

# **Trust in Water: An Institutional Analysis of China's Urban Tap Water Provision System**

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## **Dedication**

This thesis is dedicated to my parents, Wei Xiao and Weixing Zhang, for your love and selfless support to me. Thank you for everything.

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## Abstract

This thesis presents a comprehensive institutional analysis of China's urban tap water provision system from a 'source to sip' holistic research perspective. With the examination of each agent's function in the system, this thesis coins the concepts of semi-potable tap water and Hybrid Institutional Architecture to illustrate the essence of China's urban water provision system as a 'source to consumer' semi-potable tap water provision system. Based on this argument, the concept of Consumer Coping Strategy Matrix is established with analyses of its seven facilitating factors to explain Chinese tap water consumers' involvement in the potable water production. Their activities have established a 'consumer to sip' potable water production process, functioning as a compensation to 'source to consumer' urban semi-potable tap water provision system. The combination of these two systems is a 'source to sip' urban potable tap water provision system. This thesis also provides a detailed analysis of the three institutional inconsistencies in this system, arguing that they have filled the Hybrid Institutional Architecture with internal inconsistencies, which makes semi-potable tap water an inevitable outcome of Hybrid Institutional Architecture. Meanwhile, this thesis illustrates the concept of Consumer's Normalisation to semi-potable tap water, the Hybrid Institutional Architecture and Consumer Coping Strategy Matrix, arguing that such normalisation has disguised and justified not only the existence of the aforementioned concepts, but also the existence of the latent social injustice and consumer's powerlessness. All of these analyses contribute to the form of consumer's institutional distrust in semi-potable tap water. With this institutionalised distrust, an imbalanced dialectical relationship between the Hybrid Institutional Architecture, the Consumer Coping Strategy Matrix and water crises will turn consumer into the trigger of sociogenic water sustainability crises. A detailed case study of Harbin is presented to demonstrate the two sociogenic water sustainability crises occurred in Harbin with archival data and the establishments of contingent combination model, and the Hybrid Institutional Architecture of Harbin's urban tap water provision system with examining interview materials from four senior officials of key departments.

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## List of Abbreviations

<b>BCA</b>	Beijing Consumer Association
<b>BOT</b>	Building-Operation-Transfer
<b>BWG</b>	Beijing Waterworks Group
<b>CNKI</b>	China National Knowledge Infrastructure
<b>DHCCNHA</b>	Drinking Healthy Committee of China National Health Association
<b>DWI</b>	Drinking Water Inspectorate
<b>GONGO</b>	Government-Organized Non-Government Organization
<b>HWDG</b>	Harbin Water Drainage Group
<b>HWSDG</b>	Harbin Water Supply and Drainage Group
<b>HWSG</b>	Harbin Water Supply Group
<b>IWA</b>	International Water Association
<b>MC</b>	Ministry of Construction
<b>MCHURD</b>	Municipal Commission of Housing and Urban-Rural Development
<b>MHURD</b>	Ministry of Housing and Urban-Rural Development
<b>MEP</b>	Ministry of Environmental Protection
<b>MEPB</b>	Municipal Environmental Protection Bureau
<b>MH</b>	Ministry of Health
<b>MHB</b>	Municipal Health Bureau

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<b>MLR</b>	Ministry of Land and Resources
<b>MWAB</b>	Municipal Water Affair Bureau
<b>MWR</b>	Ministry of Water Resource
<b>NEPA</b>	National Environmental Protection Administration
<b>NDRC</b>	National Development and Reform Commission
<b>NGO</b>	Non-Governmental Organisation
<b>PCC</b>	People's Political Consultative Conference
<b>PDRC</b>	Provincial Development and Reform Commission
<b>PPP</b>	Public-Private-Partnership
<b>SOE</b>	State-Owned Enterprise
<b>QEITSC</b>	Qingyun Environmental Information Technology Service Centre
<b>SSLE</b>	Shanhetun State-Owned Logging Enterprise
<b>UNEP</b>	United Nations Environment Programme
<b>UNICEF</b>	United Nations Children's Fund
<b>WHO</b>	World Health Organisation

# Chapter 1 Introduction: Tap Water in China

To most Chinese tap water consumers, fresh water resources has an internal paradox. From a sustainability perspective, fresh water resources are precious. China's fresh water resources capacity is not only limited but also geographically unevenly distributed, leading to the fact that nearly every water crisis is a long-term and difficult one (Hu and Wang, 2003). From a management perspective, the administration of fresh water resources is full of challenges. China's tap water provision system is one of the most complex government administration systems, which has been influenced by at least three government administration reforms since 1998 and remains full of conflict and incoherency. From consumer's perspective, fresh water provision is commonplace. Consumers have taken for granted the semi-potable tap water (the definition of it will be given in section 3.2), as well as its low water price, for a long time, and have developed a series of coping strategies to deal with the inferior quality of tap water. Obviously, these three distinctive yet interconnected dimensions of fresh water resources have certain contradictions with each other, which would give rise to the outbreak of a sociogenic water sustainability crisis (its definition will be introduced in section 3.9). A comprehensive understanding of these three perspectives, as well as the sustainability crisis they have triggered, can only be established through institutional analyses of three themes: China's unique urban tap water provision system, Chinese tap water consumer's behaviour and distrust in tap water, and, most importantly, the mutual influences between them.

However, although a large volume of research has focused on the problems either of China's tap water quality, tap water quantity, or tap water provision system, little attention has been spent on Chinese tap water consumer, which then results the neglect of the political, economic and power problems associated with the tap water consumer in dealing with semi-potable tap water. As Erik Swyngedouw (Swyngedouw, 2009, p.58) has rightly pointed out: 'water research has for too long concentrated on either the physical

side or the managerial side of the water problematic, often tiptoeing around the vexed question of how political, economic power relations fuse the physical and the managerial together in particular and invariably socially uneven ways.'

Why does the consumer's trust in tap water deserve our attention? There is a simple answer to this question. It is because the pervasive institutional distrust of the urban tap water in China has become such an obvious social fact that no one can deny its existence and ignore the social unrests it has triggered in recent years. In other words, the theme of 'trust in water' is not an invention, but a reflection of the problem that already exists in Chinese people's lives. It is not only related to a series of environmental accidents and scandals, but also the centre of many debates. In other words, it is not the theories that prompt us to examine the issue of trust in tap water, but the many catastrophic outcomes initiated by pollution accidents and scandals that remind us consistently of the necessity of examining the consumer's trust in urban tap water at an institutional level.

## **1.1 China's urban tap water provision system**

China is a country famous for its urban tap water provision system in both positive and negative ways. It is in this country that the largest water diversion project in human history, the South-to-North Water Diversion Project was implemented and completed, even though the idea of modern tap water was introduced as late as the end of the 19th century when many Western countries had already developed tap water for many years. Given the data from China Urban Construction Statistical Yearbook (Ministry of Housing and Urban-Rural Development, 2016, p.227), between 1978 and 2015, the tap water coverage rate had increased from 45.1% in 1985 to 98.07% in 2015. The length of pipeline grew from less than 35,985 kilometres in 1978 to 710,206 kilometres in 2015. The number of water-served population rose from 62.671 million in 1978 to 451.126 million in 2015. The total amount of domestic water consumption has increased from 2.75854 billion cubic meters to 28.72695 billion cubic meters.

At the same time, it is also in this country that a series of tap water scandals influenced millions of citizens' daily lives. For example, in March 2013, there were 10,164 dead pigs floating down the Huangpu River, the tap water source for Shanghai as a city with a population of 14.35 million (China Water Safety Charity Fund, 2015) (see Figure 1.1). It is also in this country that during each of these crises, many urban citizens ignored the government announcements and promise for the safety of tap water, and rushed to empty shelves of bottled water (see Figure 1.2). It is also in this country that boiling water is still pervasive today as an advocated individualised protocol for disinfecting water for everybody, reflecting a practice that was adopted for thousands of years and was justified by Chinese traditions and medicines.



