.1 displays, we found that even though Dalian shows favorable scores on some conditions, especially those dating back to its aesthetic historical urban architectures and recent successful stories in preserving its downtown area and creating beautiful cityscapes, Dalian's urban context in most of the conditions present us with rather unfavorable records. The governance conditions as the critical condition are not met,



while the transport service conditions as another critical condition are largely met but flaws still exist. For those important conditions, Dalian’s context only partly fulfills the land use conditions, does not fulfill the conditions for restricting automobile ownership and usage, and hardly satisfies the real estate market conditions.

Table 8.1 Dalian’s fulfillment on the TOD preconditions

CONDITIONS	CRITICAL?	IMPORTANT?	FULFILLED?
Urban Design Conditions	√	YES	Dalian has fulfilled this condition given its protection of lovely historic architecture heritage and its construction of aesthetic buildings in the modern time, as well as the development of urban green and beautiful city landscape.
Governance Conditions	√	NO	Dalian’s practice of urban management and leadership processes does not fulfill this condition, because attention of the local decision-makers is focused on branding the place, producing slogans and serving business investment since the power devolution and fiscal decentralization in China. The planning as well as the policy-making process is thus fast, without deliberate comparisons among alternatives or careful technical evaluations. The enforcement of the legal system is weak. Power-play and the extensive use of personal networks during public decision-making becomes commonplace. And the criteria of cadre evaluation that creates a tie between the central and local governments and that put a lot of emphasis on GDP growth records does not play a positive role in facilitating sustainable urban development.
Land Use Conditions	√	PARTLY	Dalian’s situation with respect to this condition is a mixed one: it shows a favorable condition in the level of urban density, but the picture looks bleaker in terms of land use diversity.
Conditions for Restricting Automobile Ownership and Usage	√	NO	Regarding the conditions for restricting car ownership and usage, Dalian’s record is meager on both accounts. Given the skyrocketing private car ownership in Dalian and increasingly severe congestions on urban roads, these conditions are not yet fulfilled in Dalian. Although some possible car restricting strategies have been once considered by the policy analysts, a thorough analysis on their effectiveness and local applicability indicated they would never work out in the city. Currently, Dalian does not apply any specific policies or actions controlling car use, except for some central-level tax imposed on car purchase and fuel consumption to which most Dalian citizens have been insensitive because of their rising disposable income.

<b>Transport Service Conditions</b>	√	<b>LARGELY</b>	Dalian has fulfilled this condition to a large extent, considering that it has a relatively developed transit network. Although flaws still exist in terms of uneven network coverage between the urban center and periphery areas, Dalian still has a very good tradition in using public transit, which indicates that Dalian citizens are more or less satisfied with the service qualities. Recently, more work has been done by the Dalian government to improve service qualities. The government initiatives include system integrity at both physical and organizational levels. Bus routes have been adapted to provide better feeder services to metro lines and to improve intermodal transfer. Post-NPM reforms (by re-structuring the organizations of the transit operators) have been implemented to ameliorate operational coordination. However, defects still exist concerning the closed appointment of service providers and thus lack of open competition, as well as the absence of a fixed and legally protected subsidy mechanism.
<b>Real Estate Market Conditions</b>	√	<b>HARDLY</b>	Dalian's situation in providing affordable and mixed housing supply around transit stations is bleak. Since the reforms of urban housing in China, housing prices in Dalian have risen markedly, especially near transit stations. In spite of the unfavorable situation at the housing market for TOD implementation, except for the <i>Anju</i> projects, there is lack of economic regulation in China in general and in Dalian in particular to keep housing prices low, or to allow low-income residents to settle in homes around transit stations.

*Note: There is a scale in the table: NO-HARDLY-PARTLY-LARGELY-YES, measuring the extent to which Dalian's current circumstance fulfills the conditions.*

### 8.3.2 TOD conditions' dependence on the parameters

To fulfill TOD conditions via the actor-subsystem parameters, one has also to examine which conditions depend on what parameters. This is because people have to know which conditions would be stimulated if certain parameters are chosen for intervention. It can happen that different conditions concurrently depend on the same parameter. In this circumstance, the deliberate intervention for one parameter may help the city to fulfill several conditions at the same time.

Table 8.2 shows the dependence of each condition on the parameters. We draw the table by synthesizing the parameter scores shown in chapters 5 through 7. First, *the urban design conditions* depend on 3 parameters including *the role of the municipal government*, *the role of politicians* and *the importance of legal procedures*. According to Dalian's evidence, the municipal government takes the responsibility of the construction and the maintenance of the street network. It plans and invests in urban streets to increase their connectivity and accessibility. It also pays attention to the condition of the street network in terms of its amenities such as lighting and roadside greening. Therefore, if this responsibility is fulfilled by the municipal government, then the pedestrian friendliness of the urban design conditions would be ensured. The politicians have impact on the quality of public space. The mayor of Dalian, among

other things, has emphasized the construction of large open space, traffic circles, squares and parks in the city of Dalian, which adds more weight to the urban design conditions. Concerning architecture aesthetics, the legal procedures take effects because they specify the architecture appearance as to how buildings should be designed and rebuilt to create a harmonious and coherent cityscape.

As for *the governance conditions*, they depend on 8 parameters, consisting of *the roles of central government, provincial government, municipal government and district government, the role of politicians, the criteria of cadre evaluation, the important of personal networks, and the level of acceptance of power-play*. Power allocation among different levels of government seriously affects the governance quality. Based on Dalian's evidence, urban neoliberalism and entrepreneurialism as a result of China's fiscal decentralization become the current urban governance ideology, where more weight is put on economic indicators of the effectiveness of the political-administrative management system compared to indicators measuring environmental and ecological sustainability, and which rationalizes and promotes a pro-growth approach to urban governance. This ideology is also reflected in the criteria of cadre evaluation with one-dimensional predilection for GDP growth. As a result, the politicians put forward some flagship projects in urban planning and decision-making that give strength to their personal prestige. In addition, the quality of governance also depends on how important personal networks are in public policy-making and the extent to which a society can accept power-play. There is a high level of acceptance of power-play in the urban governance partly due to China's deeply-rooted cultural characters with respect to the large power distance and the high acceptance of inequality in the society. Personal networks play both positive and negative roles in the governance condition: positive effects concerning the successful and fast mobilization of resource and money for the realization of urban projects; negative effects concerning the high possibility of such projects being political achievement ones that abuse public money and harm the general public interests.

Regarding *the land use conditions*, they touch upon 4 parameters. They are *the role of municipal government, the importance of legal procedures, the role of land owners and the concentration of city-planning tasks*. Here, the municipal government, also known as the land owner, acts as the land leaser so as to strengthen the competitiveness of the city by preferential treatment of investors. The aspect of neoliberalism in the land policies is that the interests of the private investors, business and commercial sectors have priority above the public values, and that the fulfillment of investors' interest in obtaining the most profitable location for their business is more important than the realization of public plans. As a consequence, the most profitable land is leased to business investors while the majority of the public is excluded from using that land, leading to a low level of land use diversity. In addition, the concentration is also low considering that the city-planning tasks are decentralized to a number of sector-specific planning institutes and the plans of each sector (e.g. transport, land use, industry, economy, population and labor) are not well coordinated to generate a high level of land use diversity. Apart

from this, the fulfillment of the land use conditions strongly relates to the effectuating of the legal system. In current legislation, little space is reserved to strengthen the mixed use in urban land transformation.

*Conditions for restricting automobile ownership and usage depend on the role of municipal government, the role of policy analysts and the importance of legal procedures.* Rather than restricting car purchase and use, the municipal government promotes motorized mobility by providing ample and cheap parking space, some even occupying sidewalks. This seriously weakens the fulfillment of this condition. As for the policy analysts, they conduct analysis on car restrict policies abroad, but after finding out the impossibility of transferring these policies to the Chinese urban context, few workable policies and measures have been proposed in Dalian. The legal procedures, on the other hand, are also weak in providing adequate economic incentives to car users. Both fuel taxes and fees imposed on car purchase do not garner much impact.

Concerning *transport service conditions*, they depend on 8 parameters. Among them, *the role of policy analysts and the importance of policy analysis and analytical information* affect the fulfillment of this conditional area in terms of the accuracy of urban traffic forecast and the rationale of design for transit route and capacity. *The role of investors* lies in providing money for urban projects, thus affecting the realization of many large transport projects and the physical network's connectivity as well as coverage. *Transport infrastructure providers* apparently have direct influence on the service quality. And the parameters such as *the concentration of transport planning and operation tasks and the competition level in the selection of service providers* are relevant in achieving the service condition because bundling and unbundling of planning and operation tasks determines the interoperability and intermodality of the service, and the competition level determines the quality of the contractor as well as the operation cost of service provision. In addition, *the role of municipal government* cannot be forgotten here because it provides subsidies to the operators, and a well-formulated subsidy mechanism is important for good transport services. Finally, *the importance of legal procedures* comes into play because how much space is reserved in legislation for urban transit significantly influences the effectiveness of regulatory incentives on safeguarding service qualities.

Finally, *the real estate market conditions* depend on 3 parameters, including *the role of municipal government, the role of real estate developers and the importance of legal procedures.* The municipal government is relevant in this condition because it holds the power of granting land use rights to the real estate developers and thus determines where residential houses can be developed, and it carries the role of implementing the central policies on controlling housing price, ineffectively though. In addition, the municipal government is also active in offering economic and affordable houses to households of low income. If the municipal government is able to accomplish these roles, the fulfillment of the real estate market conditions can be stimulated. The role of real estate developers is apparently an essential parameter in this conditional area. The developers

are the actors that determine the type of the house to be developed and the price, thus affecting the fulfillment of the real estate market conditions in terms of housing affordability and the mixing of different housing types in residential neighborhoods. Last but not the least, the importance of legal procedures in managing the real estate market is another relevant parameter. China has the national real estate management law and the state directives on controlling urban commercial housing prices and the construction of *Anju* projects, but their importance remains problematical because those wishes in legislation are dashed at the local level.

Table 8.2 TOD conditions' dependence on the parameters

<b>CONDITIONS</b>	<b>PARAMETERS ON WHICH CONDITIONS DEPEND</b>
<b>Urban Design Conditions</b>	The role of municipal government;
	The role of politicians;
	The importance of legal procedures;
<b>Governance Conditions</b>	The role of central government;
	The role of provincial government;
	The role of municipal government;
	The role of district government;
	The role of politicians;
	The criteria of cadre evaluation;
	The importance of personal networks;
	The level of acceptance of power-play;
<b>Land Use Conditions</b>	The role of municipal government;
	The importance of legal procedures;
	The role of land/property owners;
	The concentration of city-planning tasks;
<b>Conditions for Restricting Automobile Ownership and Usage</b>	The role of municipal government;
	The role of policy analysts;
	The importance of legal procedures;
<b>Transport Service Conditions</b>	The role of municipal government;
	The role of transport infrastructure providers;
	The concentration of urban transport planning and operation tasks;
	The level of competition in contractor selection for transport service delivery;
	The role of investors;
	The importance of legal procedures;
	The role of policy analysts;
The importance of policy analysis and analytical information;	
<b>Real Estate Market Conditions</b>	The role of municipal government;
	The role of real estate developers;
	The importance of legal procedures;

## 8.4. Picking up the Right Parameters

Acknowledging that TOD can be stimulated in complex urban systems by changing parameter scores, one question emerges as to which parameters are the right ones to pick up, given that we cannot change everything at a time. Consider, if the governments seriously intend to meet the TOD conditions they are also unable to simultaneously enact comprehensive targeted policies or to mobilize substantial resources and support for all the conditions. This section, therefore, aims to figure out the parameters that have the most significant effect on TOD realization and on which we should exert influence.

### 8.4.1 Ordering and enslaved parameters

Table 8.3 Ordering and enslaved parameters

Actor subsystem parameters	Ordering?	Enslaved?
The role of policy analysts		<input checked="" type="checkbox"/>
The role of the central government	<input checked="" type="checkbox"/>	
The role of provincial governments		<input checked="" type="checkbox"/>
The role of municipal governments	<input checked="" type="checkbox"/>	
The role of districts governments		<input checked="" type="checkbox"/>
The role of politicians	<input checked="" type="checkbox"/>	
The role of land owners/property owners	<input checked="" type="checkbox"/>	
The role of investors (e.g. banks)		<input checked="" type="checkbox"/>
The role of transport infrastructure providers		<input checked="" type="checkbox"/>
The role of real estate developers	<input checked="" type="checkbox"/>	
The importance of policy analysis and analytical information		<input checked="" type="checkbox"/>
The importance of legal procedures		<input checked="" type="checkbox"/>
The concentration of city-planning tasks		<input checked="" type="checkbox"/>
The concentration of urban transport planning and operation tasks		<input checked="" type="checkbox"/>
The level of competition in contractor selection for transport service delivery		<input checked="" type="checkbox"/>
The criteria of cadre evaluation	<input checked="" type="checkbox"/>	
The level of acceptance of power-play	<input checked="" type="checkbox"/>	
The importance of personal networks		<input checked="" type="checkbox"/>

The ordering-enslaved dimension measures the degree of impact of a parameter on urban structure (see chapter 2 on the impact of the parameters). Specifically, it entails whether or not each actor-subsystem parameter plays a decisive role in forming the urban structure (Portugali 1997). Based on the parameter scores we explored through chapters 5 through 7, table 8.3 expresses Dalian's actor-subsystem parameters under this dimension. As can be seen, the ordering parameters contain the role of central government and the role of the municipal government which governs the urban system at different levels: in spite of administrative decentralization the central government of China still exhibits considerable influence on urban construction and development



through enacting national legal procedures for urban decision-making and local government actions, approving urban master plans and large-scale urban programs as well as mega infrastructure projects, and allocating central budget; while the municipal government under the economic liberalization conditions exhibits strong influential power in patterning urban structure, ranging from launching a variety of strategies that facilitate economic growth, formulating urban policies, planning urban land use, to the management of public transport and the provision of housing facilities for the low-income households. In addition, the ordering parameters also come from the roles of some private actors. For instance, the role of the property owners is able to govern the urban structure via giving out or retaining the occupied land for urban transformation. Another example is the role of the real estate developers. It is regarded as an ordering parameter because the housing developers driven by profit maximization are able to determine on their own the location to invest as well as the types of houses to be developed. That is to say, they will never auction on the land the location and construction requirements of which cannot generate maximum profit. As a consequence, it cannot only affect the housing affordability especially for the low-income households, but also affect the urban land use pattern in terms of the mixing of different housing types. Apart from these, given China's political and cultural environment the parameters such as the role of politicians, the criteria of cadre evaluation, and the level of acceptance of power-play also constitute to the cluster of ordering parameters. As for the role of politicians, the role of local leading officials in particular, it holds the utmost power in taking decisions and dictating government actions concerning urban development plans and projects. This is partly due to the economic reforms and the power decentralization in contemporary China, and partly related to the ordering parameters of the cadre evaluation criteria and the high level of acceptance of power-play, both of which acts as the fundamental motivations for the politicians' policy preferences and tendencies.

Regarding the enslaved parameters, first of all, they touch the role of policy analysts, as well as the importance of policy analysis and analytical information. Our empirical findings have demonstrated that the importance of policy analysis has remained low in carrying out urban decisions; the role of policy analysts, i.e. the role of various research institutes, has kept far from the core of decision-making; and the analytical information has been also manipulated whenever needed in order to support the policy options with political preference. Therefore, these analysis-related parameters are enslaved ones, which are extremely weak in determining the structure of the urban system and whose motions are slaved by some of the ordering parameters such as the role of politicians. Besides, there are enslaved parameters coming from the governmental organizations. One example is the role of provincial government because the municipalities of large Chinese cities can almost directly communicate with the central government, resulting in the situation that the role of the government at the provincial level is very weak and often skipped. In addition, the parameter with regard to the importance of legal procedures is also identifiable to be an enslaved one, because we

have found in the empirical studies that the statutory procedures are still far from being able to direct the policy-making and government actions in practice. Furthermore, some parameters with private sector identities, including the role of investors and the role of transport infrastructure providers are believed as enslaved ones. The reason is that they are not only unable to shape the macroscopic structure of the urban system, but also unable to govern the statuses of other parameters at the micro level. And finally, it is worthwhile mentioning that the importance of personal networks is an enslaved parameter. Based on our evidence on urban decision-making from the political perspective, it seems as if the personal networks play an important role in achieving the political prestige projects via the informal mobilization of funding and other resources. However, it is in fact a kind of parasitic parameter subject to the role of politicians, which means it in itself cannot govern the structure of the city, and it plays a role in smoothing or blocking individual urban projects when the politicians have such networks and are willing to use them.

## 8.4.2 Fast and slow parameters

Table 8.4 Fast and slow parameters

Actor subsystem parameters	Fast?	Slow?
The role of policy analysts		<input checked="" type="checkbox"/>
The role of the central government		<input checked="" type="checkbox"/>
The role of provincial governments	<input checked="" type="checkbox"/>	
The role of municipal governments	<input checked="" type="checkbox"/>	
The role of districts governments	<input checked="" type="checkbox"/>	
The role of politicians	<input checked="" type="checkbox"/>	
The role of land owners/property owners		<input checked="" type="checkbox"/>
The role of investors (e.g. banks)		<input checked="" type="checkbox"/>
The role of transport infrastructure providers	<input checked="" type="checkbox"/>	
The role of real estate developers	<input checked="" type="checkbox"/>	
The importance of policy analysis and analytical information		<input checked="" type="checkbox"/>
The importance of legal procedures		<input checked="" type="checkbox"/>
The concentration of city-planning tasks	<input checked="" type="checkbox"/>	
The concentration of urban transport planning and operation tasks	<input checked="" type="checkbox"/>	
The level of competition in contractor selection for transport service delivery	<input checked="" type="checkbox"/>	
The criteria of cadre evaluation	<input checked="" type="checkbox"/>	
The level of acceptance of power-play		<input checked="" type="checkbox"/>
The importance of personal networks	<input checked="" type="checkbox"/>	

The fast-slow dimension measures the speed of change of the parameters (Weidlich 1999), thus entails how hard a parameter can be influenced (see chapter 2 on the influenceability of the parameters). In other words, it measures the time needed for the parameters to change and thus also refers to the sensitivity of the parameters to urban turbulence and changes taking place in other parameters. The fast ones refer to those parameters that either adapt by themselves rapidly in response to the changes of the

systems motion driven by the internal self-organizing regularities or transform quickly driven by artificial interventions on certain parameters from exogenous sources. That is to say, the same parameter can display different statuses in different structurally stable periods of the urban system. And it is highly likely for the fast parameters to exhibit abrupt changes, especially during the short periods of urban turbulence. As for the slow ones, they need relatively much longer time to change their statuses, and they are not very sensitive either to the system internal changes or to external interferences. Therefore, it is possible that one slow parameter keeps the same status while cities evolve. To compare the fast and slow parameters, it implies that the fast ones can influence the urban system in a certain direction in the short run while the slow ones are able to exert influential power on the urban system towards a specific direction in the long run.