**Figure 1.1: The corpses of dead pig beside Huangpu River<sup>1</sup>**

<sup>1</sup> Source: <http://www.japantimes.co.jp/news/2013/03/12/asia-pacific/dead-pigs-in-river-havent-hurt-water-supply-shanghai-says> Accessed: 15 April 2017



**Figure 1.2: The empty shelves of bottled water in a shopping mall after the outbreak of Lanzhou tap water pollution scandal, 2014<sup>2</sup>**

Moreover, by taking a closer look at the whole system of urban tap water provision, one can observe that nearly every section of the system has serious problems. In respect to the water source, in some reports, 97% of the freshwater resources in China have been polluted (Luo, 2014). In respect to water treatment plants, Wang Zhansheng, the president of the National Water Advanced Treatment Research Association claimed in a report that ‘99% of China’s water treatment plants are still equipped with the water treatment technology that has been used for one hundred years’ (Luo, 2014). In respect to the quality of treated water, given the survey result of the treated water quality among 4457 urban water treatment plants between 2008 and 2009, only 58.2% of them produced tap water that was certified according to the national standard of tap water (Xinhuanet, 2012). In respect to monitoring and supervision, several serious

<sup>2</sup> Source: <http://english.caixin.com/2014-04-24/100669924.html> Accessed: 15 April 2017

water pollution accidents in China were noticed by chance, including the cadmium pollution in Zhuzhou and Xiangtan in 2008, the cadmium pollution in Longjiang River in Guangxi Province in 2012, and the tap water pollution accident that happened in Lanzhou in 2014, which has affected over 2.4 million citizens (Luo, 2014). In all three cases, the pollution was identified in random examinations. Hence, there is a high possibility that there are other pollution accidents that have not been noticed, since they may outbreak in the time gaps between different water quality examinations. With respect to the pipeline system, in China, 32.8% of the main urban pipeline is made from substandard materials, and 37% of them have an aging problem. In some Northern areas of China, the leakage rate of the urban water supply even reached 66% (Gong and Liu, 2012). With respect to the secondary water supply (or decentralised locally/community managed water supply equipment/facilities), the administration of its equipment is varying by cities. In some undeveloped cities, without effective administration and supervision, these facilities have been problematic for a long time, reflecting on occasional news about dead mouse in the water tank<sup>3</sup>. Finally, these facilities are always managed by local community services, who are neither qualified nor have a willingness to manage them. Finally, regarding public participation, in many cities and counties of China, public visits to the local tap water treatment plants are strictly controlled, if not fully prohibited. Meanwhile, there is no unified information disclosure for China's urban tap water quality. However, despite all these institutional incoherencies, the current urban tap water provision system still operates in an apparently stable and self-balanced manner.

These serious problems lead to another serious question: If trust in tap water is so important, why hasn't it received more attention from social scientists? As part of the endeavor to deal with the tap water crises, researchers have published several reports and papers focusing on the technology of water treatment. However, compared to the passion for technology innovation studies, few research papers have been written discussing the sociogenic roots of water sustainability crises. The research tendency has progressively reached an extremely unbalanced point. For instance, between 2012 to 2015, there were

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<sup>3</sup> Source: <http://www.chinanews.com/sh/2012/01-30/3630558.shtml> Accessed: 12 April 2017

15902 newspaper and 84098 web articles related to tap water pollution in China, more than 100 news reports per day on average<sup>4</sup>. One of the most prestigious science journals, *Nature*, has published 5925 relevant articles and papers about water affairs in China from 2005 to 2015<sup>5</sup>, this is a sharp contrast to the 1,414 relevant articles and papers published in all social science and sociology journals between 2005 to 2015<sup>6</sup>.

Moreover, there is a general neglect of social research in the production process of tap water, not to mention to study it in the context of the particular country, culture, political regime, economic pattern and social routine, and to study its associated impacts on the different agents of urban tap water provision system. As Mark Harvey (2015, p.15) rightly pointed out, 'much of the discussion around processes of qualification has been focused on market commodities (of which commercial bottled water is a case in point).'

Why has such an essential environmental-sociological topic been neglected by China's social science researchers for such long time? One possible explanation is that given the particular cultural, social and technological backgrounds of the tap water provision system, despite having experienced several tap water crises, the acceptance of semi-potable urban tap water (this concept is defined in section 3.2) has long been taken for granted by the Chinese. As will be revealed in this thesis, owing to tradition, the government's tacit consent, market, media propaganda, the low tap water price, water crises and social memory, and the knowledge and information gap, the public has normalised and accepts the fact that China's tap water is not potable. This normalisation and acceptance surprise many foreigners who come from other countries and places where tap water can be drunk directly. McGuire (2014), commenting the practice of boiling water in China, argued that it is not as simple as tradition. The custom of boiling water

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4 It is the searching result by using WiseNewsSearch with the date period between 2012/1/1 to 2015/1/1 and the two key words: tap water and pollution. [http://www.wisers.com/zh-cn/products\\_services/wise\\_news](http://www.wisers.com/zh-cn/products_services/wise_news) Accessed: 2 March 2016

5 It is the searching result from the website of Nature with the date period between 2005 to 2015. <http://www.nature.com/index.html> Accessed: 1 December 2016

6 It is the searching result from website of JOSTER with the date period between 2005 to 2015 in discipliners of Sociology and Social Science. <http://www.jstor.org> Accessed: 5 April 2016

has imposed a profound and deep-rooted influence on the development of the urban tap water provision system. His perspective is essential for us to understand the 'missing' link between 'source to consumer' tap water provision system and 'consumer-made potable water.' A neglect of this individualised water disinfection protocol has at the same time masked many institutional flaws long-existing in the China's current urban tap water provision system.

Such cultural, social and technological influences combine with the complexities of the aforementioned 'vicious circle' to formulate an image of tap water that is full of paradoxes and contradictions. Only when water crises happened did many Chinese for the first time become aware of the problem of tap water and their powerlessness in dealing with it. As will be demonstrated in Chapter 5, when consumers aware their powerlessness in water crises, they would become extremely anxious, which is one of the main triggers of sociogenic water sustainability crisis.

In conclusion, a consumer-oriented institutional analysis of China's urban tap water provision system is necessary for achieving a comprehensive understanding the characteristics of and incoherencies in the power, money, and water flows circulating between government, market and consumer. In Chapter 1, with an introduction of the imperative of institutional analysis of tap water, the research rationale is outlined and accompanied by a discussion of research methodology. Chapter 2 provides a literature review on the main themes of this thesis, which paves the way for the construction of the theoretical framework from a holistic research perspective in Chapter 3, which presents two essential concepts of this thesis, the Hybrid Institutional Architecture, and Consumer Coping Strategy Matrix. To have an in-depth understanding of these two concepts, in Chapter 4, an institutional analysis of three incoherencies in power, money and water flow of China's 'source to consumer' semi-potable tap water provision system will be presented on the basis of systematic analysis of the data and information from interview materials, media reports, government documents, academic publications and so on. Chapter 5 and 6 present a comprehensive and detailed case study of Harbin, a city located in the North China. With organising data and information from various sources, Chapter 5 offers an institutional analysis of two sociogenic sustainability crises that

have occurred in the recent history of Harbin. Chapter 6 presents institutional analysis on the basis of synchronised interview materials from four interviewees in key responsibility of Harbin's tap water provision system, revealing the intricacies of China's 'source to consumer' semi-potable tap water provision system, underlining the production of semi-potable tap water and Consumer Coping Strategy Matrix as the inevitable outcomes of the Hybrid Institutional Architecture. In the end, the general discussion of the thesis is concluded in Chapter 7.

## **1.2 Research rationale: the trajectory of understanding trust**

Few would doubt the validity of the following claim: tap water is an indispensable part of urban citizens' everyday lives, but few have given a thought to the meaning of trust in tap water. Both 'trust' and 'tap water' are themes with far-reaching academic potential that impossible to be exhausted in one thesis. They can both relate to very general theories and very specific case studies. Thus, the main challenge of establishing a research rationale to study trust in tap water is how to keep a balance between the generality and specificity of 'trust' and 'tap water.'

To solve this problem, it is necessary to ask several rather than one research question to reveal the connection between the generality and specificity of these two concepts. The generality of two concepts will be defined by research questions, and the Chinese specificity of them will be elaborated in the answers. In this thesis, three interconnected subordinate research questions and one main research question will be posed and answered in the following chapters.

The three subordinate research questions are:

First, what kind of tap water is supplied to China's tap water consumer?

Second, on the basis of the answer to the first question, what kind of system is supplying the aforementioned tap water?

Third, on the basis of the answers to the first and second question, what are the consumer's reactions and responses in the aforementioned tap water and tap water provision system?

The institutional analysis of these three subordinate questions have formulated a cumulative theoretical logic for, and the springboards of inquiry into, the main research question of this thesis: What is consumer's institutional trust and/or distrust in China's tap water?