At the slow pole, however, it covers the parameters such as the role of policy analysts, as well as the role of policy analysis and analytical information. They are slow ones because they almost stay the same even though the urban system evolves across different steady states. It requires a long time for them to change because the accumulation and acquisition of information and data, the development of sciences and theories, and the innovation and application of technologies normally need several generations or even centuries to increase the analytical quality and thus to change the role of the analysts as they are able to generate more convincing and accurate analytical and forecasting results. Another slow parameter comes from the role of the central government. We call it slow parameter because it is not very sensitive to individual urban changes and largely stay stable across time. In other words, the role of the central government will not change within a short period due to some local urban processes, while it may change as a result of many urban structural changes but that requires a long time. In addition, it has to stay stable in the sense of a coherent and consistent function because it serves as the global environment and the boundary condition under which each individual urban structure evolves. Apart from the role of central government, the importance of legal procedures constitutes another slow parameter. This is not only because the construction process of legal structures, or say, the development of the formal institutional and regulatory environment, requires a long time up to centuries, but also because it takes a long time for those legal procedures to be developed into some kind of behavioral standards and codes for implementers and practitioners. Similar to the role of legal procedures, the level of acceptance of power-play as a cultural aspect of an urban system is also a slow parameter. It measures the extent to which the less powerful members of institutions and organizations within an urban system expect and accept that power is distributed unequally. In the Chinese urban society this parameter is considered high given our evidence on the political power-play behavior in the urban decision-making practice. Such a high level of acceptance of power-play results from a long-term development of a society's value system and history, and thus it is a root of a society's culture. Consequently, it is stable in the course of time and takes long to change. Moreover, there are two parameters, the

role of land/property owners and the role of investors, coming from the private sector, which are also rated as slow ones. If we think of the role of land and the role of capital in the process of urban development and transformation, it is apparent that they rarely change no matter what kind of steady state the city experiences, because land and capital are the fundamental production elements for urban construction. As we can see from the empirical evidence, regardless of the urban system in socialist China or in the market economy, the role of land owners and the role of investors remains almost the same: the former leasing and transferring land use rights and the latter providing financing support.

### 8.4.3 A typology of parameters

The ordering-enslaved and fast-slow dimensions yield four types of parameters:

- **Type 1: Ordering-Fast Parameters:** *the parameters belonging to this type have decisive power in shaping the pattern of an urban system, and that power is very sensitive to either internal and external turbulence happening in the city and thus variable, unable to sustain the same status in the long-term urban evolution. That is to say, these parameters are the most dominant ones to steer the urban system towards a certain developmental direction.*
- **Type 2: Enslaved-Fast Parameters:** *the parameters belonging to this type are enslaved by the ordering parameters and thus have little influence on the appearance of the city; in addition, they are sensitive to internal movements of the city and external artificial interventions and as a result they are quite unstable and change fast during urban evolution. That is to say, these parameters cannot exhibit strong impact in directing urban development, but their effect appears rapidly.*
- **Type 3: Ordering-Slow Parameters:** *the parameters belonging to this type have considerable power in determining the form of an urban system, but that power or strong influential force are sluggish. They are resistant to internal and external disturbances that take place in the urban system, and thus are relatively stable, or change very slowly across time even that the city has experienced different steady states and urban turbulence.*
- **Type 4: Enslaved-Slow Parameters:** *the parameters belonging to this type do not have much influential power in forming the urban system, largely being enslaved by the ordering parameters. In addition, these parameters are relatively insensitive, that is, they are unable to change promptly.*

It is time to match the results of parameter analysis with the typology of parameters as presented in table 8.5. It becomes obvious from the table that the most powerful parameters are from type 1 (*Ordering-Fast Parameters*) in the top left corner, which consists of the role of municipal governments, the role of politicians, the role of real estate developers and the criteria of cadre evaluation, because their influential power on cities is not only dominant but also prompt. Less powerful ones are type 2 (*Enslaved-*

*Fast Parameters*) and type 3 (*Ordering-Slow Parameters*). Type 2 consists of the role of provincial governments, the role of district governments, the role of transport infrastructure providers, the concentration of city-planning tasks, the concentration of urban transport planning and operation tasks and the level of competition in contractor selection for transport service delivery and the importance of personal networks. They exhibit little impact on the urban form but their impact can be prompt. Type 3 contains the role of central government, the role of land owners and the level of acceptance of power-play. They are able to enslave other parameters and are thus dominant, but they require a long time to change, which means their effects become visible only slowly. As for type 4, it contains the role of policy analysts, the importance of policy analysis and analytical information, as well as the importance of legal procedures. In contrast to type 1, this type of parameter is the least dominant, merely with tiny and sluggish impact on urban form.

Table 8.5 A typology of parameters

Dimensions	Ordering	Enslaved
Fast	<p><u><i>Type 1: Ordering-Fast Parameters:</i></u>            The role of municipal governments;            The role of politicians;            The role of real estate developers;            The criteria of cadre evaluation.</p>	<p><u><i>Type 2: Enslaved-Fast Parameters:</i></u>            The role of provincial governments;            The role of district governments;            The role of transport infrastructure providers;            The concentration of city-planning tasks;            The concentration of urban transport planning and operation tasks;            The level of competition in contractor selection for transport service delivery;            The importance of personal networks.</p>
Slow	<p><u><i>Type 3: Ordering-Slow Parameters:</i></u>            The role of central government;            The role of land/property owners;            The level of acceptance of power-play.</p>	<p><u><i>Type 4: Enslaved-Slow Parameters:</i></u>            The role of policy analysts;            The role of investors (e.g. banks);            The importance of legal procedures;            The importance of policy analysis and analytical information.</p>

Accordingly, we can safely conclude that *the parameters of type 1, i.e. the ordering-fast parameters, are the right ones to be chosen to influence and consequently to stimulate TOD*. For others especially for types 2 and 3, we do not rank them because sometimes it might be possible that we need them both, and they are not mutually exclusive in the sense of their integral effects, type 2 exerting less influential prompt power while type 3 exerting influential but sluggish power.

## 8.5. Branching Possible Changes on Parameter Scores

From the previous section we know that the right parameters to pick up are the ordering-fast parameters, including *the role of municipal governments*, *the role of politicians*, *the criteria of cadre evaluation* and *the role of real estate developers*. Aiming at these parameters, this section sought to put forward possible changes in them so that the TOD conditions can be fulfilled and consequently TOD can be stimulated. Specifically, we look at how the ordering-fast parameters impact on others. And if these parameters change, how do others change?

### 8.5.1 Branching “the role of municipal government”

The process through which “the role of municipal government” is branched is shown in figure 8.1.

Branching the role of municipal government, at the first place, lies in adjusting the relations between different layers of government by slightly reallocating or redesigning their powers and responsibilities. Currently, China’s fiscal decentralization empowers the local government, which leads to neoliberalism and entrepreneurialism as the main governance ideologies of the municipal government. Such ideologies have advantages for urban development in the sense that they create conditions conducive to capital/investment accumulation within a city and subsequently to sustain the economic aspect of urban vitality. However, awareness should be created and cultivated in urban governance regarding the importance of environmental sustainability in the long-term urban growth. People and investors nowadays are voting on a city by foot, meaning that they will choose the locations to work, live and invest that are not only economically developed but also environmentally friendly. This does not always require a strict procedure, but requires more the understanding that to promote economic growth is not necessarily at the expense of the environment. To achieve this, one possible change will be that the provincial government is given more authority and budget from the central government. The purpose is to reduce the regional inequality of the province and to reward the city that implements environmentally friendly projects. If this is realized, the central government that promotes environmental sustainability would work at cross-purposes (C.) with the municipal government that aims at economic sustainability, and the role provincial government would be reinforced (R.) in urban development. As for the relation between the municipal government and the district government, while doing surveys on the traffic pattern and the land use pattern, the district government that is the closest authority to the citizens will carry more responsibilities, acting as a place of referenda and hearings where active citizens are able to reflect opinions. These hearings might



not be handled immediately, but as a chance to express the citizen's ideas. As a consequence, the role of the municipal government could be reinforced for the reason that it goes one step further towards public participation.

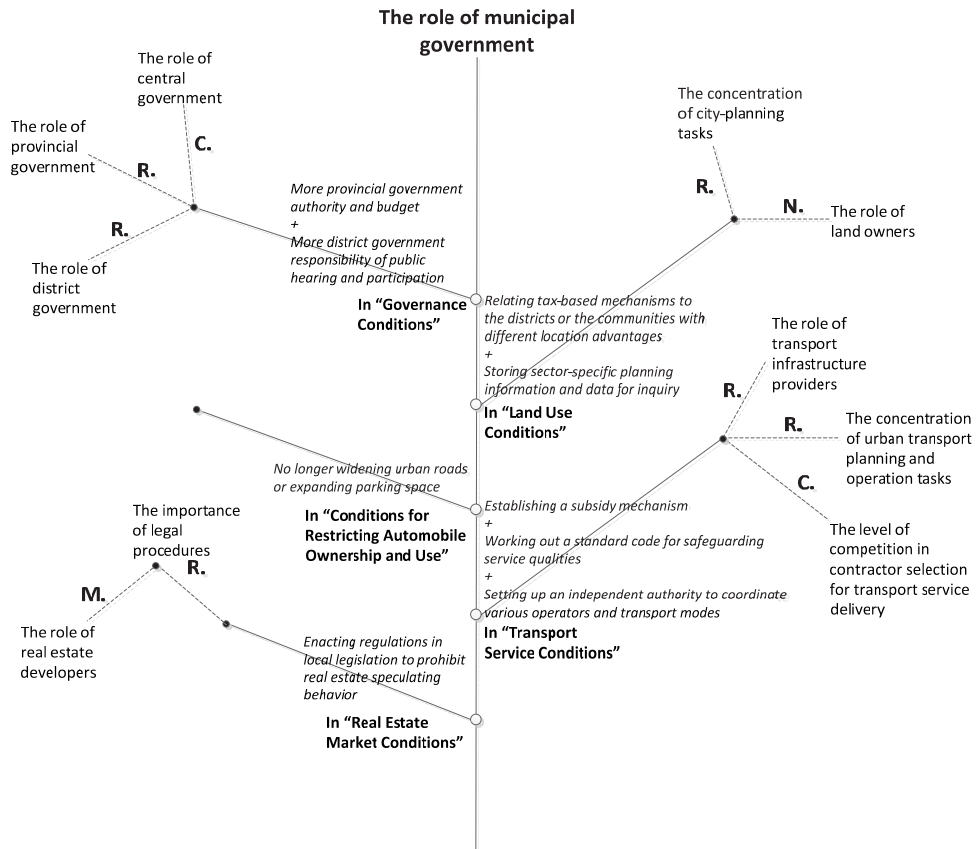


Figure 8.1 Branching the role of municipal government

From table 8.2 we know that the municipal government also plays a role in the land use conditions of TOD. To branch the role of municipal government in this conditional area, the municipal government should relate tax-based mechanisms to the districts or the communities with different location advantages. In other words, the municipal government is able to grant land use rights to private developers and investors, but the developers and investors who aim at the most profitable locations should pay much higher taxes than those who choose the locations elsewhere. It attempts to neutralize (N.) the role of land owners and to offset the perceived weakness of some districts. The new role of the municipal government encourages developments in areas where the business and commercial sectors would be normally ignored. Therefore, it can be used as a tool to lever investment into the districts throughout the city and act as a stimulus to the regeneration process of the underdeveloped districts and the gradual improvement of land use diversity. In addition, since the current concentration on the

city-planning tasks is low and specialized into individual urban sectors, the role of municipal government in coordination should be improved, especially in coordinating urban transport plans and land use plans. To achieve this, the municipal government could build up a database that stores real-time sector-specific planning information for the inquiry of other sectors. As a result, this change could reinforce the concentration of the city-planning tasks through better coordination and information sharing.

At present, the role of the municipal government in restricting automobile ownership and usage is weak. Confronted with this situation where automobile constraint strategies will not work out, possible change can be created if the municipal government will no longer invest in widening the urban roads or constructing ample parking space. In so doing people are allowed to purchase and use cars, but they have to be aware of the fact that it is very possible for them to suffer from road congestion and parking unavailability.

In addition, branching the role of municipal government in the public transport service conditions lies in improving the municipal government's regulatory effectiveness on urban transport infrastructures. This includes three aspects. First, urban governance following neoliberalist ideology has provided the local government with an excuse to withdraw from public funding for transit services and shifting the risk of profitability to the operators. This significantly reduces the incentives of the operators to safeguard service quality. Therefore, the first change will be that a subsidy mechanism is formally established. It does not strictly require the subsidy has to be monetary; it can be in the form of granting land use rights as an equivalent, but should clarify the functional options of the land that the operators can make use of. The second, along with the establishment of the subsidy mechanism, the municipal government has to work out a standard code to safeguard service qualities. And the provision of subsidy would be linked with the service performance. Both changes, as a result, will reinforce the role of transport infrastructure providers in a positive direction. Third, an independent authority is recommended to build up by the municipal government to coordinate services of different transport modes and to improve interconnection between various jurisdictions. This instrument will neutralize the drawbacks that the low concentration of transport planning and operation tasks brings about. As for the low competition level of contractor selection, chances of bringing forward changes are quite limited for the reason that there are few qualified providers to be compared. The large state-owned operation company that has run the infrastructure since the city has public transport become the only choice for the government. Therefore, the selection is based on close appointment, leading to the situation where the role of municipal government and the parameter that stresses a high level of competition in contractor selection essentially works at cross-purposes.

Furthermore, we also find the municipal government has a role in the real estate market conditions of TOD. Provided that the municipal government has been powerless to decide on the housing price due to the house developers in the

liberalization environment, the possible change exists in the area of prohibiting the real estate speculators. And the instrument would be a restriction on resale, which limits the value of the house as a consumption good compared to a capital asset. For instance, a house that is purchased is not allowed to resale within 5 years. Such restrictions discourage profit-seekers because waiting to realize better sale price may result in waste. If these regulations could be enacted by the municipal government in local legislation, the legal procedures on urban housing market would be reinforced, and the role of real estate developers will be indirectly mitigated (M.) because without housing speculators a large number of houses will remain idle and the housing price will decrease.

As can be seen, changes on the role of municipal government give rise to changes on other parameter scores. Changes on the role of the municipal government in the “Governance Conditions” of TOD reinforce the role of provincial government and the role of district government; changes on the role of municipal government in the “Land Use Conditions” reinforce the concentration of city-planning tasks while neutralize the role of land owners; changes in the role of municipal government in terms of reducing road expansion and parking space construction will improve the “Conditions for Restricting Automobile Ownership and Use” for an effective TOD while not impact on other parameter scores; changes on the role of municipal government in the “Transport Service Conditions” reinforce the role of transport infrastructure providers and the concentration of urban transport planning and operation tasks, but work at cross-purposes with the level of competition in contractor selection for transport service delivery; and finally changes in the role of municipal government in the “Real Estate Market Conditions” reinforce the importance of legal procedures in real estate market management and subsequently mitigate the role of real estate developers. Such a branching process of this ordering-fast parameter, therefore, leads to changes in ordering-slow parameters, enslaved-fast parameters and enslaved-slow parameters, and creates a more favorable environment for the realization of TOD.

### **8.5.2 Branching “the criteria of cadre evaluation”**

“The criteria of cadre evaluation” is another ordering-fast parameter which we can use as an entry point. From table 8.2 we know that this parameter has effect on the “Governance Conditions” for an effective TOD. The process through which it is branched is shown in figure 8.2.

The economic indicators will remain necessary and still stay important in evaluating the performance of a local leading official, while indicators associated with urban environmental quality should be added to the criteria. Currently, China’s official channel to publish and to rank individual city’s achievement is the State Statistical Yearbook. Very often, the Yearbook becomes the source to prove the most competitive cities in China and informally indicates the performance of the leading officials of those

cities. However, in the Yearbook, a city's achievement is largely measured in economic terms with clear indicators such as GDP, GDP per capita, FDI and export and import amount, etc., while little attention is put on urban environmental status. Therefore, we propose that the criteria of cadre evaluation should include urban environmental indicators and the values of these indicators should be officially published in the national Yearbook.

Although scientific research reveals that there is no generally accepted framework to measure and properly evaluate aspects of, and trends in, urban environmental quality, apparently, many indicators are still conceivable, including some macro-level indicators such as city livability or quality of place, i.e. the quality of the living environment, whose measurement is based on residents survey, and some micro-level ones such as urban industrial emissions, urban traffic emissions, urban air quality, urban road traffic noise pollution, area of plant, and local budget for controlling environmental pollution, whose measurement is based on technical monitoring and recording. With these environmental indicators the local economic record that has been achieved during the leadership of an official could be offset by the environmental degradation caused by the realization of economic projects. In so doing the GDP record will be transformed into a green GDP figure.