Compared to the traditional research pathway that dives into the massive literature and data regarding trust and tap water, this research rationale aims to constitute the foundations for the theoretical framework, paving the way for an in-depth examination of these two concepts. Such a research rationale is particularly useful for studies targeting China, since its situation is too complex and distinctive when compared tap water provision systems in other countries.

In general, this question-answer rationale can be described as similar to the effort of cutting a big apple into smaller pieces, finding its core and then assembling these pieces back together. The assembled 'apple' may still look like the original one, but regarding an inside-out 'analysis' it can be digested piece by piece, rather than eaten as a whole.

On a closer inspection of the three subordinate questions above, a certain logic can be observed. The first question is to define the tap water regarding the specific temporal and geographical conditions, which turns it into a macroscopic question. The second question is about the system of supplying tap water as defined in the first question. It is an intermediate question that connects the analyses at a macro and micro level. The third question focuses on the tap water consumer's role, a crucial factor that, to a large extent, compensates the deficiencies of the current urban tap water provision system. This three-level framework of research inquiry presents both the prerequisite and the rationale for analysing the consumer's institutional distrust in China's tap water.

## 1.3 Methodology

### 1.3.1 Archival research

Given the sensitivity of the theme and the novelty of the theoretical framework of this thesis, there are not many academic publications available for reference. This thesis tries to compensate for the deficiency in academic sources by explaining archival data from a wide variety of other sources, including but not limited to government documents, other Ph.D. dissertations, monographs, web articles, news reports, and social media. To guarantee and secure the credibility of these data, especially data from web articles, this thesis mainly relies on data from authoritative news websites or government official news websites. Among these archival data, the Chinese archival data is mainly collected through online databases, including but not limited to China's Core Newspaper Database, China's Core Journal Database, and China's Outstanding Dissertation Database. All of these Chinese databases are sub-databases of National Knowledge Infrastructure (CNKI).

This thesis will comment on archival data that does not have reliable and authoritative sources. However, since their number is not significant, these archival data will not exert a major influence on the general picture of institutional analysis.

All of the aforementioned archival data are the foundation of the theoretical framework established in Chapter 3 and the main reference of the institutional analyses in Chapter 4 and 5.

### 1.3.2 Semi-structured interview

Due to the fact that water resources are managed by a centralised and complicated administration system in China, the consumer does not hold much of its information. Rather, these information is held by a few people who are in key positions in this system. Thus, a semi-structured interview with the powerful elite is employed in this research. Here, the powerful is defined as a certain group of people, though in a small number, who are the 'cause and cure of social problems' (Williams, 2012, p1) . Williams (2012, p11)

pointed out that the study targeting the powerful is defined as elite study targeting 'up-system', which is different from the traditional social study that often targets people from 'down-system' of the society.

To elaborate this 'up-system' research, an in-depth and semi-structured interview is employed as a probe to identify the stances, arguments, and interests of both these interviewees themselves and their working departments. For Irving Seidman (2015, p.7), interview is a way in which details of experience has been reorganised by interviewee to reflect the social issues predicated on them in an abstraction form. Accordingly, ten people who hold important positions in the urban tap water provision system, have been interviewed in this thesis, including three experts in tap water provision and sewage treatment, one senior official in water administration department, one senior official in health supervision department, one senior engineer in water treatment plant, one senior official in water supply group, one senior manager in water utility company, one NGO leader, and one senior representative of drinking water industrial association.

The small number of interviews owes much to the political and social sensitivity of the theme of this thesis. Before the author employing his social network to identify and access the gate keepers of key departments, ten interview requests were either ignored or rejected, including five interview requests of experts, three interview requests of governmental departments, and one interview request of industrial associations and one interview request of water company. Given that, the author decided to restructure the content of this thesis by omitting the case study of Beijing.

Getting access to these ten interviewees was incredibly difficult. Obtaining access required personal and political networks and connections, which means that certain areas of discussion are taboo, especially in the interview case with senior officials from government departments. As Melanie Manion (1994) and Zhou Lihong and Miguel Baptista Nunes (2013, p.420) have pointed out, this problem is related to the difficulties of conducting social science research in a special 'Chinese context'. Manion (1994, p.741-742) argued that for quantitative research, 'obtain nation-wide probability sample of the Chinese population is both impossible and impractical', and for qualitative research, interviewees are '[...] chosen partly for

convenience and always subject to the approval of the Communist authorities.’ In the case study of Harbin, with the help of parents, the author got access at first to a senior official whose working areas include water administration. This senior official then contacted one interviewee in water company, from whom the author got the permission to visit water treatment plant and the contact information of other interviewees. Thus, here it can be said that the interview strategy in this research is that It is essential to be introduced by a senior figure who performs as gatekeeper in an inner circle such as water provision system, since him or her always can introduce you to other interviewees who were hard to get access through other means. In this sense, the obstacles, restrictions and limited channels of access to interviewing stakeholders in the water provision system are themselves an indication of why there is a lack of public trust in tap water provision.

Those interview materials have been embedded in Chapter 3 for theory development, Chapter 4 for institutional analysis, and Chapters 5 and 6 for a case study of Harbin’s current tap water provision system. During this process, both the name and the identities of interviewees have been anonymised for confidentiality.

During the semi-structured interviews, none of the respondents have disclosed any confidential data regarding any organisations. Most of their narratives are about their experiences and opinions. As it may occur in any interview analysis, there is a risk of misinterpretation and misunderstanding. To deal with this risk, the interview materials are analysed in the context of their current jobs, and their opinions are examined in light of the data collected in the archival research introduced in the previous section. By combining these two methodologies, the potential risks is counteracted to an acceptable degree. The interview materials are translated, organised and analysed through NVivo.

These interviews are designed on the basis of every interviewee’s situation specifically, with the semi-structured format and open-ended questions. This design is predicated on two considerations: first, the aim of these interviews is not to test any existed hypotheses, but to construct new hypotheses. The opened-up questions are useful tools to collect the ideas, opinions, and information. Second, the

differences between these interviewees and the general public are stark. In their replies, they always went beyond the bounds of the questions being asked to give additional information. Therefore, it would have been difficult to confine the interviewees within the format of a standardised structured interview schedule. In this case, the material generalised from the interview is mainly through inductive reasoning, accompanied by the deductive reasoning employed in the process of archival research.

To overcome the difficulty of insufficient interview materials, this thesis supplements these materials with all kinds of resources, including but not limited to the data from relevant academic publications, news reports, web articles, government documents, NGO reports, and so on. As a result, the interview materials are embedded into an analytical framework established in Chapter 3 and are checked and triangulated against other sources to demonstrate the intricacy of the urban tap water provision system.

### **1.3.3 Case study**

Case study has been employed with the aims of narrowing down the research into a manageable scope on the one hand, and to examine and refine the theoretical framework constructed in Chapter 3 on the other. This thesis selects Harbin, a city located in North China, as the target of case study.

The reasons for choosing this city as the target of case study require further explanation. First, both trust and urban tap water are broad research themes. Case study is useful to specify their generality to a tangible degree through integrating a series of specific temporal, geographical, environmental, political, economic and social conditions into analysis. Second, a detailed scrutiny of urban tap water provision system would be helpful to summarise the developmental trajectories of other Chinese cities' urban tap water provision systems.

Third, given the difficulties associated with the research on trust in individual level, the case study can provide a compensation to the understanding of consumer's reaction to urban tap water provision system. In other words, consumer's trust and distrust can be revealed through analysing the developmental trajectory of urban water provision system in the case city. This is because the fact that compared to the

data of consumer's behaviour, the data of a city's development is much more abundant, much easier to access, and much more comprehensive to be examined to establish new theoretical hypotheses and frameworks. These data are mainly derived from city's yearbook and statistical record, as well as various papers and books focusing on the operation of one or many agents in Harbin's urban tap water provision system.

Besides, as will be demonstrated in Chapter 6, the institutional analysis of urban tap water provision system, especially the institutional analysis of the Hybrid Institutional Architecture (its definition will be coined in section 3.4) requires a holistic research perspective to establish the causality between reality and hypotheses and between the limited conditions, problems and inevitable outcomes of urban tap water provision system. Only case studies of a city can present such analysis in an institutional level.

Given the analyses above, Harbin, the capital city of Heilongjiang, has been thoroughly examined in this thesis for two reasons: first, it is a famous industrial city which has experienced at least two remarkable sociogenic water sustainability crises. Thus, the institutional characteristics of this capital city are quite distinctive, and looking at institutional variation is an effective way to understand the specificities of Chinese water provisioning systems. Its tap water provision system can link the developmental trajectories of other major industrial cities throughout China; second, Harbin is the only city that the author can use his social network (*guanxi*) to get access the gatekeeper and other interviewees in key agent of urban tap water provision system. For author, it would be nearly impossible to implement the same case study in other cities since he would have no social network (*guanxi*) there to interview the local powerful people.

In a qualitative study, the major task is to interpret how the target of research works in a particular context. The examination of Harbin takes into the account of the generality of the main themes, the theoretical hypothesis constructed in Chapter 3, and the characteristics of the case cities. With detailed institutional analyses of the historical, cultural and social development of the tap water provision system, Chapter 5 mainly analysed Harbin's two sociogenic sustainability crises. Chapter 6, in another hand, analysed

Harbin's current 'source to consumer' urban semi-potable tap water provision system with an institutional analysis of interview materials.

## 1.4 Conclusion

This chapter introduced the structure of this thesis. It stresses the imperative of developing an institutional analysis in China's urban tap water provision system from a consumer perspective. To have a comprehensive understanding of the risk of sociogenic water sustainability crisis, which has yet been fully studied, demands an examination of China's tap water consumer. To achieve this goal, consumer's trust/distrust in tap water is the signal of consumer's attitude towards, and the reaction to, the flaws existing in the current tap water provision system. Three subordinate research questions and one main research question are presented as research rationale. Connected each other by cumulative theoretical thread, these research questions manage to cover four different themes, tap water, tap water provision system, tap water consumer and consumer's institutional trust in tap water, into a rationale framework. Archival research, semi-structured interview and case study are the three methodologies adopted in this thesis to achieve data from various sources.

# Chapter 2 A Literature Review: Water, Consumer and Trust

## 2.1 The political characteristics of water resources

To have a general view of the political characteristics of water resources, a scrutiny of historical perspectives is required. In the late 20th century, there was a heated and controversial debate on the relationship between power, water, and political regimes.

Karl August Wittfogel (1959) signals the culmination of such debate by the publication of *Oriental Despotism: A Comparative Study of Total Power* in 1957, believed to be the first theoretical analysis of the relationship between the social power and water (Swyngedouw, 2006, p.15). Taking China as the example, Wittfogel claimed that there was a causal connection between the demand of utilising water resources and the emergence and operation of despotic regimes. Presenting the idea of 'oriental despotism,' he argued that behind these despotisms there was a 'hydraulic society' whose legal and moral foundation is the operation of a comprehensive mechanism of hydraulic facilities. However, he did not place much emphasis on the connection between the hydraulic facilities and tap water supply facilities, just claimed that the former were the grounds for the latter.

Based on the critique of communist ideology, Wittfogel used his theory as a weapon to attack the legitimacy of the so-called despotic regimes. Such a controversial attempt severely divided the directions of further research by inspiring two new waves of research on the interaction between hydraulic management and political regimes in both Eastern and Western academia. In China's academia, the research developed in three stages.

The first stage was the ignoring stage. This is signaled by the fact that although Wittfogel's work was mainly targeting the history of China, it was not published until 1989, and was never reprinted again, despite having been translated into Chinese in the early 1960s. The second stage was the denouncing stage. It began from 1990 and lasted almost ten years. Two special symposia were held in 1990 and 1994 in China, whose main themes were to denounce Wittfogel's work critically. In 1997, a collection titled *The Comments of Wittfogel's Work 'Oriental Despotism'* was published based on the outcomes of the two symposia. It consists of 15 articles by 18 prominent Chinese historians, criticising Wittfogel's work from different historical and theoretical perspectives (Li, 1997). For example, one contribution argues that there were several equally important factors that influenced the prosperity of society, which discredited the direct connection between the power of Chinese dynasties and the intensity of hydraulic management. This book paved the way for the third stage, which has redefined the meaning of 'hydraulic society' in the Chinese context. Wang Ming Ming (2005, p.23) argued that '[...] the way of a combination of hydraulic resource and the society in given regions is possibly a topic with far more importance than the idea of "hydraulic society"'. The main concern of his claim is that the various kinds of contradiction around the distribution of water resources as a public good can demonstrate a comprehensive picture of society. Until now, it can be said that the research perspective of the idea of 'hydraulic society' has been transformed from the top-down research perspective in Wittfogel's work to a bottom-up research perspective, and its definition has been dramatically depoliticised in a more detailed research scheme.

Nowadays, many western scholars have inherited Wittfogel's perspective in analysing the development of society regarding the development of hydraulic facilities. For example, Erik Swyngedouw (2005) has coined a conceptual triad about the relationship between water, money, and power, which will be highlighted in the next section. Francois Molle (2009) underlined the concept of 'hydraulic bureaucracies' from Wittfogel's narrative, though the original term only appeared once in the book as 'agro-hydraulic bureaucracy,' emphasising the crucial function of a type of bureaucracy that is in charge of the specific issues of water management. Historically speaking, the emergence of the hydraulic bureaucracies can be seen as the natural outcome of the circulation of power and capital. On the one hand, in areas with low

agricultural productivity, there was a high demand of constructing hydraulic facilities. On the other hand, those who have been bestowed with the power of managing water resources are eager to make use of this power by circulating it in a given administration system, which would then promote the circulation of capital. As a result of the combined actions, the construction of large-scale hydraulic facilities became prevalent. In this context, power and capital would be gradually centralised into the hands of a small group of people, which consists of 'a cadre of professionals' (Molle, Mollinga and Wester, 2009, p.328), including but not limited to 'scientists and engineers who achieved sophisticated ability to manipulate the natural riverine environment' (Molle, Mollinga and Wester, 2009, p.329). These professionals always occupy leadership roles in various water resources management agencies, thus creating what is labeled as 'hydraulic bureaucracies.' Molle's work tried to avoid the cold war style of debate over ideology divergence, which was one of the main themes in Wittfogel, resulting in the omission, to a large extent, of the direct connection between the hydraulic society and the regime. Therefore, the developmental trajectory of hydraulic bureaucracies is similar to the developmental trajectories of other types of bureaucracies, whose foundations are also the circulations of power and capital. The hydraulic bureaucracy was mainly discussed regarding its negative influence on constructing and managing hydraulic facilities, rather than connecting it to the legitimate governing of people, as Wittfogel demonstrated.

Since many developed countries have undergone the privatization reforms in water management which have contributed to the decentralization of the power of managing water resources, and since the rising environmental movement has nurtured the awakening awareness of their civil societies, the power and capital shared by such bureaucracies have been partially shifted to the market and the hands of the citizen, resulting in the raising of a series of new questions regarding the interconnection between water, capital, market and community. The basic theoretical foundation of 'hydraulic society' and 'hydraulic bureaucracies' is undergoing a radical modification.

Karren Bakker (2013) focused on managing water as a public resource. Developing her argument about water as 'uncooperative commodity' (this concept will be reviewed in next section), she claimed that given

the turbulence triggered by the uncooperativeness of water resources in both pricing and managing, tap water administration in UK has experienced both the 'market failure' and 'governance failure' in its attempt of neoliberalisation. This argument reflects the complexity of tap water administration and its internal conflict with the ideology of neoliberalism.

Maria Kaika (2003) claimed that the 'social production' of water's scarcity and its associated implications for water politics deserve further attention. In her work, the project of water facilities in Athens did not solve the problem of water scarcity but sustained the socio-economic order and the current economic and social pattern of water supply and consumption. She pointed out that by building the equation between scarcity, valuable and expensive, the natural drought has been transformed into the socially constructed water scarcity, paving the way for the following hydraulic facilities, which sustains the current socio-economic arrangement and opens up the opportunity for privatisation. In other words, the manifestation of water scarcity was driven by the social agents who would like to benefit from shifting power relations associated with the new water resources arrangement. In China, particularly in developed cities, the situation is the total opposite: the sense of water affluence is socially and politically constructed and normalised to function as the stabiliser of the current urban tap water provision system. This will be analysed in further in Chapter 3.