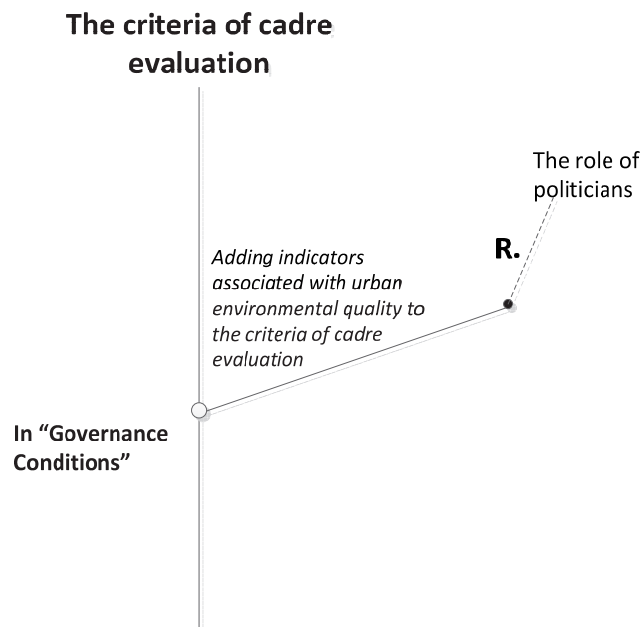


Figure 8.2 Branching the criteria of cadre evaluation

Changes in the criteria of cadre evaluation toward more environmentally friendly would almost promptly lead to changes on the role of politicians as well as their behavior. Considering the assumption that the politicians are political climbers who

seek to maximize their own power, income and prestige, the basic way they can pursue this ambition is to satisfy the criteria of cadre evaluation and then to be promoted to a higher rank within the government hierarchy. Adding environmental indicators to the criteria will reinforce the role of the politician in the “Governance Conditions” for TOD, because the leading officials are doomed to give environmentally friendly projects a higher priority in government action and on the policy agenda, and to change urban policies that are more favorable for urban transit development. In this way, the new criteria for cadre evaluation will foster a long-term view of the politicians to invest and to develop the urban area.

### **8.5.3 Branching “the role of politicians”**

Changes in the criteria of cadre evaluation will bring changes to the role of politicians, but this branching process focuses on shifting politicians’ personal motivation in the processes of making urban policies and launching urban projects towards more environment-friendly. More intention to change the role of politicians focuses on enhancing pluralism in urban planning and policy-making. With the emphasis on who has the right to participate and how they participate in the urban policy-making process, pluralism stresses the importance of widespread political participation and holds that decision-making power is dispersed among a wide variety of social groups and authorities. Therefore, it ascribes its effectiveness of influencing the score of “the role of politicians” to the existence of channels whereby social groups and citizens are able to control their political leaders and thus to shape the process of urban policy-making. The branching process of “the role of politicians” is illustrated in figure 8.3.

Currently, the politicians are “strong arm” of the regulating power of urban societies, which is constituted by a small number of “governing elites” in an urban area, performing political functions, controlling significant resources, monopolizing power and enjoying the benefits that power brings. As normally practiced today, the top politicians of a city exert power in almost every stage of the decision-making process. One day they decide and initiate plans, for example to demolish certain old residential buildings; to build high-rises in certain areas of the city; to develop industrial parks; to build rapid transit lines; and to widen urban expressways. The next day they are the commanders who can compel the policy analysts to manipulate the analytical information and to generate policy options that are favorable for their proposed projects. The third day they either become the leading members of the city’s planning department or use personal networks to approve the plans they have made yesterday. Therefore, in fact they approve their own plans that later become the tasks to be implemented by the municipal governments under their leadership. All these take place under the same physical individuals. And this situation makes the politicians authoritative. The fundamental reason for this, however, is that there is no urban planning council that promotes pluralism of decision-making.

To build up the planning council, an independent working group should be formed by incorporating people who are professionals and experts specializing in both law and urban planning; standards and procedures should be formulated in local legislation as to what plans can be approved; and planning courts are to be created at different spatial levels so that there is a planning court for neighborhood planning affairs, and a planning court for planning matters in the city. As a result, the function of the council is to evaluate, approve and reject plans proposed by any of the social groups and organizations that operation in the city like citizen association, private and state-owned enterprises, planners from various urban planning departments and bureaus, and even the individual politicians. Once their plans are in conformity with the pre-established standards, they are able to obtain the approvals and implement their plans. In doing so, any social groups who intend to take action that might change the city's configuration have to apply for approvals from the planning courts. Consequently, if well enforced, the planning council creates an environment where planning flows come from a variety of different sources and only the best plans can be appropriated with resources such as land. In this way, the political struggle and power play can be reconciled with the need for long-term, sustainability-oriented considerations.

### The role of politicians

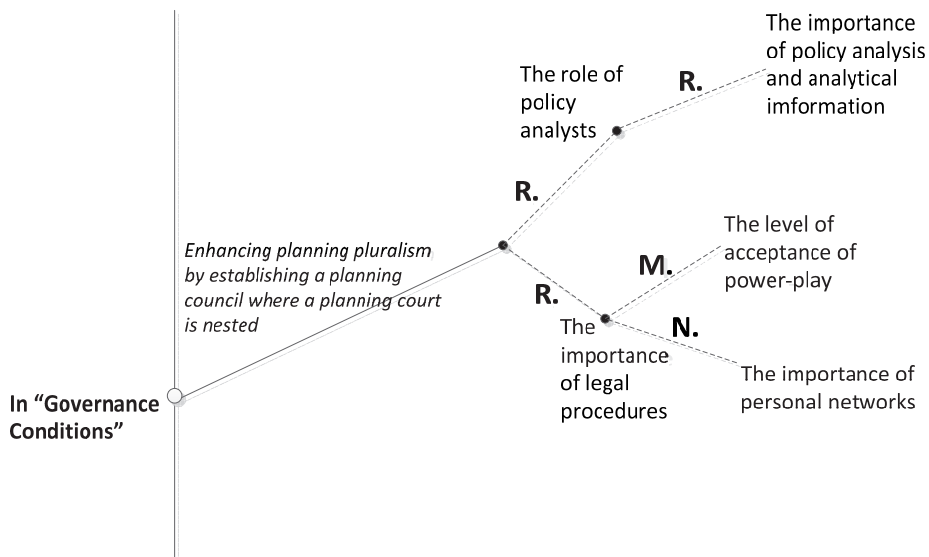


Figure 8.3 Branching the role of politicians

If the above changes could take place in the role of politicians, then they are able to branch out and bring changes to many other parameters. The establishment of the urban planning council can reinforce the importance of legal procedures because more explicit standards and procedures would be enacted to evaluate the plans from various social groups. Concurrently, it reinforces the role of policy analysts because it is the



professionals and experts that constitute for the members of the council, and it is very likely that these professionals and experts are also policy analysts and advisers. Furthermore, the enhancement in the role of policy analysts would automatically reinforce the importance of policy analysis and analytical information in public policy-making. And the improvement on the importance of legal procedures, apparently, would neutralize the importance of personal networks because when formal way of decision-making is facilitated, the informal way would be somewhat replaced. In addition, once the importance of legal procedures is increased, the level of acceptance of power-play would be mitigated. Although we realize that these branched parameters are largely enslaved-slow ones, which means they adapt slowly, constant endeavor on enforcing the planning council would still take effect on them and subsequently create a condition conducive for TOD.

#### **8.5.4 Branching “the role of real estate developers”**

The last but not least parameter that should be picked up to influence is the role of real estate developers. To influence this parameter has to shift the real estate developers’ role toward carrying more social sustainability responsibilities through enacting real estate market regulations in local legislation. The branching process is shown in figure 8.4.

The real estate developers can be considered a relatively new actor in the Chinese urban society, emerging promptly after China’s economic reforms and the broken of the *Danwei* scheme. The rise of the real estate market is so speedy that they have become the main pillar of the local economy. However, management regulations on the real estate market have lagged far behind. That is the fundamental reason leading to the rapidly rising housing price and thus the concerns about urban housing affordability, given that the developers are all profit maximizers.

To develop real estate market regulation, three aspects are important, and the realization of which would create favorable conditions for the implementation of TOD. First, the local legislation should stipulate that the private housing developers could be granted with land use rights only if their plans for residential neighborhoods reflect mixed types of houses. In other words, they cannot only build houses that are of low density, large and luxury and only aim at the rich as potential buyers. Within the same community to be developed, they also have to build houses, or apartments, that are of high density, small and affordable for low-income households. In doing so the private housing developers would carry more social responsibility not only in housing affordability but also in terms of social inclusion and cohesion.

Second, the local legislation on the management of real estate market also has to articulate that the developers should develop accessory facilities and services along with the real estate projects, such as small shopping malls, grocery stores, restaurants, public space, playing ground, etc. That means, not all the houses in the real estate

projects are for residential purposes; a small number of houses that are on the ground level and with entrances at the roadside can be used for commercial purposes. In this way, it creates a diversity of land use within the community. Consequently, the real estate developers would carry some responsibility of improving the diversity of urban land use in small areas.

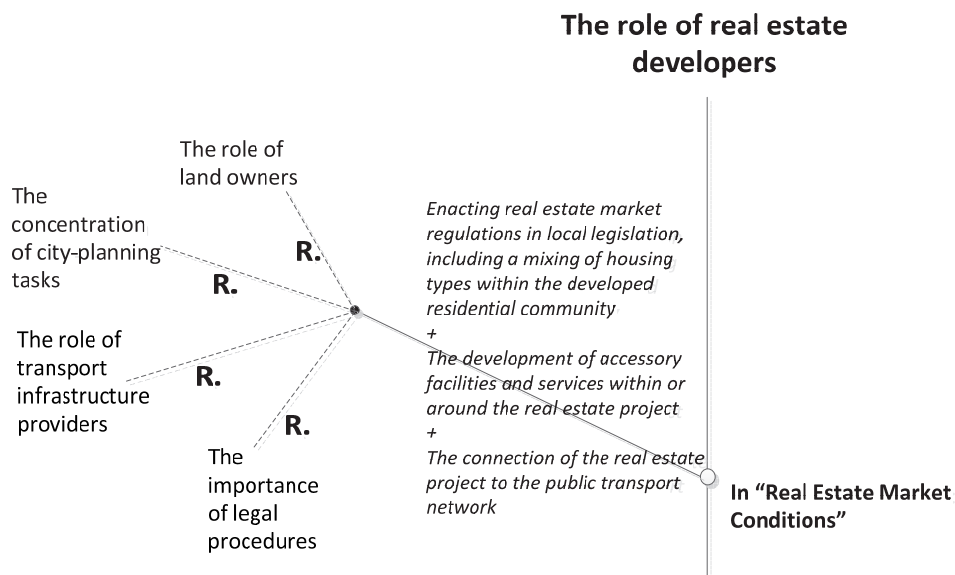


Figure 8.4 Branching the role of real estate developers

Third, the local legislation needs to consider the role of the real estate developers in safeguarding the mobility of residents. It should stipulate that the housing developers have to connect their real estate projects to the public transport network either by providing physical transit feeder services or by negotiating with local transport providers on the expansion of service routes to the real estate projects. Put bluntly, the realization of any real estate project has to make the public transport connections ready for service. In addition, sometimes it also aims at focusing the power of real estate companies to meet wider sustainable transport investments. For those real estate companies that invest around transit stations, partial financing responsibility for the transit infrastructure will be transferred accompanied with granting the station area land.

As can be seen from figure 8.4, changes in the role of real estate developers would bring changes in other four parameters, some ordering-slow, some enslaved-fast and some enslaved-slow. Apparently, the improvements in the local legislation in the management of real estate market would reinforce the parameter "the importance of legal procedures". Specifically, the wider social responsibilities that the private real estate companies should take, including the mixed housing types, the diverse land use

in the communities and the connection of the housing projects to public transport, would certainly strengthen the role of the land owner, the concentration of city-planning tasks and the role of transport infrastructure providers. All these endeavors will enhance the “Land Use Conditions” and the “Transport Service Conditions” for effective TOD.

## 8.6. Conclusions

To conclude, this chapter aims to plan TOD in Chinese cities based on the empirical evidence in the previous chapters. Concerning the issue whether deliberate intervention can work out in complex and self-organizing cities, we recap the theoretical assumption “cities as complex systems”. We argue that artificial design for TOD in complex urban systems is possible, but its possibilities are quite limited. Large-scale design is only possible during urban turbulence, while incremental and marginal changes can take place by carefully picking up right system elements to influence and at right moments. Therefore, it is possible for us to argue that TOD can be facilitated if the city’s fulfillment on the TOD conditions can be improved through changing the right parameter scores.

Building upon the empirical evidence, we observe that the city’s actor-system parameters function in two dimensions. The ordering-enslaved dimension entails that some parameters play decisive and dominant roles in shaping urban configuration while others are enslaved and weak in determining the urban appearance. The fast-slow dimension measures the time needed for the parameters to change: fast ones are able to promptly adapt their scores whenever needed while slow ones always take a very long time to grow and develop. The two dimensions provide us with four types of parameters (i.e. the ordering-fast, the ordering-slow, the enslaved-fast and the enslaved-slow) and apparently the ordering-fast parameters are the right ones for us to pick up and to influence because they have both dominant and prompt roles in the operation of cities. They include the role of municipal governments, the role of politicians, the criteria of cadre evaluation and the role of real estate developers.

Therefore, this enables us to know which parameters are the right ones to exert influence for the facilitation of TOD. Through putting forward possible changes on these ordering-fast parameters, we found that their changes will bring about changes in other types of parameters. This is a branching process. For instance, changes in the role of municipal governments with a subsidy mechanism and an independent coordination authority would reinforce the role of transport infrastructure providers and the concentration of urban transport planning and operation tasks, but the role of municipal government still works at cross-purposes with the level of competition of contractor selection for transport service delivery. Changes on the criteria of cadre evaluation with indicators of urban environmental quality would branch out and bring

changes to the role of politician in promoting environmentally friendly projects. Changes in the role of politicians by enhancing planning pluralism through establishing a planning council would reinforce the role of policy analysts and the importance of legal procedures, the improvements of which would further lead to changes on other parameters: the importance of policy analysis and analytical information would be reinforced; the level of acceptance of power-play would be mitigated; and the importance of personal networks would be neutralized. Finally, changes on the role of real estate developers toward carrying wider social sustainable responsibilities would reinforce other four parameters, including the role of transport infrastructure providers, the concentration of city-planning tasks, the role of land owners and the importance of legal procedures. As can be seen, all these changes on the ordering-fast parameters and their branching processes will lead to a better urban environment that facilitates the fulfillment of the TOD conditions.

# 9. Conclusions and Reflections

## 9.1. Introduction

Chinese cities have been with us for more than a hundred years. This is true, of course, if we do not consider some early, premature, appearances such as archaic towns and villages in ancient times. How to deal with these partly fascinating and partly frightening creatures of mankind, both intellectually and practically, concerns all of us and in particular presents a real challenge to city planners and policy-makers. Each historical period has its own particular “Zeitgeist” associated with urban construction and development. Accordingly, the planning of cities is based on different criteria and methods. But in spite of these differences, urbanism is still at the center of our life and a growing concern is whether or not cities can be planned when they grow into complex systems and self-organizing socio-spatial entities. In line with this debate, we posed our main research question “can TOD be planned in Chinese cities?” in the introduction of this book. After a long journey, guided by several sub-research questions, it is time to synthesize our results and present the answers to the research questions. What did we discover? What did we learn? And what did we create? In this concluding chapter, section 9.2 systematically answers the research questions. Section 9.3 conjures up a vision of the future urban development in Dalian if the parameter scores indeed changed in line with the recommendations proposed in the previous chapter. Finally, section 9.4 presents the research limitations and future research agenda.

## 9.2. Answering Questions

To answer the main research question, we put forward four sub-questions. The first and the second revolve around the theoretical issues of understanding complex urban systems and establishing the preconditions for effective TOD. Based on our theoretical framework, the third sub-question centers the research on the exploration of an empirical case. According to the empirical data the last sub-question focuses on searching for an approach as to how TOD can be planned in complex urban systems.

- (1) *How can cities be understood? Can a conceptual framework be sketched to depict cities? If yes, what parameters fall into such a conceptual model? And how to explore the scores of the city parameters in practice?*

Cities can be understood as complex systems which contain numerous subsystems and components, constantly interacting, changing and synergistically generating an urban configuration (Hayek 1949; Jacobs 1961; Berry 1964; Alexander 1966; Forrester 1969; Chadwick 1971; Allen and Sanglier 1981; Allen, Engelen et al. 1986; Allen 1996; Weidlich 1999; Portugali 2000; Batty 2005; Batty 2012). To reveal a city's configuration, the city can be simulated through a conceptual model. The model does not necessarily reflect every component of the city, but can focus on one sector of the city such as urban transport in our case. In line with this thought, a conceptual model was built up to depict the urban transport sector in Chinese cities. This model has four subsystems, including *the natural subsystem* that depicts a city's naturally endowed conditions, *the physical subsystem* that depicts a city's built environment, architecture, landscape, infrastructures and technologies, *the social subsystem* that depicts a city's zeitgeist related to urban transport, the wider economic and demographic situations, and *the actor subsystem* that depicts a city's multitude of actors and institutions gluing the actors together and guiding their interactions. The subsystems are measured by 36 city parameters in total. These parameters serve different functions in revealing complex cities. Parameters from the natural, physical and social subsystems mainly presenting the wider context of an urban area can be taken for granted, while parameters from the actor subsystem are the ones that urban planners and policy-makers should aim to influence.

To obtain the score of the actor-network parameters in practice, the three decision-making perspectives have been useful. One is the policy analyst perspective, which views urban planning and decision-making as a process of rational calculation and comparison and as a result of scientific forecasting on the future trends. The second is the legal perspective, which explores the existence of legal provisions and regulatory policies and examines their compliance in practical implementation, i.e. the disparities between the statutory procedures and the practical operation. The third, the political perspective, focuses on the issue of power-play in public decision-making and holds the idea of urban planning and construction being a political and power struggling process. The three perspectives, even though not covering everything such as the psychological perspective of decision-making, are additional to reveal the facts taking place in public policy-making among a multitude of actors.