At the specific level of hydraulic facility construction, the traditional motivations have gradually ceased to be significant given two main reasons. First, agricultural productivity in China has been dramatically improved by the wide-spread utilisation of fertiliser and pesticides. Consequently, large-scale hydraulic facilities are no longer urgently demanded as the sole method of improving the agricultural productivity, as it was in China's history. Second, the basic agricultural hydraulic network has been already established, and agricultural development has ceased to be the facilitator for constructing large-scale hydraulic facilities. Instead, with the soaring urbanisation, the construction of tap water provision system is now increasingly important for infrastructure development. However, they also suffer numerous

administration drawbacks. Chapter 3 will illustrate such importance and drawbacks with systematic analyses.

## **2.2 The economic characteristics of water resources**

In Chinese academia, the discussions around economic characteristics of water resources can be seen as policy-oriented and practical-oriented. This inevitably leads to a fact that most studies are focusing on specific economic indicators instead of general relationship between economy, nature and society. In other words, water resources is always being studied in the economic context that isolate itself from natural and societal contexts. However, as Harvey (2015, p.3) pointed out, tap water '[...] provided a powerful optic for exploring the relation between economy and nature.' Moreover, the recent development of China's urban tap water provision system has drawn many lessons from UK, making the analysis about UK's urban tap water provision system also becomes a particular valuable reference for understanding China's system. Given the above analysis, this section mainly reviewed three theoretical frameworks, which not only demonstrate the economic characteristics of water resources in a context that integrate not only economy but also nature and society, but also being developed from UK's practical experience in urban tap water provision system.

The original source of such analytical perspective is from Karl Polanyi. Highlighting the dynamic relationship between market and society, Polanyi (1957) argued that the market is incapable of regulating natural resources to prevent commercial exploitation that would lead to environmental destruction. This argument conflict with the ideal of neoliberalism, which aims to 'reorganising capitalism at multiple scale' (de Freitas, 2015, p.240).

Focusing on specific regulatory aspect of pervasive neoliberalization in UK and Global South, Karen Bakker (2003; 2005; 2013) analysed the differentiations between definitions of privatisation, marketisation and

commodification in neoliberalization, arguing that tap water is an 'uncooperative commodity' when supplied in an urban tap water provision system. In section 4.4.2, an analysis of China's marketisation reform in urban public utility will echo her argument through demonstrating the incoherency in money flow circulating in the urban tap water provision system.

In his study of tap water, Mark Harvey (Harvey, 2015) scrutinized the development of urban tap water provision system in different geographical and socio-economic contexts, elaborating the analyses of its connection with cultural, political, legal, biological and environmental processes. The concept of the economy in his research is defined from sociological and anthropological one, which means that there is an intellectual insulation between the presuppositions of investigators' understanding of the economy and the economy that under investigation. In this perspective, there is a fine line between the subjective judgment of the economy and subjective prejudice of economy.

#### **Karl Polanyi's theoretical framework: examine nature resource in social milieus**

To locate the relevant position of economic issues in all the social sciences, Karl Polanyi (1957) elaborated his theoretical approach and conceptual categories for analysing non-marketing economies in his book *Trade and Market in the Early Empires*. In this book, he offered a compact conceptual configuration of the substantive meaning of economy, aiming to bond the understandings of the economy and nature together and criticised the 'formal' meaning of economy which advocates the 'magic' of self-regulation of the market mechanism. By this logic, Polanyi argued that the economy's position is historically and socially dynamic, and the market mechanism has its inherent flaw in regulating the natural resources such as water.

Polanyi's arguments highlighted the fact that the economic characteristics of natural resource needed to be socially examined in specific social milieus and relationships. His theoretical concerns realise individual's limitation by their dependency on both natural environment and social relations. Both natural resources and social relations are required for human beings to satisfy their material demands. Thus, tap water exemplified the need to develop Polanyi's conception of substantive economy.

**Karen Bakker's theoretical framework: neoliberalisation of water resources and its failure**

In her work about the privatisation of tap water, Karen Bakker (2013) raised two questions: what is the difference between privatisation, marketization and commodification of water resource, and why they are deemed to be problematic in the case of tap water provision?

To answer these two questions, Bakker argued that the privatisation highlights the process of handover of ownership and/or management right from the central authority to private actors. Thus, it entails the change of organisational ownership. Marketisation includes commodification and commercialisation, it changes the mode of natural resource management, emphasising the commercial principles (such as efficacy), methods (such as cost-benefit assessment), and objectives (such as profit-maximization) (Bakker and Bridge, 2006). Thus, it entails an institutional change, which may include the change of rules, norms, and customs. The occurrence of privatisation may not entail the occurrence of marketisation, but the occurrence of marketisation may promote the occurrence of privatisation. Besides, in China marketisation is also considered as an alternative management instrument available for the public utilities to employ, mainly aiming to recover the full cost. This will be discussed in section 4.4.2.

As a part of marketisation, commodification is to create economic good from natural resources enabled by a specific institution, and then those economic goods will be transmitted to the market mechanism with a price being determined by supply and demand. The commodification can be summarised into two dimensions: the transforming dimension, which entails the market mechanism to initiate the exchange of natural goods by pricing, charging and allocation; and the reconstruction dimension, which is to reconstruct the natural goods to the standardised form of commodity desired by consumers (Bakker, 2003; 2013). Essentially, commodification is a process where natural goods are alienated from their source and transformed into exchangeable forms adapted to the market mechanism.

Bakker emphasised the essential function of historically-geographically specific practices. By this perspective, neoliberalisation is a re-regulation and reconfiguration process to adjust the role of the state in regulating natural resources within the context of 'market environmentalism' (Bakker, 2003, p.1).

However, the true competition and the implementation of cost-reflective pricing has been proved ineffective, which impeded the development of neoliberalisation process. The water resource's inherent characteristics '[...] render it particularly resistant to commodification' (Bakker, 2005, p.559). For example, water resources is cheap to store but expensive to transport, making it hard to be distributed in a financially profitable manner (Bakker, 2003, p.42). Therefore, economic, political, environmental and even ethical dilemmas emerged in the attempts of valuing, metering, and pricing the water resource, making it an 'uncooperative commodity'.

In her case studies of water provision industry in England and Wales, she argued the traditional neoliberal privatisation and marketisation processes was not fully demonstrated and failed in dealing with the contradictions in the process of modifying water resource, resulting in a failure of neoliberalisation of nature resource. However, she only discussed neoliberal governance in a de-centralised administration mechanism. This thesis will contribute to the understanding of neoliberalisation through providing a detailed analysis of Chinese centralised administration of water resources and tap water provision system and its attempt of marketisation reform.

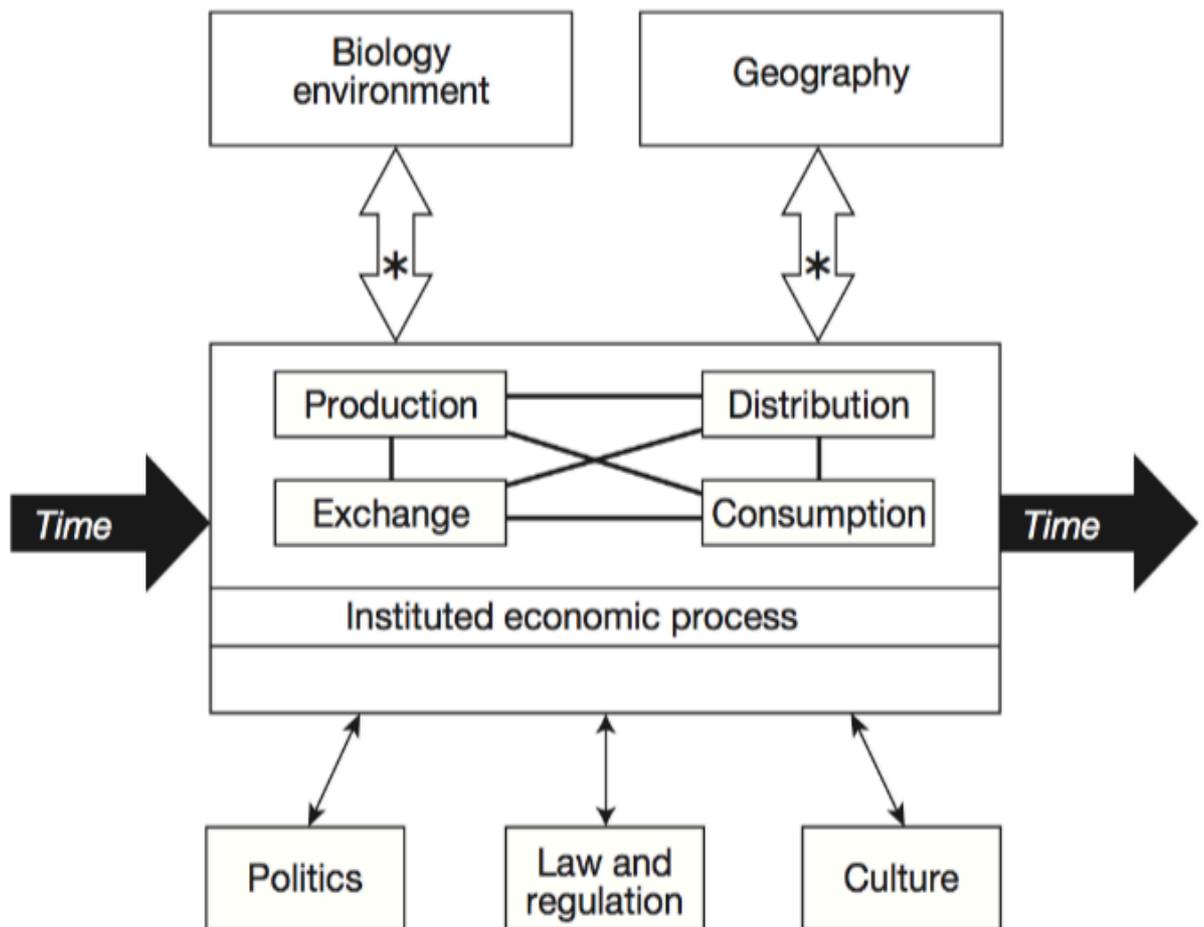
In addition, Bakker's concept of 'uncooperative commodity' also contributes to the form the concept Hybrid Institutional Architecture, since it offers an explanation to the institutional incoherencies in money flow (reviewed in section 2.3) circulating in and being encapsulates by the Hybrid Institutional Architecture.

### **Mark Harvey's theoretical framework: a 'source to sip' research perspective**

Following Bakker's arguments, Harvey (2015) claims that tap water is an 'unruly public good', since the 'public' aspect of tap water is always contested, as it centres on both the local and international debates over the sustainability relationship between human demand and natural supply. As Harvey (2015, p.20) claimed, his account is to respond Bakker's analysis of neoliberalism '[...] by arguing for an historical account of the emergence of new forms of public, hybrid, and indeed commodity goods in different historical and societal contexts.' Moreover, he criticised the studies of understanding the water resources as a 'common pool,' which grounds the taking-for-granted availability of water, and the idea of 'free access'

of all human to the water resource. He argues that the 'common' label of the water resources disguise the societal variation of water economy, especially the ingrained social inequalities. These social inequalities demonstrate themselves in various forms, especially in the taken-for-granted availability of tap water. Based on this viewpoint, he highlighted that from historical and anthropological stances, these stoical inequalities reflected and evidenced different forms of social hierarchy in accessing water resources that have integrated and normalised these social inequalities.

Another critical perspective of his research is historical conceptualisation, which offers a standpoint for an elaborate analysis of sociogenic water sustainability crisis. This analytical perspective is especially helpful in examining the sustainability crises happened in China. Taking historical, anthropological, and societal variations and conditions into consideration, he established his theoretical framework, the Instituted Economic Process, to examine the interconnections between the production, distribution, exchange and consumption of certain commodity (See Figure 2.1)



**Figure 2.1: Instituted Economic Process in a complex nexus of interactions between various conditions (Harvey, 2015, p.7)**

By adopting Instituted Economic Process and recognising Polanyi's two constitutional processes of the economy, the processes of displacing entities in space and processes of changing who exercises control over those entities, Harvey (2015, p.9) further developed another two constitutional processes of economy, the processes of transformation of qualitative characteristics of entities (objects, activities, people) and processes of transformation of the functionality of using those entities. Note here that these four processes have constituted a research nexus combining both the geographic and political perspectives into the research of economy, reflecting the openness of this research mode.

The two new economic processes correspond to the production/provision and consumption process respectively (Glucksmann, 2013, p.8). In the case of tap water, these two processes are mainly associated

with the quality and functionality changes in tap water provision and consumption processes. Regarding quality change, the processes of transformation of qualitative characteristics of entities reveal a series of tap water quality transitions, from undrinkable nature water to standardised tap water. Regarding functionality changes, the processes of transformation of the functionality of using those entities reveal a series of tap water transitions from nature resource to a commodity. In other words, an Instituted Economic Process has taken into consideration the whole trajectory of tap water supply from a 'source to sip' perspective (Harvey, 2015, p.10), which is particularly useful in analysing the operation of complex system that contains many agents, such as China's urban tap water provision system. Thus, this holistic research perspective will be adopted in probing China's urban tap water provision system, which will be analysed in Chapter 3 and Chapter 4.

Here, Miriam Glucksmann's concept of consumption work (reviewed in section 2.4) also sheds light on both processes. This concept stresses the consumer's production process after the transfer of ownership of certain commodity, which determines the final function and quality of certain commodity (Glucksmann, 2009; 2013). Particularly, both scholars claimed that the norms and routines of water consumption played a major role in the consumption behaviours. As will be highlighted in Chapter 3, these norms and routines to a large extent influence the development of tap water provision system, formulate the unique interaction pattern between consumer and tap water provision system.

## **2.3 The nexus of power/money/water**

The previous section has reviewed the economic characteristics of water resources from a perspective that not only takes water's economic value into consideration, but also scrutinises such value in a more broader historical, geographical and societal context. They have revealed the fact that water is much more than a tangible entity in urban areas, since it is always intertwined with a series of intangible elements such as power and money. Thus, a discussion of such intertwining is necessary.

Expounding Wittfogel's theory, and in order to illustrate the relationship between the flow of water, the flow of power and the flow of money, Swyngedouw (2004, p.2) presented the conceptual triad 'power/money/water nexus', emphasising that it '[...] lays bare the political economy of the urban fabric and the functioning of mechanisms of domination and subordination within the urban arena.' The logic behind this conceptual triad is that the access of water resources demands certain financial capacity, which is also inevitably connected with political power (Swyngedouw, 2006). Thus, taking a holistic research perspective, water flow, money flow and power flow always demonstrates themselves in an intricate network of each other.

This conceptual triad centres on the contests around the access to water. Swyngedouw believed that during the process of accessing water, there are various contests among people of different classes, genders and ethnicities. This demonstrates the relationships of domination and subordination (Swyngedouw, 2004; 2006; 2009). Thus, he used water as a probe to reveal the political economy circulating behind the fabric of municipality in several case studies (Swyngedouw, 2004, p.4).

Swyngedouw has modified the theoretic flaws existing in Wittfogel's theory through admitting that '[...] it has now been commonly accepted that there is no necessary link between aridity or relative scarcity of water and authoritarian political and economic power relations' (Swyngedouw, 2006, p.17). As demonstrated in the previous section, this so-called 'link' has been criticised by Chinese academia as well. While keeping a safe distance from this argument, Swyngedouw at the same time tried to stress that there are links between the management of hydraulic construction and 'large, hierarchically organised, bureaucratic organisations', and between these organisations themselves (Swyngedouw, 2006, p.17).

However, four restrictions about this concept can be observed. First, although his studies have recognised the internal connection between power, money and water, they only discussed the unequal distribution of and access to the water resource, rather than systematically investigating the concrete effects and influence of this concept in specific urban tap water provision system. In other words, by admitting the influences of unequal power positions between various agents of certain urban tap water provision system,

the resulting chain reactions that are triggered by such inequality and its associated influences on the other agents have yet to be fully revealed.

Second, following this restriction, in his research the analyses of tap water consumer was inadequate. They can be considered as people who do get access to tap water through purchasing but still lack the power to deal with other agents in the tap water provision system. Those people, even though may be in a better situation than those who are incapable of accessing water, also suffered a series of veiled problems regarding quality, quantity, scandal and legal right of tap water in many developing countries, such as China.

Third, in his analysis, this conceptual triad has been generalized into a common idea, instead of a concept that can be employed in different contexts with different features. Are the power/money/water nexuses of different areas coterminous with each other? The answer is undoubtedly no. Given the difference in the political regime, monetary system, water provision system, culture and traditions, their power/money/water nexuses must occupy various socio-spatial realms, which demand more detailed and specific analysis to every single case.