(2) *What is TOD? What are the good and bad experiences with TOD around the world? What are the preconditions for successful TOD according to the worldwide experience and the academic literature?*

TOD has emerged as one possible solution for sustainable urban transport, with supporters claiming that it can help reshape the quality and form of urban growth towards enhanced accessibility and mobility, pedestrian friendliness, increased sustainability and potentially a higher degree of human interaction. By definition, a TOD community (or neighborhood) means creating a pedestrian-friendly built



environment, in which the centrally located rail or bus stations are surrounded by relatively high-density and mix-used commercial and residential developments. TOD communities are generally located within a radius of about 400-800 m from a transit stop, as this is considered to be an appropriate scale for pedestrians. A TOD city refers to the built urban forms that are composed by numerous TOD communities built on the transit line. In other words, it is a model of promoting transit through integrating traffic with urban land use. However, it is not equated with a region where transit largely replaces the private automobile or even captures the majority of motorized trips. Rather, the transit-oriented metropolis represents a mobility environment where public transport is a much more respectable alternative to automobile travel; enough travelers opt for transit riding in spite of continued automobile dominance.

What factors constitute effective TOD? Numerous academic works and government documents that record and analyze the experiences and lessons of implementing TOD worldwide in urban and suburban areas emphasize a variety of influential factors for its effective implementation. Among these factors, urban design (including architecture aesthetics, public space and pedestrian friendliness), governance (including transport service coordination and pro-active town planning), land use (including factors such as density and diversity), strategies on restricting automobile use (for instance, congestion pricing and parking restriction), transit service quality and management of the real estate market rank high as essential TOD preconditions. Literature from which these factors can be distilled include: Cervero (1998); Vuchic (1999); Crawford (2000); Dittmar and Poticha (2004); Wright (2005); Newman and Jennings (2008); Renne (2009); Queensland Government (2010). Furthermore, these preconditions can be distinguished in critical conditions and important conditions. Such a distinction allows us to think further: if there must be a sequence in satisfying these conditions in the process of adopting the TOD policy because of resource limitations and/or urban specific contexts, which conditions should be given priority? And can TOD work in a reasonable way if some of the important conditions are not fulfilled?

**(3) *What do the current scores of the city parameters look like in the Chinese city of Dalian that has officially adopted TOD and historically has the modal split most favorable for public transport in all of China?***

Dalian's given context shows a mixed picture in facilitating TOD. Its natural system with mountainous landforms makes the utilizable land area only account for 20% of the total area and consequently requires dense, well-planned and efficient land use. In addition, its natural system which shows karst and sea erosion topography makes the utilization of the underground space technically difficult and risky. Its physical system is relatively propitious in terms of transport networks and cityscape, which gives strength to the prospect of developing TOD. Concerning the transport networks, Dalian basically has extensive and multi-modal transport infrastructures: the first and the widest expressway of China linking Dalian to the capital city of the province, a large

network of urban fast roads, the most important and busiest international container port, the high-speed rail line connecting Dalian with the most northern city, Harbin, and generally the high capacity and coverage of the urban bus network and the rapid development of the urban rail transits. Regarding the city's architecture, landscape and civic facilities, most of today's downtown area and the port area were developed and heavily fortified in foreign architectural styles, including Russia's classical and baroque buildings and cobweb fashioned street network and the traditional buildings of Japan with Meiji and Colonial architectural characteristics. Nowadays, this interesting and attractive legacy has been preserved and well maintained. Moreover, since 1990s, the city benefits a lot from modern construction. Among other things, the city banned motorcycles, built large areas for walking paths, emphasized urban greening, created large, lush parks in many traffic circles and generally built very attractive architecture.

With the gradual decentralization of fiscal administration during the reform period, Dalian's social system has undergone significant transformation. It used to be an area where people were frugal; citizens lived in houses provided by *Danwei*, which were cheap, small but enough to dwell; traffic demand was low; travel distance was short; the mobility pattern was dominated by public transport; and one rarely saw automobiles on the road. Since the economic reforms, Dalian has enjoyed continuous GDP growth and an increase in the level of personal/household disposable income. Concurrently, Dalian experiences a rapid urbanization process with respect to land sprawl and rural-urban population migration. Under economic liberalization, the *Danwei* scheme of housing provision was broken down and replaced by private real estate developers. Since then, the issue of housing affordability has been under threat. Instead of purchasing houses that are close to transit services and expensive, most people's attitude is more prone to own cars and to live in houses that are on the edge of the town, quiet, large and relatively cheap. This leads to the centrifugal movement of people and the rapid motorization process, and gives rise to the shift of urban traffic patterns toward car-dependence. Therefore, although there were days, not long ago, when Dalian had a good record in public transit use, nowadays, this good tradition is deteriorating. Travel distance is much longer than before; the dependence on private cars is intensifying; and modal split in public transport is rapidly eroding.

Dalian's actor system does not show a bright prospect for TOD. From the policy analyst perspective, the role of policy analysts and the importance of policy analysis in public decision-making are both weak and much less influential than the role of politicians. Several reasons account for this fact. First, the legacy from the central planning economic period of China when a national elite decision-making model prevailed while a scientific- and technical-based decision-making model was of little interest or awareness has made the policy analysts especially in the field of urban studies insignificant until recently. Even though after the economic reforms a few research centers and organizations at universities were founded for urban transport studies along with the growing complexity of urban transport, their role is weak for the reason

that they are still at the early phase of the learning curve of transport engineering and analytical skills and tools for transport policy-making. They are less influential also because the policy analysts have remained distant from the stage where decisions are finally taken and these organizations where experts and professionals work are semi-governmental organizations heavily dependent on government funds. As a result, in the analysis process, they dutifully assume the preferences of the government, or say, the leading officials. In addition, the policy analysts are acutely aware of the fact that their advice only plays a tiny role in the forthcoming government decisions and actions, so in most circumstances they are reluctant to put much effort into analysis. Therefore, it is unsurprising that they always generate policy options in a self-effacing and modest way.

From the legal perspective, although China's legislation in promoting sustainable transport has made impressive progress, there are still flaws concerning the facilitation of land use diversity and the space reserved in legislation for urban transit remains low. In addition, in many circumstances the great national expectations have been dashed locally. There were disparities between law and reality. By examining the scores of the city parameters such as the concentration of city-planning tasks, the concentration of urban transport planning and operation tasks and the level of competition in contractor selection for transport service delivery, we found that the national legal prescriptions concerning the co-planning and coordination of urban land use and urban transport indeed materialize in Dalian if we consider the city's planning practice in the station catchment areas from uncoordinated to a more integrated and consistent program, i.e. the co-development of rail-based urban communities and new neighborhoods and the light rail system as an example of this. However, if we look at the delivery process of public transport services, the legal prescriptions play a weak role. The service provider is selected based on direct appointment without open tenders; the overall service qualities do not reach the quality levels articulated in the operation ordinances; and the reality of appropriating large land areas for constructing more parking space essentially goes against the legally prescribed transit first principles and is detrimental to the improvement of modal split for public transport. Therefore, we can conclude that the importance of legal procedures in influencing urban planning and decision-making shows a bleak picture for TOD.

From the political perspective, we examined how the Chinese politics works at national and local levels of public decision-making. By unfolding the political structure at the local level, we witnessed a shifting pattern of urban politics from egalitarianism to autarky in terms of resource allocation and public budget appropriation among cities. Such fiscal decentralization has given unprecedented room and freedom to the local leading officials to use the public money and to determine the city's development mode. As a result, the local politicians are playing a dominant role in urban planning and policy-making. They hold tremendous influential power in initiating a particular policy and affording that policy with the highest priority in the government agenda. However, what determines their mental process when the politicians compare and choose from a

variety of options? Why do the local politicians nowadays only have interest in projects that are able to bring the city remarkable economic benefits while ignoring those that are weaker in facilitating economic growth but more environment-friendly? Here, the criteria of cadre evaluation enter, which put great emphasis on the achievement of local economic growth, and which automatically encourage local politicians to take pro-growth decisions and projects that can add more weight to their political performance. Given the large number of administrative jurisdictions (e.g. cities and towns) in China and thus the serious competition among the local leaders if they attempt to climb to higher positions in the hierarchy, the local leading officials have to distinguish themselves by building up magnificent political records. Under such a political constellation, it is not surprising to see the emergence of numerous political prestige projects in urban areas. A lack of effective monitoring to detect the motives of the politicians for initiating large urban projects leads to a flood of prestige projects. Another factor breeding political achievement projects is that some political players are able to mobilize project funding. Here, the investors, in case of China the large state-owned banks instead of private investors, come into play, carrying out a role of providing the projects with loans simply based on a government guarantee signed by the city leader. However, it is surprising to find that some prestige projects are still successful if we look at their performance in operation and levels of public demand. To empirically examine the reasons by comparing two prestige projects in Dalian, one a success and another a failure, we discover that in addition to the politicians' personality characters such as far-sightedness, intelligent and boldness, their personal networks can play a supporting role in mediating/informally coordinating between authorities and thus pushing the projects to move forward.

Having exposed the actor subsystem through three perspectives, we realized that neither the policy analysis nor the legal procedures are the real determinants of an urban policy or program. The incentives behind urban decision-making stem from political struggles and power-play. Although efforts have been made to improve the quality of policy analysis and the reliability of the analysts, although progress can be noted in enhancing the legal framework, policy decisions are largely made by the real holders of power. As a result, the quality of the decision will heavily depend on the quality and personality of the powerful politician. This fact gives a bleak prospect for the realization of TOD.

*(4) What lessons can be drawn from Dalian's parameter scores? Can we develop a new approach with respect to planning TOD in complex urban systems?*

By recapping our theoretical framework that understands cities as complex systems, we knew that design possibilities in complex systems are quite limited. It is only possible for urban planners and decision-makers to intervene in the systems by influencing actor-network parameter scores while taking parameters from the other three systems as given. However, it is impossible for decision-makers to change all the actor-network

parameter scores at a time because of man's limited rationality to clarify and compare alternative policies beforehand, limited resources to initiate fundamental changes, and the high probability for the exhaustive policy to cause conflicts among the existing consensus. It is only possible to stimulate TOD through changing scores of a few right parameters. And the changes in the right parameter scores will branch out and bring about changes in other parameters. Therefore, the essence of this branching process is to find out what actor-network parameters are the right ones to pick up and how their changes impact on others.

According to the empirical scores of the actor-network parameters, it was visible that the parameters operate along two dimensions. One is the ordering-enlaved dimension, where a few parameters play dominant and decisive roles in shaping the urban structure, while other parameters are comparatively weaker in determining the urban configuration. We can describe such relations among parameters by the *enslavement principle*. It enables the urban system to generate reproducible relations among its numerous components by enslaving their motions. This is a process of reproduction and this is the reason that the urban system is able to stay stable for a period of time and to be capable of withstanding some internal and external disturbances.

Apart from the ordering-enlaved dimension, we recognized that the parameters perform with different capacities to adapt. It is the fast-slow dimension that measures the speed of change of the parameters. Fast parameters are sensitive and able to adapt their statuses/scores rapidly in response to changes happening in other parameters or systematic changes such as urban turbulence. For fast parameters, we recognize that their influential power in shaping urban development, no matter strong or weak, is prompt. At the other end we find the slow parameters. These slow ones require a much longer time to adapt. They are not very sensitive to changes of other system parameters or the system's whole movement. Therefore, it is quite possible for the slow parameters to keep the same scores for a long time, and their impact tends to be slow and sluggish.

The two dimensions typify the parameters into four classifications (figure 9.1). Type 1 is the ordering-fast parameters. Parameters belonging to this type have decisive power in shaping the pattern of an urban system, and that power is prompt. Type 2 represents the enslaved-fast parameters. Although their impact is prompt, these parameters are enslaved by the ordering parameters and thus have little influence on the appearance of the city. Type 3 is the ordering-slow parameters. Parameters belonging to this type have considerable power in determining the form of an urban system, but their impact comes about slow. Type 4 is the enslaved-slow parameters. Parameters belonging to this type do not have much influential power in forming the urban system, largely being enslaved by the ordering parameters, nor do they have prompt influence. After comparing these parameter types, it becomes clear that the ordering-fast parameters are the most dominant ones to steer urban system and therefore they are the right parameters to be selected as the targeted urban elements to influence.

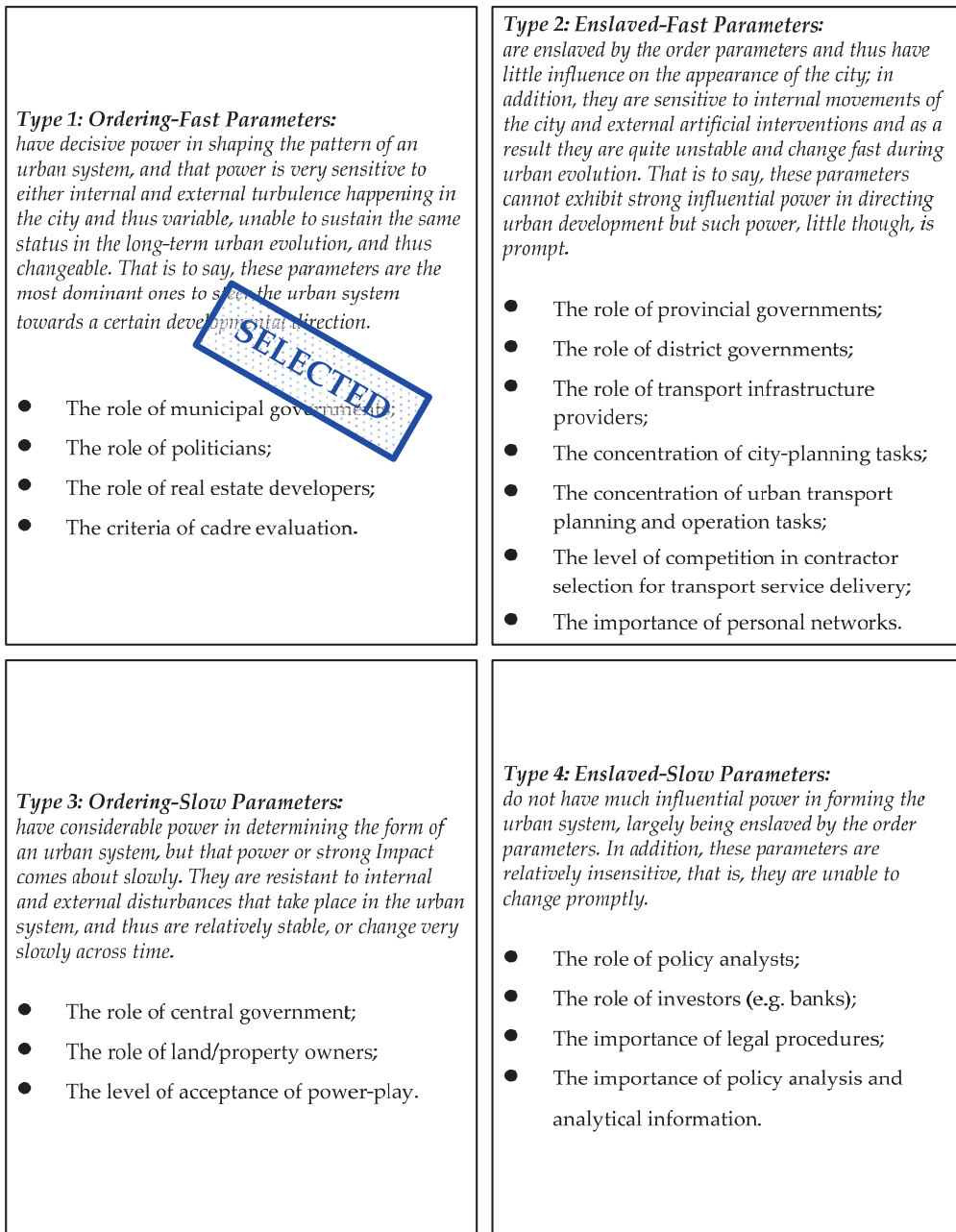


Figure 9.1 Picking up the right parameters

Policy measures are recommended to change their scores, leading to changes in other parameter scores. For instance, changes on the role of the municipal governments with a subsidy mechanism and an independent coordination authority would reinforce the



role of transport infrastructure providers and the concentration of urban transport planning and operation tasks. Changes in the criteria of cadre evaluation with indicators of urban environmental quality would cause changes in the role of politicians toward promoting more environmentally friendly projects. Changes in the role of politicians by enhancing planning pluralism through establishing a planning council would reinforce the role of policy analysts and the importance of legal procedures, the improvements of which would further reinforce the importance of policy analysis and analytical information; however, the level of acceptance of power-play would be mitigated; and the importance of personal networks would be neutralized. Changes in the role of real estate developers toward carrying wider social sustainable responsibilities would concurrently reinforce the role of transport infrastructure providers, the concentration of city-planning tasks, the role of land owners and the importance of legal procedures.

To answer the main research question, “*can TOD be planned in Chinese cities?*”, the answer is yes, but that yes is quite conditional. TOD can only be designed in cities by picking up the right actor-network parameters to influence. The right parameters are the most dominant ones, playing both decisive and prompt roles in shaping urban configurations, and changes in their scores can bring about changes in other parameter scores in the direction favorable for the fulfillment of TOD conditions. In the case of Chinese cities, the right parameters include the role of municipal governments, the role of politicians, the criteria of cadre evaluation and the role of real estate developers.

### 9.3. What if...?

Complex systems have numerous components and countless causal relations between the components. Some of the relations are non-linear. And a multitude of feedback loops may exist among a couple of components. As a consequence, drawing a system-level scenario that depicts a complete picture for the future city and that includes all the parameters as well as their causalities is unrealistic. Even if that is possible, the causal diagram would be too complex to read. For us, having known the four parameters that act as the right entry points for system change, we draw four small-scale scenarios, each focusing on the changes in one of the ordering-fast parameters and watching the changes it brings to the city.