Fourth, Swyngedouw's studies did not illustrate how the power/money/water nexus functions in concrete water provision systems in a central command economy. In this context, the power/money/water nexuses are embodied within specific agents in the urban water provision system, such as water source, pipeline, hydraulic project, water treatment plant, and consumers. In this sense, the mobility of flows of power and money needs to be explored in a relational and systematic perspective. Moreover, Swyngedouw failed to illustrate how different contests, clashes, and social struggles have certain casual connections with each other. Taking an example of China, the social struggle between the government, the water company and the consumer is causally interrelated to the incoherent power and money flows of a central command political regime. Given that, Chapter 3 attempts to fill the gap in understanding the conceptual triad of power/money/water through defining a series of concepts about China's urban tap water provision system.

This conceptual triad of power/water/money nexus sheds a particular light on the macroscopic methodology of analysing the urban water supply system. However, Swyngedouw did not present a clear image demonstrating how these three factors function in specific water provision system. This thesis tries to bridge this gap.

When taking a closer look to this conceptual triad, one can find that it especially fits the situation of tap water provision system in China, because, as has been highlighted before, China's urban tap water provision system has various controversial financial and regulation issues, reflected in the incoherencies in power/money/water flows. Even though some of these problems can be catalogued into more specific classes, such as the problem of low water rates, the problem of standards, the problem of outdated water treatment equipment and so on, in fact these problems are inextricably linked both with each other and with the three main agents of tap water provision system: the government, the market and the consumer. Therefore, this conceptual triad is helpful to reveal these pivotal links in the tap water provision system as well as highlighting the importance of the power/water/money nexus not just as a whole, but in every single systematic section. To further illustrate this concept, the theoretical framework in Chapter 3 coined the concept of the Hybrid Institutional Architecture, which is the embodiment of this power/water/money nexus.

## 2.4 Consumer and tap water

So far, very little research has been carried out on the relationship between consumer and tap water. However, this relationship plays a vital role in the operation of urban tap water provision system. To have a general idea about this relationship, three concepts are reviewed in this section. They are the foundation of the Consumer Coping Strategy Matrix, an essential concept coined in section 3.5.

### **The ordinariness of tap water**

In his work, Harvey (2015, p.1) highlighted an important phenomenon: the consumer seems to have a sense that domestic tap water is characterised by 'taken-for-granted ready availability.' Moreover, this

sense of availability is the root of another consumer's sense, the 'ordinariness' to the domestic tap water supply. Most consumers recognise the water flow from their bathroom taps as an 'ordinariness' in daily lives, though they may know little about the exact water supply system. It seems true to them that only random accidents would undermine the stability of such a system. Harvey emphasised that the way water develops from extraordinary to ordinary is simultaneously a process in which water is manufactured into an all-purpose water. He then presents the case studies of Delhi and Mexico City to demonstrate the fact that this ordinariness is constructed from an interaction between urban tap water provision system and consumers.

However, there is another problem associated with the ordinariness of tap water. If the tap water quality is substandard, then the ordinariness of the tap water would be transformed into another ordinariness: the consumer's ordinariness and normalisation to the substandard tap water. Such transformation is crucial in understanding the consumer coping strategies and consumer's institutional distrust in tap water, which will be analysed furthermore in Chapter 3.

### **Consumer Coping Strategy**

In the discussion of individualisation, Beck emphasised that the changing social milieus force people to become their centres of life to plan and conduct their plans (Beck, 1992). A consumer coping strategy can be considered as a good reflection of this argument. To explain the response of Indian citizens to their problematic urban water supply system, Harvey (2015, p.17) developed the concept of 'consumer coping strategy', defining it as a series of actions to collect water from different sources in both the formal and informal, legal and illegal ways. He highlighted that the internal contradiction of the coping strategy is the interface between the public authority and the privately owned property:

The integrated approach moreover highlights aspects which may be overlooked: public water infrastructures and provision of tapwater by a public authority are complemented by privately owned domestic infrastructures, and the interface between the two (the transfer of control) historically has often been highly contentious (Harvey, 2015, p.10).

This concept highlights two important factors: first, the demand for water cannot be compromised even if the general water supply system is flawed. Second, under the condition of the first factor, the consumers will be compelled to develop strategies for accessing potable water. This concept illustrates the consumer's action and its associated influences on the tap water provision system as a whole. By doing so, it shifts the vantage point from the discussion about the performances of different agents in the water supply system to consumers' behaviours.

In Swyngedouw's (2004, p.4) analysis of the power/money/water nexus, 'informal struggles' are adopted by the powerless local tap water consumer to deal with their problematic water supply. This is an analogic concept of 'copings strategy.' However, there is an essential distinction in these two concepts: the 'informal struggle' is describing activities in the quest for control over water, while the 'coping strategies' emphasise the individual's behaviour mode in reacting to the other agents' control over the water. The usage of such two terms can be told from two sides of the same coin: the power and the empowerment of controlling water. The 'informal struggle' emphasises the mobilisation of tap water consumer who tried to seize the power of control over water from the hand of governments; the 'coping strategy' asks the question of when consumers are powerless compared to the government in controlling over water resource, what could and would they do to deal with the problematic tap water? In other words, the coping strategy can be seen as a peaceful informal struggle; the informal struggle can be seen as a violent or pro-active coping strategy.

Moreover, such coping strategy may exert a profound impact on the development of the water supply system. For example, Bakker (2007, p.1855) concluded in her case study of Jakarta that those residents who were not bestowed with the identity of 'citizen' developed alternatives to accessing tap water. She believed this is the main cause that promoted the fragmentation of the water supply system, which is not a top-down but a bottom-up driver. However, although she has witnessed the outcome of these alternatives as a driver of fragmentation, she did not make a thorough analysis of how these alternatives generate such influential effects on driving the direction of the development of tap water provision system.

In practical perspective, Michael J McGuire (2004) is the one who bestowed 'boiled water' the meaning equivalents to 'coping strategy'. In his blog article, he defined boiled water as Chinese 'individual safe drinking water solution', which parallels to government's 'public health solution'. With discussion about its incomprehensiveness, he argued that this is a phenomenon related to people's distrust in water, whereas arguing that the cost of boiling water is huge in terms of energy consumption and waste generation. His article has laid bare the primitive relationship between government, consumer, culture and market regarding tap water provision. However, he did not make an in-depth exploration on how such link is constituted and developed.

In sum, to present a comprehensive understanding of the consumer's position and their behaviours, it is essential to examine this concept in specific cultural and political context. Therefore, in the following Chapter, the concept of Consumer Coping Strategy Matrix will be coined, which expands the concept of consumer coping strategy into a more general scope, covering not only consumer's behaviour, but also the other associated strategic arrangements from market sphere.

### **Consumer Consumption Work**

End consumers and their associated work have been studied by a vast and growing body of literature. A series of terms, such as consumer's self-service (Pahl, Wallace and Courtenay, 1986), consumption practice (Goss, 2006), social labour (Anderson, Hamilton and Tonner, 2016), consumption work (Glucksmann, 2013) were coined and delivered by scholars from various fields, especially business and sociology.

In 2004, Sharon Zukin (2004) pointed out in her book the consumer's work for smart shopping. However, she did not present a comprehensive analysis to such 'work' for shopping, neither did she indicate the work existing after consumption. Grounded by Zukin's work, Jon Goss (2006) further elaborated the concept of work of consumption in its commercial context, but he still confined his analysis to a practical level rather than posting it into a bigger picture as labour division. In her seminal work published in 2009, Miriam Glucksmann (2009) firstly coined the concept of consumption work in the social context of renewed economic processual social labour division.

Consumption work refers to the labour associated with the consumption. Glucksmann (Glucksmann, 2013, p.2) argued that goods or services are not always be ready to be used when their ownership shifts from the seller to the consumer without further activities, enforcing consumers to be integrated into the provisioning system by implementing these activities. Thus, she defines consumption work as 'all work undertaken by consumers necessary for the purchase, use, re-use and disposal of consumption goods' (Glucksmann, 2013, p.2). She further added that 'the work of consumers includes a whole range of activities both before, during and post-acquisition of goods or services that are a precondition of using or appreciating them. Each good or service comes with its specific range of consumption work tasks' (Glucksmann, 2013, p.10). She also pointed out that consumption works vary by different countries, cultures, traditions (Glucksmann, 2013, p.7).