#### (1) ... *the role of municipal government changed*

What would happen if the role of municipal government changed in line with its recommendations we proposed in section 8.5.1? When it comes to planning new projects or making new urban policies, the Dalian municipal government actively communicates both with the Liaoning provincial government at the upper level and with its four district governments at the lower level, no longer monopolizing urban

decisions. For the former, the Dalian government is motivated to obtain administrative affirmation and financial support from the provincial government if its proposed projects are environment-friendly and transit-oriented. For the latter, the Dalian government delivers its draft plan to citizens through the district governments and collects public opinions in order to evaluate whether the new project protects the general public values and interests. Specifically, when it relates to land use plans, the Dalian government is in the best position to lead the planning process and to assist each planning bureau with entitlements to inquire information and data from other bureaus and planning institutes. It creates and sustains the necessary long-term vision for land use by giving land areas with different location advantages varying degrees of acquisition taxes. As a result, Dalian uses the taxation leverage to balance land values across the city. Land outside the downtown area is more attractive than before for private developers, state-owned enterprises and large organizations. Underdeveloped land is rebuilt; key infrastructures and place-making amenities follow; and traffic flows are redistributed and no longer concentrate in the urban center.

The Dalian government does not implement any restricting policies on automobile ownership and usage, but it slows down the expansion of urban expressways and stops investing in parking space. People can own cars but they are less incentivized to drive because they suffer from severe road congestion and the unavailability of parking lots. The local budget saved from cutting down road investment and parking space construction is then used for subsidizing public transport. Whenever the monetary subsidies are inadequate for the profitability of the operators, the municipal government grants land using rights to the transit operation companies. The land is usually adjacent to the terminals of public transport. Once the operation companies own the land near to their terminal stations, they view joint development as a way to increase ridership; they carefully conduct station area planning with diverse land functions; and they generate revenues from leasing land to retailers. The operation companies also help plan at the system-wide scale and think at the urban level about the interplay between land uses around stations and how this affects transit ridership. However, based on the standard code of service quality, the municipal government has to conduct quality assessments periodically. If the service qualities are not safeguarded, the municipal government substantially reduces subsidies and puts penalties on transit operators.

Dalian's 13 transit operators are coordinated by an independent authority established by the municipal government. In concert with DPTOG which is the parent company of the transit operators, this authority develops monthly or quarterly coordination plans, aims at sharing information among the operators, and provides passengers with adequate information regarding the urban transit network, its services, routes, schedules and fares. These plans include specific project proposals, a financial summary and an overall work program, including staffing requirements, operators' responsibilities and a schedule for implementation. Objectives include identifying opportunities for enhancing efficiency and effectiveness of services through providing

accurate information at all transfer points and developing a coordinated outreach program to promote transit awareness. Other coordination activities concern intelligent transit services. All transit operators are provided with technical equipment and assistance to solve problems of inter-operator transfers. Baseline data on inter-operator transfer volumes is gathered and established to identify locations most in need of improvement; and transfer points are recorded and a list of places in priority is created for future improvement in urban transit route coordination. Although some coordination might be technically difficult, some have considerable political factors attached, the general picture that emerges is one of a continuing incremental advance toward a better coordinated multi-operator transit system, where problems, as they are identified and given priority, are placed on an agenda for resolution.

(2) *... the criteria of cadre evaluation changed*

If the criteria of cadre evaluation were indeed changed by seriously stressing urban environmental qualities and incorporating the environmental quality indicators we indicated in section 8.5.2, what would happen to the leading official of the city, say, the mayor, and how we can predict his behavior in urban planning and decision-making? As an economically powerful city of Liaoning province with a large population, Dalian has earned its economic growth to some extent at the cost of environmental quality during the past two to three decades. Previous policies and projects promoted by the mayors were economically-oriented without taking enough environmental concern into account and consequently sped up the environmental degeneration of Dalian. Facing changes on the cadre evaluation criteria, the mayor realizes the importance of urban environment in evaluating his performance and pays greater attention to improving urban environmental quality.

The mayor carries out urban planning and decision-making toward sustainable development through locally legislating China's Strategic Environmental Assessment (SEA). SEA is a decision support tool to predict and evaluate the potential environmental impact of policies, plans and programs promulgated by regional and local governments and to provide measures to avoid, mitigate or compensate for their impacts. The mayor knew SEA since China officially enacted the Environmental Impact Assessment Law (EIA Law) in 2003 at the national level, but he never adopted SEA because it would significantly obstruct projects that produce abundant economic benefits while bringing about considerable environmental deterioration. Along with the introduction of the new cadre evaluation criteria, SEA is adopted by the mayor and employed as a systematic and comprehensive decision-aiding tool for integrating the consideration of potential environment impact of proposed urban projects so as to better achieve the environmental indicators.

The mayor establishes several SEA goals: to formulate appropriate indicators to apply in the early baseline setting stage; to find out suitable methodologies for the impact assessment, to identify the task team for assessment; and to figure out appropriate

procedures of the SEA process. First, the mayor adds those environmental indicators from the cadre evaluation criteria into the SEA indicators, such as urban air quality, urban industrial emissions, urban traffic emissions, up-to-standard rate of urban noise, energy efficiency of industry, energy efficiency of urban transport and the efficiency of land use. Apart from these environmental indicators, the mayor also has to retain some economic indicators, such as the tax of industrial value-added, GDP growth rate, GDP per capita, the proportion of value-added of high-tech industries, population growth rate and employment rate. Given this, the mayor employs a number of actuaries to precisely calculate economic contributions versus environmental costs of a project, a policy or an external investment. The calculation would be more accurate and not be rigged because the leader himself likes to be very sure about the environmental costs since it matters much to his governance reputation, prestige and political achievement. Given the calculation results, generally the mayor only promotes those programs that generate the maximum economic results at the minimum expense of environmental impact. Specifically, the mayor enhances the transformation of the industrial structure from traditionally resource and pollution intensive to knowledge and technology intensive, whereby only high-tech and high value-added industries and investments are vigorously encouraged and introduced in to the city as economic contributors; as for the urban transport sector, the mayor promotes to optimize the existing urban road network to achieve a higher efficiency rather than widening it. He puts constraints on road investment because he knows that road transport has adverse effects on energy consumption, air pollution, CO<sub>2</sub> emissions, road accidents, land take and noise pollution, all of which contribute negatively to his performance records. Instead, the mayor facilitates public transport; initiates rail transit projects; favors rapid bus lines; and pays much attention to efficient land use. He also promotes green vehicles, firstly adopted by public transport operation companies and governmental organizations, latterly employed by large enterprises and individual drivers with tax preferential policies.

### *(3) ... the role of politicians changed*

The role of politicians is changed toward promoting more transit-oriented projects in urban areas along with the change on their evaluation criteria. What would the city look like if the dominant role of politicians in urban planning and decision-making was weakened by giving more participatory space and decision-making power to other types of actors?

If a planning council as we described in section 8.5.3 was established in Dalian, there is a general planning court at the municipal level and four subordinate planning courts for each district. Professionals and experts both in law and in city planning, who constitute the planning council, have formulated urban zoning laws and land use standards in the local legislation. These laws and standards promote both diverse and dense land use patterns, and facilitate a transit-oriented urban development. Given this,

the planning court at the municipal level takes the responsibility of evaluating, approving or rejecting the urban master plan compiled by the municipal government. This urban master plan no longer contains district plans or detailed urban construction plans, while it only focuses on the overall urban development direction and objectives within five to ten years. If the general objectives are in accordance with established rules, the court approves the master plan and hands over the plan to its district planning courts. Each district planning court, therefore, opens to receive proposals for detailed urban construction projects, evaluates whether the project plans conform to the general legislation and also the master plan, and approves/rejects.

A variety of people and organizations, including government departments, state-owned and private enterprises, business owners, transit operation companies, urban planning institutes as well as individual politicians, are able to submit their construction projects, plans or programs. They have equal power in forming a partial urban configuration. There would be competition among the applicants in terms of acquiring resources because the plans come from a multitude of flows. For instance, several applicants may aim at the same piece of land. In this case the planning court has to judge the realization of which projects would bring the city with most strength and prospect in achieving its master plan objectives. It is also possible that land lies idle and the planning court is waiting for good proposals. The politicians do not dominate the planning process any more, and their plans also have to undergo the evaluation of the planning court. The legal procedures become more important; analysts, experts and professionals play an important role in the assessment of the proposals; the effectiveness of power-play and the extensive use of personal network are both substantially reduced.

What consequences does this planning council have on urban transport? Let us imagine what if one of Dalian's transit operation companies submitted a plan of promoting the development of the surrounding areas of transit stations to the planning court, and what if this plan was approved given its objectives of promoting transit ridership? Several small pieces of land around the stations are granted. Granted with the approval, the transit company starts rebuilding the stations along its transit line as both "node" within the larger urban transit network and "place" in its own right. It constructs bay areas for buses loading and unloading passengers at stations; it builds sheds for storing bicycles; it creates safety paths for passengers coming and leaving the stations; it installs amenities; and it also develops small kiosks for snacks and drinks. For some stations where larger areas of land are available, the transit company also builds shopping malls, café and restaurants. Banks, pharmacies and gyms may also reside. The rebuild task is difficult, though. The transit company needs to keep an eye on every aspect of the project, from physical layout and design to project finance. Lenders, such as the banks, are willing to finance such projects because passenger patronage will grow considerably, and the lenders will show greater willingness when the transit company can show support from the nearby residential communities as we will discuss in the following section.

#### *(4) ... the role of real estate developers changed*

What would happen to Dalian if the real estate developers carried more social responsibilities in housing provision and met wider sustainable land use as we proposed in section 8.5.4? In that case, the real estate developers should see themselves as more than house sellers. This requires them to be full participants in the process of creating neighborhoods with long-term value by making plans for the real estate projects that reflect mixed types of houses, mixed uses of land and connections to public transport network.

Most of the city's newly developed residential communities are composed of ten to twenty buildings with diverse housing types: large and luxury houses for the rich or for the large families, a higher density high-rise apartment complex for small families, young couples or singles, commercial houses at the ground level for retailers and service providers, and low-profit affordable houses for those that are eligible as low-income families. Each building of the community is the neighborhood precinct, which is surrounded by a landscaped square, playgrounds, several small shops and one or two eateries. A system of walkways links all the neighborhood precincts within the community. Automobiles are not allowed in the community, while there are separate gates and roads that directly lead cars to the underground parking space. The community also has a laundry, a pharmacy and a gym. It is not only a place full of houses but also a place where house owners can play, chat, find services and recreation. Dwellers are able to meet their basic daily activities within the community, and consequently this significantly reduces the demand for long-distance transport.

The community as a whole is not isolated from the external world. If the community is located far from transit stations, for instance, it takes more than ten minutes for the residents to reach the transit stations by foot, the developers provide residents with minibuses running between the community and the nearest public transport services. However, it is more often for the developers to extensively partner with the existing transit operators. They reach an agreement concerning the extension of the operating routes to the community. In most circumstances, the transit operators show willingness to offer paratransits as feeder services to the main public transport network because they know a livable community full of vitality will add growing ridership to the public transport.

Such communities, therefore, have TOD characteristics: a livable place for residents and a workable area for small businesses and service providers, as well as a location with public transport connections. In these communities, homeowners who may be the most concerned about property values and traffic do not have to worry anymore; low-income people do not have to worry about gentrification; and a chamber of commerce does not have to worry whether retail in the real estate project will compete with existing businesses that are far away from the residents. In the long run, the residents can benefit from having and living in the houses that are parts of vital neighborhoods



and that have high property values. The real estate companies can benefit from these successful projects and earn themselves not only profits but also a high reputation. If Dalian is composed of such TOD-like interlocking communities managed by the real estate developers, the city will automatically become a transit-oriented metropolis.

## 9.4. Research Limitations and Future Agenda

This research aims to understand cities as complex systems; it pries open the complex system with respect to urban transport with 36 parameters; and it intends to plan the city toward the TOD direction through changing scores of a few dominant parameters.

While the research sheds new light on the way leading cities in China to a more transit-oriented and sustainable development direction, it has several limitations. Firstly, as notified in chapter 3, TOD is a normative concept, and its adoption means the development of public transport related infrastructures and facilities gains priorities in public policy and it requires setting the rules conducive to TOD that should be followed by all the relevant actors. However, scholars of public policy may be skeptical on the effectiveness of TOD for the reason that other values (e.g. auto-dependent cities) may exist and really matter in public decision-making and these values should be equally treated. Therefore, if TOD is selected as the targeted policy to be realized, the multitude of actors with diverse values and interests need to make extensive trade-offs. Whenever the actors get together and attempt to make the trade-offs, stalemates are bound to emerge and consensus is hard to achieve. When the actors block each other, nothing can be changed. Consequently, people of public policy consider it a relieve that the system is so complicated and little knowledge is available on how to guide the city. Nevertheless, given the fact that many Chinese local governments aim to development their cities toward the TOD direction to combat urban transport problems and as such, taking the Chinese governments as the client, the intention of this research tries to find out entries of the complex urban systems where changes can happen. To do this, it requires planners and decision-makers to have a greater insight into cities' dynamic, self-organizing and emergent behaviors to gain improved feasibility of directing urban development, rather than to relieve through "do-nothing" approach. It is well recognized that in complex urban systems enacting one policy above everything is very likely to fail. As a result, city planners and decision-makers should look at the policy from the systems level, and find out the right entry points to exert interventions that may be nudging but far-reaching. This is called the branching method of urban evolution in the thesis. The branching method does not require all the actors to learn and to engage into the branching activities, but shows how system changes toward TOD can be generated in complex cities.

In addition, people may have the hesitation as to who set the parameters, or who are able to change the parameter scores in such a way that they are conducive to the

realization of TOD? In our opinion, a complex urban system has many actors and thus successful transit-oriented development projects have many makers. Governments at different layers, its various bureaus and departments, planning and design institutes, research centers, transit operation companies, real estate developers, investors, land owners, and politicians all play a role in shaping the urban configuration and all of them may help bring TOD projects from concept to concrete. All of these actors, not to mention the wider transit riders, automobile owners, neighborhood residents and the public at large, may have a wide range of concerns about what a city or a TOD project in particular should accomplish. For instance, the transit operation companies often come under pressure to maximize their profits, while the municipal government has been thinking of minimizing subsidies. While the municipal government is responsible for affordable housing provision, the real estate developers aim at generating the largest returns for their projects. Automobile owners expect wide road and parking, often free parking, but transit riders like to see safer and landscaped transit stations. Given this, no single actor can completely set the parameters, and all actors have the tendency to behave according to what they perceive as the best for them. Therefore, no one actor or interest can make TOD work by itself. All actors influencing the system are system components and thus inside the system. In order to fulfill its potential, goals and resources of the various actors should be dependably and accountably aligned. And this would be an interesting future research topic that focuses on the multiple and often conflicting roles played by the actors and provides recommendations on how to trade-off their interests so as to reform the policy process and facilitate TOD projects.

Another area of our research limitation lies in Dalian's representativeness of other large Chinese cities and the transferability of the case lessons. We argued that Dalian's empirical data can largely mirror the situation of the large cities in China, and Dalian's lessons can provide significant implications for other cities that intend to implement TOD. However, it is important to realize that there are substantial regional differences in China. Consequently, both composition and scores of the city parameters may vary from city to city. For instance, the largest metropolitan areas near the Southeast coast (Shanghai, Shenzhen and Guangzhou), which can be called more "developed" in public management than Dalian because they are more professional and scientific in generating public policies, may have more favorable scores on the parameters "the role of policy analysts" and "the importance of policy analysis and analytical information" to the realization of TOD. Cities in the central region of China and in the most northern part of China (Chongqing and Harbin, for instance), which contain more political struggles, power-play and corruption rates, may have worse scores than Dalian in the parameters like "the role of politicians", "the level of acceptance of power-play" and "the importance of personal networks". In addition, there might be the situation that in small cities without direct planning and management from the state the parameter "the role of provincial governments" would become an ordering parameter. Such differences, therefore, present a good opportunity for the future research which

revolves around identifying China's regional differences in terms of urban systems and conducting comparative studies.

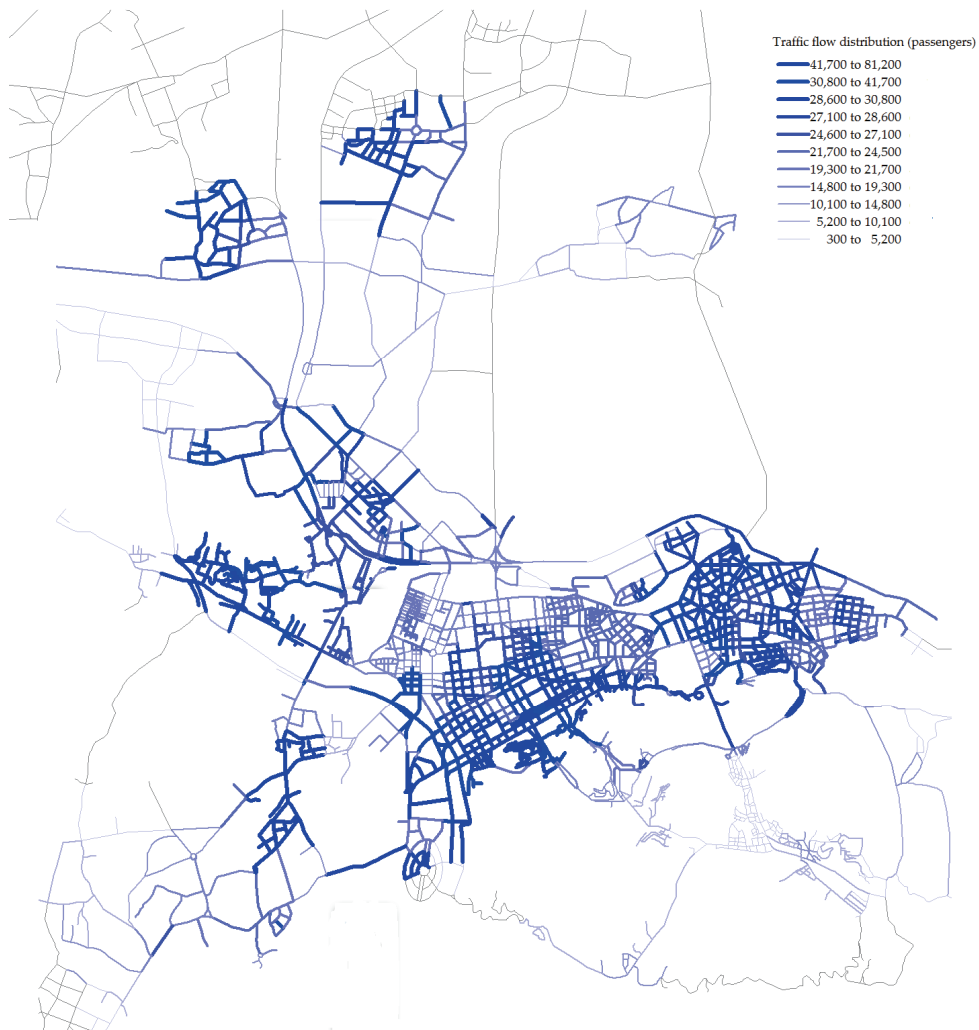
Last but not least, our research is conducted at a conceptual level. Due to time and effort limitations, we did not simulate the city into a system dynamic model. It might be unfortunate, but our conceptual model may become a foundation for future city simulation using system dynamics. When such a model is built with real urban data, it will show the growth processes of urban areas, the interacting processes of system components, and the branching processes on city parameters. When it comes clear for us how branching processes work out in the urban dynamic model, the system behavior may offer us with more findings, trigger us to precipitate more discussions and brings out additional supporting and/or contradictory information that helps refine the conceptual model of cities as well as its parameters.



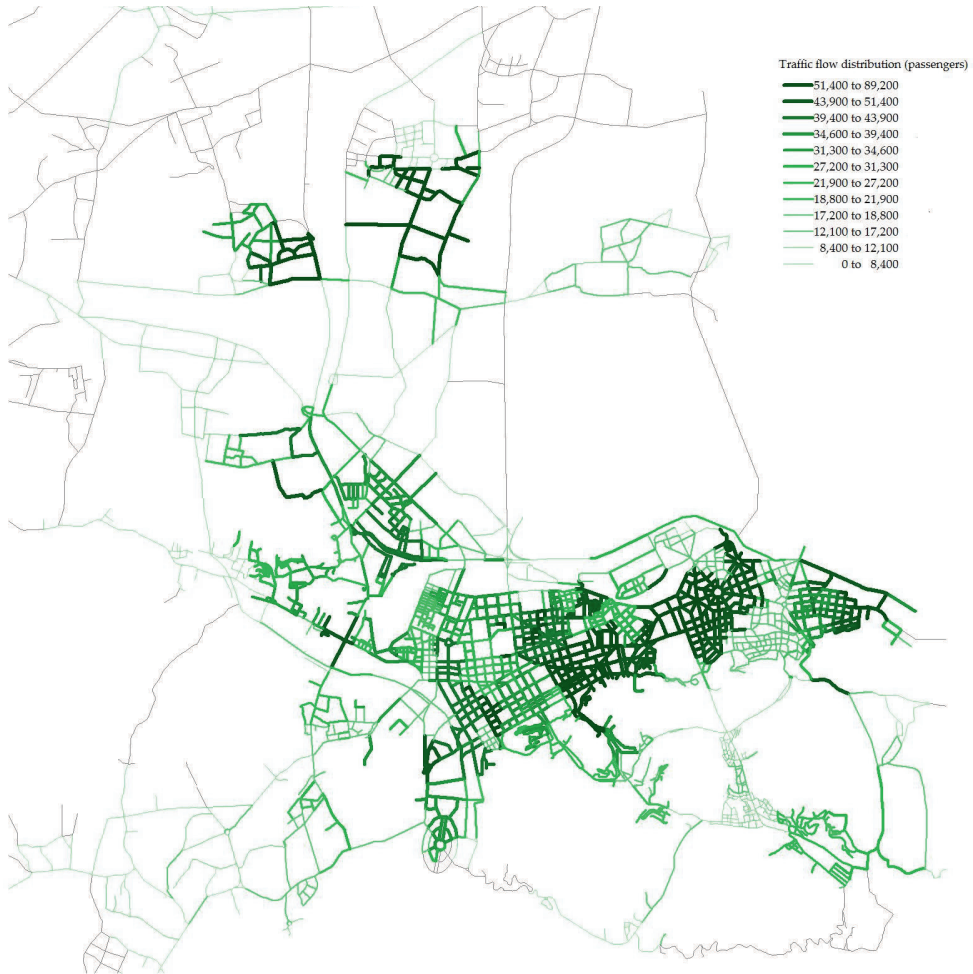
# Appendix A

## Passenger assignment results for scenarios:

### Scenario A

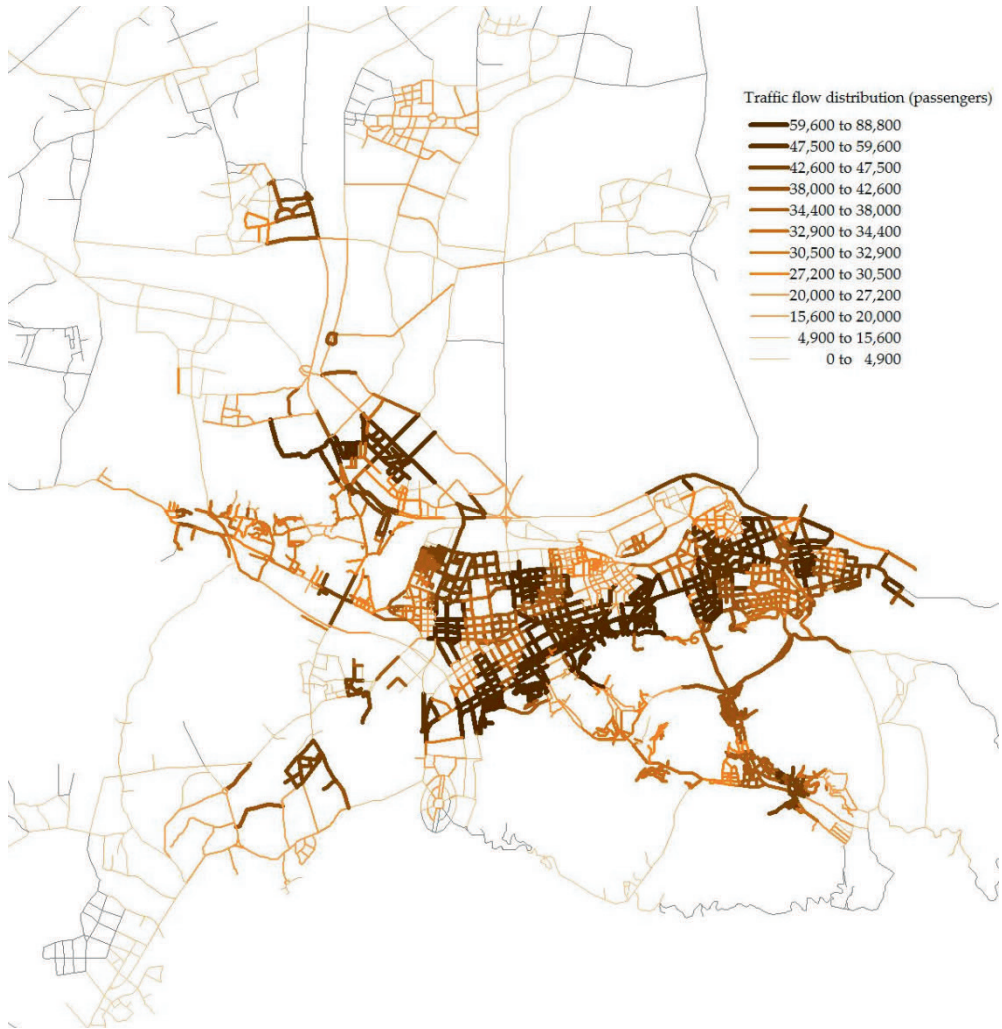


## Scenario B





## Scenario C





# Appendix B

## Notes on the calculation methods of the performance indicators:

- The traveling time of passengers is constituted by waiting time at transit stops and in-vehicle time. For the waiting time, it is calculated from the formula  $\sum_i \frac{1}{2f_a} \times q^u + \bar{t}^u \times q^u + \bar{t}^d \times q^d$ , where  $f_a$  represents frequency,  $q^u$  and  $q^d$  represents number of passengers getting on and off from the vehicle at transit stops, and  $\bar{t}^u$  and  $\bar{t}^d$  are respectively the time needed by passengers to get on and off the vehicle. Here we assume that the arrival of passengers is subject to a “uniform distribution”. For the in-vehicle time, it is calculated from the formula  $\frac{l_{ij}}{v} \times q^{in} + \bar{t}^s$ , where  $l_{ij}$  is the travel distance,  $v$  is the speed of the vehicle and  $q^{in}$  is the number of passengers in the vehicle, and  $\bar{t}^s$  represents the average time needed by the vehicle to acceleration and deceleration at stops.
- The expected number of transfers is derived from the difference between the O-D volume on  $l_{ij}$  and the real number of up-passengers  $q^u$ .
- The monetary costs of passengers are obtained from the fare multiplied by the average number of transfers per passenger.
- Comfort (C) is influenced by two factors: the space available per passenger in vehicle ( $m^2$ )  $C_1$  and the vibration acceleration of the vehicle when traveling ( $m/s^2$ )  $1/C_2$ . Thus  $C=C_1+1/C_2$ . More specifically, we define that the comfort level of the most crowded transit vehicle (i.e. there are more than 6 passengers per  $m^2$  in the vehicle) is 0, while the most comfortable level (i.e. there are less than 2 passengers per  $m^2$ ) is 1. Then according to the data of passenger volume on each vehicle and vehicle space, the comfort level of Dalian transit in terms of the space available for each passenger is about 0.3 of scenario A (i.e. there are 3 passengers per  $m^2$ ), and 0.45 of scenarios B and C (i.e. there are 2.5 passengers per  $m^2$ ). For the values of vibration acceleration of the vehicle when traveling, they are measured to be 1.49  $m/s^2$  and are considered the same for scenarios. Therefore, the value of  $1/C_2$  equals to  $1/1.49=0.67$ .
- Safety is indirectly measured by the accident rate per passenger per trip. More specifically, it is calculated by the accident rate per kilometer of public transit that is multiplied by the average trip distance per passenger. According to the statistics, the accident rate per kilometer of public transit in Dalian is 0.013, and the average trip distance per passenger in Dalian is about 5.9 kilometers. Therefore, the accident rate per passenger per trip equals to  $0.013*5.9=0.0767$ . And thus the safety is measured by  $1-0.0767=0.923$ .

- The costs of operators are composed of the operation and maintenance of the vehicles, the consumption of oil as well as the salaries of the staff.
- The revenues of operators are generally equal to the total monetary costs of passengers.
- Modal split over car and public transit is calculated from the previous equations (3) and (4).
- Environmental impact is measured roughly by the total CO<sub>2</sub> emissions reduced in the urban transport sector, and the amount of reduced emissions has been converted to monetary savings.
- Land use impact is measured from the density of land use around transit stops.

# Appendix C

## Landscape around the Dalian Station

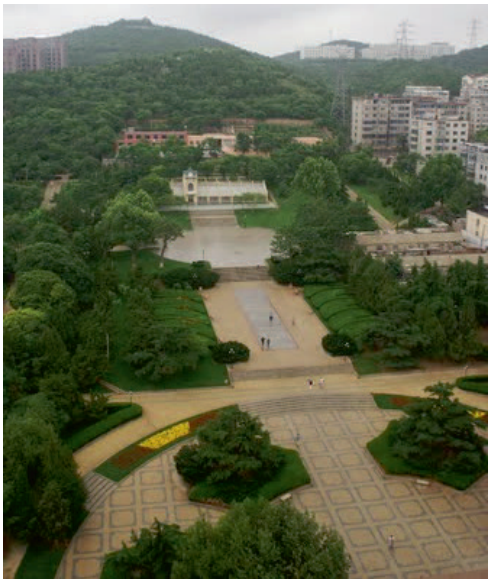


## Landscape around the Xianglujiao Station





## Landscape around Jinjiajie Station



## Landscape around Quanshui Station



## Landscape around Houyan Station





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# Nederlandse Samenvatting

Dit boek behandelt China's stedelijk transportbeleid na drie decennia van hervormingen. Het onderzoekt de praktijk van de Chinese stedelijke planning en besluitvorming in deze periode. Het is vooral een zoektocht naar nieuwe planningsprincipes die geschikt zijn voor complex stedelijke systemen, en verschilt van, is misschien zelfs strijdig met die welke nu worden toegepast door Chinese planners en beleidsmakers en gepropageerd worden in gepubliceerde wetenschappelijke artikelen en overheidsrapporten.

## *Motivering van het onderzoek en onderzoeksvragen*

In de afgelopen jaren hebben de meeste Chinese steden te maken gekregen met een sterke afname met de modal split voor openbaar vervoer. Het blijkt dat de gevolgen van de 'socialistische markteconomie', zoals de ontkoppeling van het sociale leven en de productieactiviteiten, de vermarkting van stedelijke grond, de commercialisering van de stedelijke planning, en grootschalige suburbanisatie veel bewoners ertoe hebben gebracht te gaan wonen in locaties die ver weg liggen van hun werk en die diensten waarvan ze dagelijks gebruik maken. Die hebben daarom het openbaar vervoer vanwege zijn lage servicekwaliteit gelaten voor wat het is. Tegelijkertijd kunnen we samen met een groeiend besteedbaar inkomen en de komst van de auto een snelle groei van het gemotoriseerd verkeer in stedelijke gebieden waarnemen. Als gevolg daarvan worden de wegen overstelpt met auto's, congestie, luchtvervuiling en is verkeersveiligheid een belangrijke kwestie geworden in China.

China heft echter ook een ander gezicht daar waar gemeentelijke beleidsmakers streven naar het opstellen van plannen voor stedelijke metro's en Bus Rapid Transit systemen, verzoeken om centrale goedkeuring voor deze plannen, en geld aantrekken om de financiële gaten te vullen van deze stedelijke openbaar vervoerprojecten. Zulke pogingen verschaffen mogelijkheden voor veel Chinese metropolen om stedelijke groei in duurzamere banen te leiden. En het stelt de gemeenten in staat om het concept 'Transit-Oriented Development' (TOD) nader te bezien. TOD is een model met wereldwijd succesvolle toepassingen waarbij openbaar vervoer wordt bevorderd door de integratie van verkeer met grondgebruik en het creëren van een omgeving voor mobiliteit waar openbaar vervoer een veel respectabeler alternatief voor autovervoer is.

Terwijl de Chinese gemeenten de potentiële voordelen van TOD voor duurzame stadsontwikkeling erkennen en het begrip omarmen, beseffen ze echter niet dat het effectief invoeren van TOD het vervullen van een aantal voorwaarden vereist. Indien overheden serieus van plan zijn aan deze voorwaarden te voldoen ze er niet aan ontkomen bewust een omvattend en gericht beleid te voeren en aanzienlijke middelen daarvoor moeten uittrekken en steun moeten verwerven. Daarnaast beseffen ze

onvoldoende dat vanwege de onstuimige groei, hun steden zijn uitgegroeid van relatief eenvoudige systemen leunend op kunstmatige planning naar hele complexe die zich gedragen als zelforganiserende en vrijwel niet te plannen systemen. Dat maakt de realisatie van TOD extra ingewikkeld. Met andere woorden, het is erg waarschijnlijk dat overwegen ontwerp voor TOD verzandt in de complexiteit die deze modern steden kenmerkt. Dit komt doordat ontwerpmogelijkheden in complexe systemen heel beperkt zijn en alleen doenlijk worden via het uitkiezen en veranderen van de juiste componenten op de juiste momenten.

Liever dan focussen op het aanleveren van beleidsinstrumenten en aanbevelingen van de implementatie van TOD voor Chinese lokale overheden, tracht deze studie te begrijpen hoe steden opgebouwd zijn, hoe ze werken, hoe ze kunnen beschouwd als complexe systemen, en zo bezien hoe ze gepland kunnen worden (met betrekking tot TOD). Daarom poogt dit boek de zwarte doos van complexe stedelijke systemen te openen voor leidende politici, beleidsanalisten, hoge ambtenaren, juristen en het geïnteresseerde lekenpubliek hoe TOD tot zijn recht kan komen hedendaagse steden in China. In overeenstemming met deze motivering zien de belangrijke onderzoeksvragen er als volgt uit:

### *Kan TOD gepland worden in Chinese steden?*

Om deze algemene onderzoeksvraag te beantwoorden moet een serie theoretische en empirische sub-vragen achtereenvolgens worden nagelopen:

*(1) Hoe kunnen steden worden begrepen? Kan een conceptueel raamwerk worden geschetst waarmee steden kunnen worden beschreven? Zo ja, welke parameters vallen binnen zo'n conceptueel model? En hoe kunnen de scores van deze stedelijke parameters in de praktijk worden uitgezocht?*

*(2) Wat is TOD? Wat zijn de goede en slechte ervaringen met TOD over de hele wereld? Wat zijn de voorwaarden voor succesvolle TOD zoals gevonden in die internationale ervaringen en volgens de wetenschappelijke literatuur?*

*(3) Hoe zien de huidige scores voor de parameters eruit in de Chinese stad Dalian die officieel TOD omarmd heeft en historisch de meest gunstige modal split voor openbaar vervoer heeft voor heel China?*

*(4) Welke lessen kunnen worden getrokken uit Dalian's parameter scores? Kunnen we een nieuwe benadering ontwikkelen met betrekking tot het plannen van TOD in complexe stedelijke systemen?*

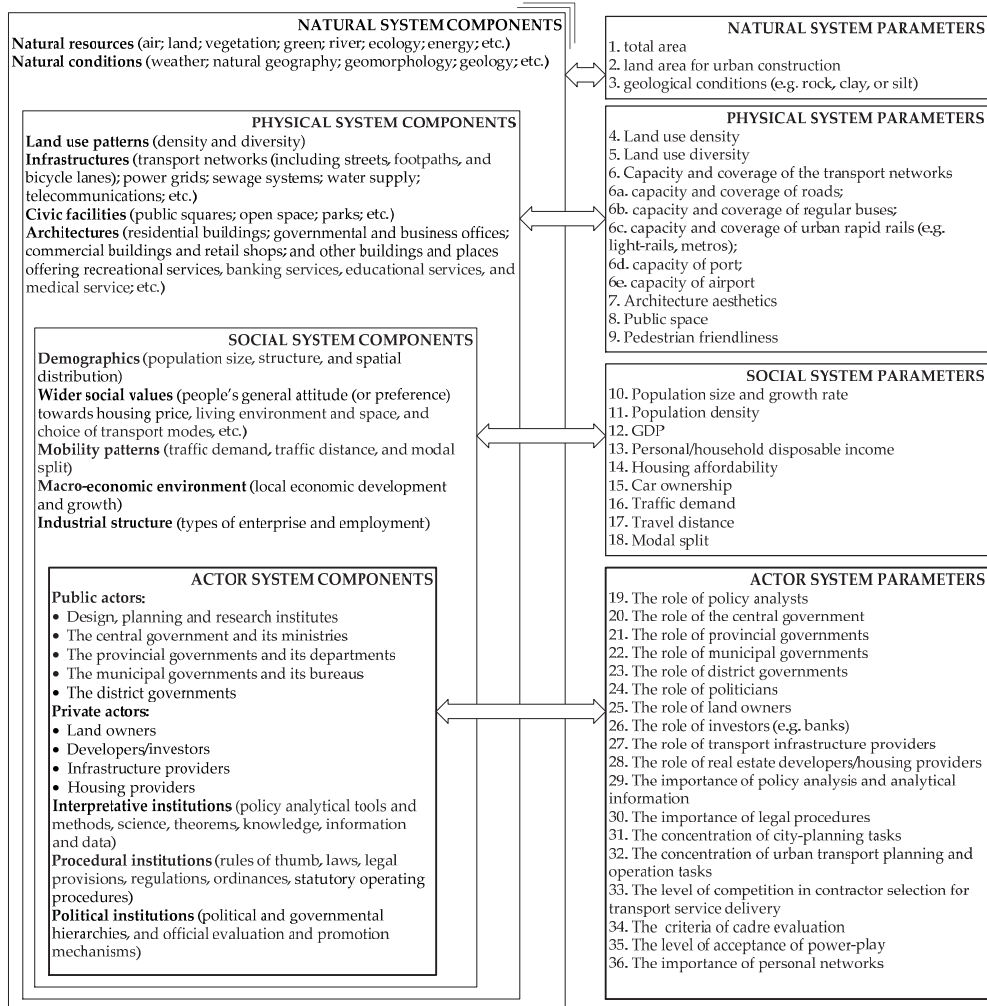
### *Theoretisch raamwerk*

OM een geschikt planningsparadigma voor complexe steden neer te zetten moeten we blootleggen hoe die systemen in China in het echt werken, welke planningsprincipes in

staat zijn om de vitaliteit van TOD te bevorderen, en welke principes van kunstmatig ontwerp TOD attributen verstikken. In dat licht gezien is een model geconstrueerd om steden te conceptualiseren. Dit model, dat de transportaspecten van het stedelijk systeem weergeeft, bestaat uit vier subsystemen: het natuurlijk subsysteem, het fysiek subsysteem, het sociaal subsysteem en het actor subsysteem. Elk subsysteem bevat alle relevante stedelijke componenten. Het fysieke subsysteem bevat bijvoorbeeld componenten als grondgebruikpatronen, infrastructuren, civiel-technische faciliteiten en architectuur, terwijl het sociale subsysteem is opgebouwd uit componenten als de demografie, bredere maatschappelijke waarden, mobiliteitspatronen, de macro-economische omgeving en de industriële structuur. Het natuurlijk subsysteem bevat de natuurlijke condities van de stad en de natuurlijke hulpbronnen. En het actor subsysteem telt diverse actoren in het stedelijk veld, naast instituties, waardoor de acteurs worden gebonden en interacteren.

De conceptuele stad kan worden gedefinieerd met 36 stadsparementen, en planning in complexe steden kan gebeuren via het veranderen van bepaalde parameterscores (figuur 1). Bij praktische toepassing worden de scores op de parameters van de natuurlijke, fysieke en sociale subsystemen eenvoudig aangenomen gegeven de context van een stedelijk gebied, terwijl stadsplanners en beslissers zich concentreren op scores van de actor subsysteemparameters als de bron van kunstmatige interventie. De scores op de actor-netwerk parameters zijn afgeleid van drie perspectieven: dat van de beleidsanalist, de jurist en de politicus.

De keuze van de drie perspectieven als toegevoegde lenzen voor het zien van publieke besluitvorming in een multi-actor context is grotendeels gebaseerd op het werk van Allison (1971) en Snellen (2002). Allison definieert drie verschillende besluitvormingsmodellen: *de rationele actor*, *het organisatorisch proces en besluitvormingspolitiek*, terwijl Snellen vier rationaliteiten onderscheidt binnen de bestuurskunde: *de professionele rationaliteit*, *de economische rationaliteit*, *de juridische rationaliteit en de politieke rationaliteit*. Een vergelijking tussen Allison en Snellen leidt tot de conclusie dat het model van de rationele actor en dat van de professionele rationaliteit overeenstemmen, omdat ze beide benadrukken dat goed beleid voortkomt uit gedegen wetenschappelijke berekening en vergelijking. Het besluitvormingspolitieke en het politieke model zijn ook grotendeels hetzelfde. Beide leggen de nadruk op gevechten rond beleid en power-play in het besluitvormingsproces. Voor Snellens model voor de juridische rationaliteit heeft Allison niet echt een equivalent. Belangrijke elementen van Allisons organisatorisch proces kunnen worden gevonden in Snellens economische rationaliteit op micro-economisch niveau. Het micro-economisch aspect van de economische rationaliteit richt zich op interorganisatorische relaties en valt dus samen met wat Allison het organisatorische proces noemt, d.w.z. de organisatorische routines.



Figuur 1 Een conceptueel model van steden en stadsparameters

Wanneer we pogen deze modellen toe te passen vinden we echter dat data over de routines van diverse organisatorische actoren ontbreken, niet alleen omdat sommige formele operating procedures en routines niet openbaar toegankelijk zijn voor externe onderzoekers in China, maar ook omdat er vele informele routines zijn die besluitvorming geleiden. Deze informele routines vaststellen vergt veelal dat onderzoekers persoonlijk betrokken zijn in elk van organisaties, waarnemen en informele interacties 'beleven'. Daar wij geen participerende observatie kunnen uitvoeren en de routines niet kennen, passen we het micro-economisch aspect van Snellens economische rationaliteit niet toe, en evenmin Allison's organisatorisch proces. Met betrekking tot het macro-economisch aspect van de economische rationaliteit welke de 'facts and figures' rond de bredere samenleving laten zien, deze hebben we in

de sociale subsystemen van ons conceptuele model van de steden opgenomen. Daarom stellen we uiteindelijk onze eigen selectie van perspectieven op besluitvorming samen, te weten dat van de *beleidsanalist*, dat van de *jurist* en dat van de *politicus*.

Het eerste perspectief behandelt de klassieke besluitvorming, waar de beleidsanalisten het probleem formuleren, doelen en besliscriteria vaststellen, alternatieven identificeren, modellen bouwen, data verzamelen, alternatieven vergelijken en beslissers ondersteunen. De praktische toepassing ligt in het ontdekken wat de analisten doen wanneer ze opties voor de verbetering van het stedelijk transportsysteem aanbrengen die TOD vooruit helpen. Het tweede perspectief gaat over juridische besluitvorming, waar wetgevers en verschillende gezagsdragers en ambtenaren die achter de schermen hun dagelijks werk uitvoeren en overheden op diverse niveaus ondersteunen. De praktische toepassing ligt in het ontdekken van bestaande regels en juridische procedures en het onderzoeken van het gat tussen wet en realiteit. Het derde perspectief gaat over politieke besluitvorming, waar politici strijden om macht en beleidsvorming de arena is waar politieke deals worden gevormd tussen spelers. De praktische toepassing is gelegen in het schetsen van een plaatje van Chinese stadspolitieke en hoe machtsuitoefening stedelijke vervoersprojecten beïnvloedt.

Door het boven geschetste raamwerk op te bouwen beantwoorden we tevens de eerste onderzoeksvraag. Steden kunnen worden begrepen als complexe systemen. Hun complexiteit kan worden onthuld met behulp van het conceptuele model van de vierlagige subsystemen. En steden kunnen worden ontdekt via de 36 parameters die op hun beurt gemeten kunnen worden via de perspectieven van de beleidsanalist, de jurist en de politicus. Voor de beantwoording van de tweede onderzoeksvraag deden we een uitgebreide theoretische studie naar het TOD concept in het derde hoofdstuk van dit boek. In deze samenvatting herhalen we niet in detail wat het concept inhoudt of wat de fundamentele leerstellingen ervan zijn. Wat we wel doen is een kort antwoord geven op de tweede vraag, namelijk dat de realisatie van effectief TOD vereist data aan een aantal voorwaarden wordt voldaan, waaronder een hoog niveau van dichtheid in het grondgebruik en een grotere variatie daarin, aantrekkelijk urban design en stadslandschappen, beperkingen aan autogebruik, hoogwaardig openbaar vervoer, solide bestuur, en een onroerend goed markt die betaalbare en gemengde types huisvesting aanbiedt.

### *Empirische verkenning*

Door een uitgebreide case study (Dalian) hebben we de scores verkregen voor elk van de parameters. We kozen Dalian als casus om de volgende redenen. Ten eerste is Dalian een stad die momenteel significante infrastructuurinvesteringen ondergaat, in het bijzonder grote transportprojecten. En het is een van de pilotsteden in China waar het TOD concept officieel wordt gepromoot en doorontwikkeld. De lokale overheid is

erg actief bij de verbetering van stedelijke verkeer- en vervoersplanning, en men geeft politieke en economische prioriteit aan het ontwikkelen van een betrouwbaarder en duurzamer stedelijk vervoerssysteem. Bovendien heeft Dalian een sterke traditie in openbaar vervoergebruik, en dat is zichtbaar in een erg gunstige modal split in vergelijking met welke andere Chinese stad dan ook. Dalian kan worden beschouwd als de stad die de grootste kans maakt TOD daadwerkelijk effectief in te voeren. Als het daar niet werkt gegevens de uitgangscondities, zou het moeilijk te implementeren zijn in elke andere Chinese stad. Daarnaast is de beschikbaarheid van data in Dalian uitstekend voor ons, via nauwe persoonlijke relaties met experts en beleidsmakers op het terrein van vervoerskunde, planning en management.

De parameterscores van Dalian geven een gemengd beeld ten aanzien van TOD. Het natuurlijk systeem met bergachtige vormen maken het bruikbare landareaal schaars en het natuurlijk systeem laat een topografie van karststeen en zee-erosie, wat het gebruik van ondergrondse ruimte technisch moeilijk en risicovol maakt. Daardoor heeft Dalian te maken met de uitdaging dicht, goed gepland en efficiënt grondgebruik te realiseren. Niettemin is het fysiek systeem relatief gunstig in termen van vervoersnetwerken en stedelijk landschap. Dalian heeft in feite een uitgebreid en multi-modaal transportinfrastructuursysteem. En de stad heeft veel baat bij zijn aantrekkelijke gebouwen uit de perioden van Russische en Japanse overheersing en van zijn modern bouw die stedelijke vergroening benadrukt, Daarbij horen grote gebieden voor voetpaden, lommerrijke parken en over het algemeen fraaie architectuur. Dalians sociale systeem heeft aanzienlijke transformatie ondergaan, die een somber beeld geeft voor TOD. Het heeft historisch de meest gunstige modal split voor openbaar vervoer onder alle Chinese metropolen en was een gebied waar mensen weinig uitgaven en in kleine maar goed bewoonbare huizen woonden. Deze voordelen voor de realisatie van TOD staan zwaar onder druk. Tegenwoordig wensen de meeste mensen hun eigen auto's te bezitten en te wonen in grote huizen met groot ruimtebeslag, rustig en ver weg van het centrum. Deze feiten leiden tot toenemende vraag naar vervoer en vergroten de reisafstand, om kort te gaan een auto-afhankelijke samenleving.

In het actorsysteem dekt het perspectief van de beleidsanalist twee actor-netwerk parameters, de rol van de beleidsanalist en het belang van beleidsanalyse en analytische informatie. Beide blijken zwak te zijn in de planning en besluitvorming over verkeer en vervoer in Dalian. De professionals van onderzoeksinstituten zien beleidsanalyse niet als hun hoofdmissie. Ze beschouwen zichzelf niet als beleidsanalisten, maar gedragen zich eerder als aannemers van de overhead en nemen de beleidswensen van de laatste gewoon over. Ook beseffen ze terdege dat hun analyses nauwelijks invloed hebben op de vorming van overheidsbeleid en maatregelen. Gezien deze mentaliteit schuwen vervoersingenieurs pogingen om een omvattend simulatiemodel te bouwen en naar optimale beleidsopties te zoeken. In plaats daarvan worden veel aannames gedaan om het model eenvoudig te houden en toch acceptabele uitkomsten te genereren en aan de wensen van de overhead te beantwoorden.



Het actorsysteem vanuit het juridisch perspectief verkennend vonden we dat de hoop regels en procedures overwegend op duurzaamheid zijn gericht, met groeiende aandacht voor synergie tussen grondgebruik en transport, energiebesparing, milieubescherming en voorrang voor het openbaar vervoer. Ondanks geboekte vooruitgang bestaan er zwaktes in de nationale wetgeving ten aanzien van gemengd ruimtegebruik. Ook zijn er problemen in de ruimte die voor openbaar vervoer wordt gereserveerd, en voor de gemeenschappelijke ontwikkeling van transportinfrastructuur en grondgebruik rond stations. Los daarvan wijst zorgvuldige analyse van het empirisch materiaal uit dat er aanzienlijke discrepantie bestaat tussen het juridisch raamwerk en daadwerkelijk uitvoering ervan (waaronder dienstverlening en het wegbeheer en de implementatie van het voorrangbeleid voor OV).

Having exposed the actor system from the political perspective, we see that neither the policy analysis nor the legal procedures are the real determinants of an urban policy or program. The incentives behind urban decision-making stem from political struggles and power-play. Although efforts have been made to improve the quality of policy analysis and the reliability of the analysts, and even though progress can be noted in enhancing the legal framework, policy decisions are largely made by the real holders of power. As a result, the quality of the decision will heavily depend on the quality and personality of the powerful politician. This fact does not show a bright prospect for the realization of TOD.

Via ons theoretisch raamwerk verkregen we 36 parameterscores voor Dalian, waardoor we in staat waren een beeld te schetsen van de subsystemen in de stad. De huidige situatie in de subsystemen konden we daarmee bepalen, en de derde onderzoeksvraag beantwoorden.

### *Analyse van en overwegingen bij de planning in complexe stedelijke systemen*

We vonden dat enkele parameters doorslaggevende invloed uitoefenen op de stedelijke structuur, daar waar andere juist een vrij zwakke rol spelen bij de bepaling van de stedelijke configuratie. We noemen dat eerste 'ordenende parameters' en de laatste 'gevangen parameters'. De aanblik van de Chinese steden is daarmee bepaald via het beginsel dat sommige parameters het gedrag van andere 'gevangen houden'. Typische voorbeelden van ordenende parameters zijn de rol van de centrale overheid, de rol van gemeentelijke overheden en de rol van politici, en tot de gevangen parameters kunnen worden gerekend de rol van beleidsanalisten, het belang van juridische procedures, en de rol van provinciale overheden. Ordenend of gevangen zijn is geen eeuwig vaststaand feit. Ordenende en gevangen parameters worden zichtbaar na een strijd gedurende stedelijke turbulentie. Terugkijkend op de periode van China's nationale economische en politieke hervormingen kunnen we vaststellen dat de gemeentelijke

overheden de concurrentiestrijd hebben gewonnen en nu een van de belangrijkste ordenende parameters leveren.

<p><b>Type 1: Ordering-Fast Parameters:</b>  <i>have decisive power in shaping the pattern of an urban system, and that power is very sensitive to either internal and external turbulence happening in the city and thus variable, unable to sustain the same status in the long-term urban evolution, and thus changeable. That is to say, these parameters are the most dominant ones to steer the urban system towards a certain developmental direction.</i></p> <ul style="list-style-type: none"> <li>● The role of municipal governments;</li> <li>● The role of politicians;</li> <li>● The role of real estate developers;</li> <li>● The criteria of cadre evaluation.</li> </ul>	<p><b>Type 2: Enslaved-Fast Parameters:</b>  <i>are enslaved by the order parameters and thus have little influence on the appearance of the city; in addition, they are sensitive to internal movements of the city and external artificial interventions and as a result they are quite unstable and change fast during urban evolution. That is to say, these parameters cannot exhibit strong influential power in directing urban development but such power, little though, is prompt.</i></p> <ul style="list-style-type: none"> <li>● The role of provincial governments;</li> <li>● The role of district governments;</li> <li>● The role of transport infrastructure providers;</li> <li>● The concentration of city-planning tasks;</li> <li>● The concentration of urban transport planning and operation tasks;</li> <li>● The level of competition in contractor selection for transport service delivery;</li> <li>● The importance of personal networks.</li> </ul>
<p><b>Type 3: Ordering-Slow Parameters:</b>  <i>have considerable power in determining the form of an urban system, but that power or strong Impact comes about slowly. They are resistant to internal and external disturbances that take place in the urban system, and thus are relatively stable, or change very slowly across time.</i></p> <ul style="list-style-type: none"> <li>● The role of central government;</li> <li>● The role of land/property owners;</li> <li>● The level of acceptance of power-play.</li> </ul>	<p><b>Type 4: Enslaved-Slow Parameters:</b>  <i>do not have much influential power in forming the urban system, largely being enslaved by the order parameters. In addition, these parameters are relatively insensitive, that is, they are unable to change promptly.</i></p> <ul style="list-style-type: none"> <li>● The role of policy analysts;</li> <li>● The role of investors (e.g. banks);</li> <li>● The importance of legal procedures;</li> <li>● The importance of policy analysis and analytical information.</li> </ul>

Figure 2 A typology of parameters

Parameters verschillen niet alleen in termen van hun invloed op de stedelijke structuur, maar ook hun beïnvloedbaarheid. Sommige parameters veranderen snel als gevolg van

externe interventies of wijzigingen in andere parameters. Ze zijn vatbaar en passen zich snel aan, zoals binnen 5-10 jaar. We noemen ze snelle parameters. Voorbeelden zijn de rol van politici, de criteria voor de beoordeling van kaderleden en de rol van onroerend goedontwikkelaars. Anderzijds kost het langzame parameters lange tijd, 10-50 jaar, om te veranderen en het is goed mogelijk dat die de zelfde status houden gedurende een lange tijdsspanne. Voorbeelden zijn de rol van de centrale overheid, het belang van beleidsanalyse en analytische informatie, en het niveau van acceptatie van machtsuitoefening.

De ordenend-gevangen en snel-langzaam dimensies definiëren een typologie van parameters (figuur 2). We kunnen ordenend-snel, ordenend-langzaam, gevangen-snel en gevangen-langzaam onderscheiden.

Ordenend-snel parameters hebben doorslaggevende invloed op de patronen van een stadssysteem, en die invloed is erg vatbaar voor zowel interne als externe turbulentie in de stad en varieert daarom, niet in staat om dezelfde status in de lange termijn evolutie vast te houden. Anders gezegd, deze parameters zijn dominant in de besturing van het stedelijk systeem in een bepaalde ontwikkelrichting.

Gevangen-snel parameters worden gevangen door ordenende parameters en hebben daarom weinig impact op de aanblik van de stad; daarbij komt dat ze gevoelig zijn voor interne bewegingen van de stad en externe kunstmatige interventies. Daardoor zijn ze erg onstabiel en veranderen snel gedurende stedelijke evolutie. Met andere woorden, deze parameters hebben geen grote invloed op de richting waarin de stad zich ontwikkelt, maar hun effecten worden wel snel zichtbaar.

Ordenend-langzaam parameters hebben aanzienlijke impact op de vorm van een stad, maar die impact groeit geleidelijk aan; ze reageren niet snel op interne en externe verstoringen die plaats hebben in het stedelijk systeem, en zijn daarom relatief stabiel, or wijzigen erg langzaam zelfs al heeft de stad al verschillende stadia doorgemaakt of diverse golven van turbulentie doorstaan.

Gevangen-langzaam parameters ebben niet veel invloed op de vorming van het stedelijk system, grotendeels omdat ze gevangen worden gehouden door ordenende parameters; bovendien zijn ze ook nog eens weinig beïnvloedbaar: ze zijn niet in staat prompt te veranderen.

Nu kunnen we de vraag “welke parameters kunnen er het best worden uitgepikt?” beantwoorden door aan te geven dat de ordenende-snel parameters zijn omdat die TOD het meest en het snelst kunnen stimuleren. Andere parameters, vooral de ordenende-langzame en de gevangen-snelle, zullen we niet in een rangorde plaatsen omdat het denkbaar is dat we beide nodig hebben. Ze sluiten elkaar ook niet uit; ze kunnen in voorkomende gevallen beide relevant zijn.

### *Vertakkingen in de mogelijke veranderingen van parameterscores*

Parameters die kunnen bijdragen aan systeemverandering zijn de rol van de gemeentelijke overheid, de criteria voor kaderbeoordeling, de rol van politici en de rol van onroerend goed ontwikkelaars. Beleidsmakers en urban designers in China kunnen deze parameters nemen als de juiste ingangspunten en kunstmatig intervenieren in het systeem ter bevordering van transit-oriented development.

De vraag blijft wie deze parameters vaststelt of wie deze zo kan/kunnen wijzigingen dat ze TOD dichterbij brengen? Zoals voorgesteld in het conceptueel model heeft een complex stedelijk systeem veel actoren en daarom hebben TOD-bevorderende projecten vele makers. Geen enkele actor kan de parameters geheel bepalen, en alle actoren hebben de neiging zich zo te gedragen dat ze hun belangen het best gewaarborgd zien. Overheden op verschillende niveaus, hun verschillende bureaus en afdelingen, planning en ontwerp instituten, onderzoekscentra, vervoersbedrijven, projectontwikkelaars, investeerders, grondeigenaren, en politici spelen alle een rol in de vorming van de stedelijke configuratie en ze kunnen alle helpen doelbewust het algemene TOD concept in concrete acties te vertalen.

Mogelijke veranderingen in de rol van de gemeentelijke overheid kunnen behelzen:

- De centrale overheid past de relaties tussen provincies en gemeenten aan door meer gezag en budget toe te kennen aan de provincie, zodat regionale ongelijkheid binnen de provincie kan worden verminderd en steden die milieu- en openbaar vervoersprojecten entameren te belonen.
- De centrale overheid past de relatie tussen gemeentelijke overheid en district aan door meer verantwoordelijkheden toe te kennen aan districten, zodat publieke participatie kan worden verbeterd. Omdat ze studies uitvoeren naar vervoers- en grondgebruikspatronen staan de districten het dichtst op de burgers en kunnen ze het best geldende meningen en wensen peilen via hoorzittingen en petities.
- De gemeentelijke overheid relateert belasting-gerelateerde mechanismen aan de districten en gemeenschappen met verschillende locatievoordelen om investeringen in de districten door de stad heen om stadsvernieuwing en –ontwikkeling in nog onderontwikkelde gedeelten mogelijk te maken en gemengd grond- en ruimtegebruik te stimuleren.
- De gemeentelijke overheid bouwt een database die real-time sectorspecifieke planningsinformatie beschikbaar maakt voor planners uit andere sectoren.
- De gemeentelijke overheid investeert niet langer in verbreding van stadssnelwegen, en evenmin in aanleg van ruime parkeergelegenheid.
- Een formeel subsidiemechanisme voor openbaar vervoerbedrijven wordt vastgesteld. Het hoeft hierbij niet alleen om monetaire middelen te gaan, maar kan ook grondgebruiksrechten betreffen, maar het moet de functionele grondopties duidelijk waarvan bedrijven gebruik kunnen maken.

- Naast subsidies moeten gemeenten ook een standaardcode uitwerken om servicekwaliteit te waarborgen, en subsidietoekenning is verbonden aan geleverde kwaliteit.
- De gemeente roept een onafhankelijke instantie in het leven om de diensten van de verschillende OV-bedrijven en vervoersmodaliteiten te coördineren, zowel fysiek als qua management.
- De gemeente neemt lokale regelgeving aan om speculatie rond onroerend goed te verbieden, zodat betaalbare huisvesting kan worden gewaarborgd.

Mogelijke wijzigingen in de criteria voor kaderbeoordeling kunnen zijn:

- Het belang van economische indicatoren zoals groei in het stedelijk BNP en FDI kan worden behouden, zolang indicatoren als stedelijke milieukwaliteit (industriële en transportemissies, luchtkwaliteit, geluidhinder door het verkeer en een lokaal budget voor beheersing van de milieuvervuiling worden toegevoegd aan de criteria voor beoordeling van kaderleden.

Mogelijke veranderingen in de rol van politici zijn:

- Planningspluralisme wordt vergroot door een planningsraad in bepaalde gebieden in te stellen. Dat is een onafhankelijke werkgroep die bestaat uit professionals en experts gespecialiseerd in recht en stedelijke planning; standaarden en procedures zouden in gemeentelijke regelgeving moeten worden aangenomen over welke plannen goedgekeurd kunnen worden; en planningshoven moeten worden ingesteld op verschillende overheidsniveaus zodat er een hof is voor buurtplanning en een voor stedelijke planning.

Mogelijke veranderingen met betrekking tot de rol van onroerend goedontwikkelaars zijn:

- Regelgeving over de onroerend goedmarkt wordt lokaal vastgesteld, en vereist de menging van woningtypen binnen ontwikkelde woongemeenschappen.
- In regelgeving met betrekking tot onroerend goed worden ontwikkelaars verplicht tot het meenemen van bijbehorende voorzieningen en diensten binnen en rondom de projecten, om een gevarieerd en multifunctioneel ruimtegebruikspatroon te creëren binnen gemeenschappen.
- In regelgeving met betrekking tot onroerend goed worden ontwikkelaars verplicht tot realisatie van verbindingen tussen hun eigen projecten en het netwerk van openbaar vervoersvoorzieningen. Ze kunnen samenwerken met OV-bedrijven of eigen feederdiensten aanbieden.

Doelbewuste interventies op deze ordenend-snelle parameters roepen veranderingen op in andere parameters. Effecten van de nieuwe scores van de vier parameters vertakken zich naar andere parameters.

De nieuwe rol van gemeenten die een subsidiemechanisme vaststellen en een onafhankelijke instanties in het leven roepen zouden bijvoorbeeld wijziging in de rol

van vervoersbedrijven en concentratie van stedelijk vervoersplanning en operationele taken kunnen triggeren. Wijziging in de criteria voor kaderbeoordeling met indicatoren voor milieukwaliteit zouden zich vertakken en verandering brengen in de rol van politici in het bevorderen van milieubeleid en TOD-projecten. Aanpassingen in de rol van politici via instelling van een planningsraad versterken het planningspluralisme, en daarmee wellicht de rol van beleidsanalisten en het belang van juridische procedures. Verbetering daarin leidt dan weer tot wijziging op andere parameters, zoals het belang van beleidsanalyse en analytische informatie. Acceptatie van blote machtsuitoefening zou verminderen en het gewicht van persoonlijke netwerken geneutraliseerd. Tenslotte kan aanpassing in de rol van onroerend goedontwikkelaars in de richting van bredere verantwoordelijkheden op sociaal en duurzaamheidsgebied vier andere parameters beïnvloeden, waaronder de rol van vervoersbedrijven, de concentratie van stedelijke planningstaken, de rol van grondeigenaren en het belang van juridische procedures. Elk van deze veranderingen in de ordenend-snelle parameters en hun vertakkingen leiden tot een betere stedelijke omgeving die de vervulling van de voorwaarden voor TOD dichterbij brengt.

Tot dusverre hebben we de laatste onderzoeksvraag beantwoord door te wijzen op regelmatigheden in de stadsparameters. Ze functioneren op de ordenend-gevangen en snel-langzaam dimensies. De twee dimensies definiëren vier typen parameters, waaronder de ordenend-gevangen categorie het meest dominant is in de bepaling van stedelijke configuraties. En het zijn de parameters die urban designers als uitgangspunt zouden moeten nemen in hun werk. Verandering hierin brengt verandering in andere typen parameters te weeg. We noemen dit proces vertakking voor de realisatie van TOD in de complexe stedelijke omgeving.

### *Toekomstvisie voor Chinese steden*

Wat zou er gebeuren indien bovengenoemd vertakkingsproces inderdaad zijn beslag kreeg? Wanneer het op de planning van nieuwe projecten of stedelijk beleid aankomt, communiceert de gemeente actief met de provincie aan de bovenkant en het district aan de onderkant, en monopoliseert besluitvorming niet langer. Voor het eerste wordt de gemeente bewogen tot het verkrijgen van bestuurlijke bevestiging en financiële steun van de provincie indien de voorgestelde projecten milieuvriendelijk zijn en bijdragen aan TOD. Voor het laatste levert de gemeente zijn conceptplan aan burgers door het district en het publiek erbij te betrekken zodat kan worden ingeschat hoe deze aansluiten bij algemene publieke waarden en verlangens. Met name wanneer het raakt aan de coördinatie van plannen rond ruimtegebruik en transportnetwerken, zijn sectorspecifieke ontwerp- en planbureaus van verschillende vervoersmodaliteiten gerechtigd om wederzijds informatie en concept-plannen uit te wisselen. Investerings in stedelijke snelwegen worden teruggeschoefd, terwijl de gemeente zijn budgettaire kaarten zet op de versterking van dienstverlening door openbaar vervoer. Intermodaliteit and interoperabiliteit worden verbeterd door vestiging van een



onafhankelijke instantie die vervoersdiensten coordineert, zowel fysiek als qua management. Autobezitters zullen aarzelen alvorens ze besluiten in de auto te stappen omdat het een onaantrekkelijke ervaring is vanwege ernstige congestie en parkeerproblemen. Openbaar vervoer daarentegen kan zijn positie verstevigen door een groeiend aantal lijnen met 'exclusive right of way' (ROW).

Indien de criteria voor kaderbeoordeling inderdaad worden gewijzigd door serieus aandacht te besteden aan milieukwaliteit, het meest belangrijke wat een burgemeester in China kan doen is het uitvoeren van een Strategic Environmental Assessment (SEA) als een systematisch en alomvattend instrument voor de integratie van verschillende milieueffecten van voorgestelde stadsprojecten om de prestaties op sommige indicatoren te verbeteren. De burgemeester bevordert de transformatie van de industriële structuur van een traditionele en vervuilingintensieve in een kennis- en technologiegestuurde, waarbij alleen high-tech en high value-added industrieën en investeringen sterk aangemoedigd worden als bijdrage aan de economische ontwikkeling; voor wat betreft de stedelijke vervoerssector, de burgemeester promoot de optimalisering van bestaande netwerken van wegen om een hogere efficiency te bereiken in plaats van wegverbreding na te streven. Hij stelt beperkingen aan investeringen in wegen omdat hij weet dat wegvervoernegatieve effecten heeft op energieverbruik, luchtvervuiling, CO<sub>2</sub> emissies, ongelukken op de weg, grondverbruik en geluidhinder, welke allemaal negatief uitwerken op zijn prestatieoverzicht. In plaats daarvan faciliteert hij openbaar vervoer; hij initieert spoorprojecten; geeft voorrang aan snelle busverbindingen; en besteedt aandacht aan efficiënt ruimtegebruik. He promoot ook groene voertuigen, eerst in gebruik gesteld door vervoersbedrijven en overheden, maar later ook door grote ondernemingen en individuele automobilisten via gunstige belastingregelingen.

Wanneer planningraden worden ingesteld in bepaalde gebieden, bevatten China's stedelijke masterplannen geen districtplannen en gedetailleerde bouwplannen meer. Ze richten zich liever op generieke ruimtelijke visies en doelstellingen zoals vereisten voor intensief en divers ruimtegebruik en TOD. Een verscheidenheid aan mensen en organisaties, waaronder overheidsafdelingen, publieke en private ondernemingen, kleine bedrijfjes, vervoersbedrijven, planningsinstituten en individuele politici zijn in staat hun gedetailleerde bouwprojecten, -plannen of -programma's in te dienen. Ze hebben gelijke macht in de vorming een gedeelte van de stedelijke configuratie. Er zou concurrentie zijn onder de indieners over de verwerving van middelen omdat er van diverse kanten voorstellen komen. Verscheidene kandidaten azen wellicht op hetzelfde stukje land. In dit geval moet het planningshof bepalen welke projecten de stad de beste vooruitzichten bieden om de doelen uit het masterplan te bereiken. Het is ook mogelijk dat grond braak ligt en het planningshof wacht op goede voorstellen. De politici domineren het planningsproces niet meer, en hun plannen moeten eveneens evaluatie door het hof ondergaan. De wettelijke procedures worden belangrijker; analisten, experts en professionals spelen een cruciale rol in de beoordeling van de

voorstellen; de effectiviteit van machtsuitoefening en grootschalig gebruik van persoonlijke netwerken wordt behoorlijk gereduceerd.

Tenslotte, als de onroerend goedontwikkelaars meer maatschappelijke verantwoordelijkheid krijgen in het verschaffen van huisvesting en duurzaam ruimtegebruik zullen de Chinese steden in de toekomst bestaan uit verscheidene kleinschalige openbaar vervoergeoriënteerde gemeenschappen. De gemeenschappen leveren gemengde woningtypen voor mensen van verschillende inkomensgroepen. Elk gebouw hoort bij de gemeenschap en wordt omgeven door een landschappelijk fraai plein, speeltuinen, diverse kleinen winkels en een of twee restaurants. Een stelsel van voetpaden verbindt alle buurten met elkaar. Auto's zijn niet toegestaan in deze gemeenschappelijke ruimte, en er komen aparte toegangspoorten en wegen die auto's direct naar de ondergrondse parkeergarages geleiden. Het is niet alleen een plek vol huizen maar ook een waar huiseigenaren kunnen spelen, babbelen, en diensten en recreatie vinden. Bewoners kunnen hun dagelijkse behoeften en activiteiten binnen de gemeenschap afwikkelen, en als gevolg daarvan daalt de vraag naar lange afstand vervoer aanzienlijk. Voor lange afstand verkeer leveren de ontwikkelaars bewoners minibuses die de gemeenschap verbinden met de meest nabije knooppunten voor openbaar vervoer of ze partneren met bestaande aanbieders om tot een overeenkomst te komen over de uitbreiding van de routes. Zulke gemeenschappen zijn daarom OV-georiënteerd; het zijn prettige oorden om in te wonen en werken, ook voor kleine productie- en dienstverlenende bedrijven, met goede OV-bereikbaarheid.

# About the Author

Mu Rui was born in Shenyang, Liaoning Province, China, on February 19, 1983. She graduated from Dalian University of Technology in 2006 when she obtained her bachelor degree in project management of civil engineering. After graduation, she went to the Netherlands and continued her study at Delft University of Technology where she obtained her master's degree in 2008 and specialized in engineering and policy analysis. Her master thesis focused on public-private partnerships and the management of expressways in China approached through agency theory. She graduated under the supervision of Prof. Ernst ten Heuvelhof and Prof. Martin de Jong, who also became the promotor and co-promotor for her dissertation.

In January 2009, she became a Ph.D. candidate at the Policy, Organization, Law and Gaming section in the Faculty of Technology, Policy and Management at Delft University of Technology. Her Ph.D. research focused on Transit-Oriented Development in China and aimed at searching for a new planning paradigm for self-organizing cities. The research was partly funded by the Delft University of Technology and partly by the Next Generation Infrastructures. Apart from her Ph.D. research, she also developed and published several articles in *Journal of Transport Geography*, *European Journal of Transportation and Infrastructure Research*, and *Policy and Society* on various topics revolving around public administration and decision-making in the transport sector in China.



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