Three major features of this definition have been highlighted in her work: first, there is interdependent labour prior and after the purchase behaviour; second, the labour after the purchase should be distinguished from consumption; and third, the division of labour has been expanded from the paid employment in the market to the unpaid labour beyond the market. Accordingly, she suggests that the role of the consumer should be revisited, and the notions of production and consumption should be modified.

The concept of consumption work challenges the traditional understanding of division of labour. Glucksmann (2009) presented an analytical framework of 'socio-economic formations of labour', arguing that besides the traditional technical division of labour, there are division of labour existing in and between various socio-economic modals and the processual dimension of instituted economic process composed of four transformations, which have been reviewed in section 2.2, production, exchange, distribution and consumption. As she rightly pointed out, 'work does not simply disappear when it shifts across socio-economic boundaries' (Glucksmann, 2013, p.5), and from the public service shifted to the other social agents (Glucksmann, 2013, p.18).

In sum, Glucksmann's work restructured the concept of division of labour in a modern market economy context, shifting and expanding the attention from the labour generated in the market field to the socio-economic labour generated both in and, particularly, between economic and social fields, demonstrating that these labours are shaped by each other during the social and economic processes. Consumption work, as she emphasised, has been marginalised in the analysis of labour division, which mainly focuses on agents in the context of market relations before the commodity reaches the consumer.

As she claimed, this theoretical framework is a preliminary one, demanding future exploration. For example, she argued that the labour division is partially derived from the shift of state's responsibility to the private sector, volunteer sector and household (Glucksmann, 2009). However, besides the overt, active responsibility shift from the state to market, which initiates the latter's expansion and technology reform, there is also a covert, passive production responsibility shifts from the state and water company to the consumer, which initiates the formation of Consumer Coping Strategy Matrix and, as a consequence, gives rise to the booming markets of bottled water, barrelled water and domestic water filtration equipment. As will be explained in Chapter 3, this is what happens in China's tap water provision system.

Talking about tap water and its associated consumption work, in Glucksmann's conceptual framework, the consumption work related to tap water is not considered significant enough to be counted as consumer work, as the consumer only needs to turn on the tap (Glucksmann, 2013, p.26). Note here that there are different types of labour associated with water in homes, but in this thesis the consumption work associated with tap water is referring explicitly to the labour embedded in the transformation of tap water into potable water, not the household services that are delivered through that tap water. When it comes to China and many other developing countries, consumption work associated with tap water provision is much more than turning on the tap. This consumption work is, in essence, the coping strategy that consumers adopted to deal with the semi-potable tap water. As will be revealed in later sections, this consumption work has even been supported by the state government for nearly one hundred years until today. Such an intersection of the two concepts has profound

implications on the development of tap water provision system and consumers' institutional distrust in tap water.

In this thesis, a primary focus would be placed on the shift of production responsibility from state and water company to the consumer, and the resulting constitution of Consumer Coping Strategy Matrix. Together, they functioned as an essential condition for consumers' institutional distrust in tap water.

## 2.5 The research on trust

The study of trust has received considerable attentions from studies of different majors. Most research has concerned trust at both individual and general level.

### **Trust at individual level**

At the individual level, the study of trust always associates with other key factors, such as leadership, knowledge, rumour transmission, and the relationship between the individual and other entities. Niclas Luhmann (1979) aimed to use trust as a way to reveal the highly abstract relations between self and environment. He argues that the functional analysis did not build the connections between established data and knowledge, but to take into account the increasing social complexity of the space and time. He argues that systems want to have different alternatives that can both reduce and simplify the complexity they meet, so as to maintain their inner stabilities. In this context, he believes that trust can be explained as a dynamic process that will both reduce the complexity and increase the risk of confronting more complexity.

Other scholars are more interested in to what extent can trust influence people's perception and reaction to the character and information not only ascribed to other people (leader), and mediators (knowledge, rumour, tradition, custom, norm), but also in different institutions (organization, group, state and natural environment) (Kramer and Cook, 2004; Gurtman, 2004; Meyer and Ward, 2009).

Another significant research tendency is to illuminate the interpersonal trust regarding economic rationality. Since trust can be interpreted as anti-rationality interaction, at the same time it demonstrates a strong willingness to take the risk of exposing the trustor's weakness to the trustee either as a consequence of a belief in a partner's good intent, belief in their competence and capability, belief in their reliability, or belief in their perceived openness (Nahapiet and Ghoshal, 1998). Contrary to this, James S Coleman (1994) indicates that the elements confronting the potential trustor are nothing more or less than the considerations a rational actor employed in deciding whether to place a bet. The actor knows how much may be lost (the size of the bet), how much may be gained (the amount that might be won), and the chance of winning. He premises that if the trustor has no aversion to or preference for risk, it is a 'simple matter' for him to decide whether to place the bet. Because the decision could be simplified as the comparison between the two fractions: the chance of winning/chance of losing and the amount that would be lost/amount that would be won. If the trustor is rational, he/she should place the trust over the trustee. However, Coleman's theory ignores an important question: how could people achieve the perception of what they will gain or lose before they place their trust over others and before such placement generates the final outcomes? The formulation he claimed, if they truly exist in people's minds, is at most an expectation and experience stemming from people's personal knowledge, information and the institution guaranteeing the safety of trust placement.

Parallel to Coleman's rational choice theory, Herbert A. Simon (1972) established the theory of 'bounded rationality', which focused on the perception of individuals when they make decisions. As argued above, the purely rational calculation of the precise gain and loss of bestowing trust over others is difficult, if not impossible. Given that, Simon claimed that if we acknowledged that there is a boundary of individual's rationality, and if the precise prediction is displaced by a feeling of satisfaction, the rationality choice theory may still be valid in explaining the individual's realistic praxis.

**Trust at general level**

Trust at the organisational level has triggered the interests of many for its close connection with the business management and market order building. From a manager's point of view, Chris P. Long and Sim B. Sitkin (2006) analysed the relationship between task control and trust-building activities. They argue that there exists a dynamic balance between the control and the trust inside the body of a company, which exerts significant influence upon the organisations' performance. Philip Bromiley and Jared Harris (2006) critiqued that the transaction cost economic was an arbitrary argument on the combination of trust and calculativeness. They argued that the spillover effect of business to the social relations is also plausible in the reverse direction.

Many scholars argue that the understanding of trust should be embedded in a more general framework to which different elements could be examined in certain historical-geophysical dimensions. Mark Granovetter (2008) acknowledged the idea of trust as a social mechanism that is embodied in structures of social relations. He criticised that the social perspective studies in trust constitution in recent years always overweigh their moral and social origins. He argued that the reason of trust could be explained as the comprehensive outcome of influences of socially constrained contexts. Sanjay Banerjee, Norman E. Bowie und Carla Pavone (2006) studied the ethical value of the general recognition and agreement of the vulnerability occurring in all the definitions of trust. It depends on the specific context, as they argued, whether the trustee should be judged as unethical or not, in living up to the trustor's expectation. Mark Casson and Marina Della Giusta (2004) emphasized the function of trust in resource distribution while acknowledging its natural scarcity. They demonstrate that trust is both valuable in reducing the transactional cost and the reputation building on the basis of its obligational, emotional, and moral basis.

Here it is necessary to highlight the relationship between trust and power, which is always considered as an important theme of the trust between person and organisation. Bachmann (2006) argued that trust, similar to other concepts such as power, functions as a social mechanism that allows people to coordinate with each other and control their interactions. He argues that in some situations, power can replace trust

to initiate certain behaviours since it is a 'combinable functional equivalents' to trust (Bachmann and Zaheer, 2006, p.339).

Different forms of trust and power can constitute different mechanisms of combinations, which will then have different effects and consequences in the business environment. Russell Hardin (2002) developed the concept of 'encapsulated interest' account of trust, emphasizing the influence of social relations on the establishment of interpersonal trust. In the context of this argument, Henry Farrell (2004) discussed the logical connections between trust, distrust, and power. He has two major arguments: first, in certain circumstance, power will drive trust out by ignoring the interests of people who have less power into considerations of people who has more power. Second, if the powerful person is not powerful enough to violate his/her credible commitments, then even if that person's power overweighs the power of the other person, the trust and power are no longer 'mutually exclusive' as they are in the first argument (Farrell, 2004, p.3).

In sum, when it comes to the institutional analysis of consumer's trust/distrust in tap water, the focus on individual choice, individual or inter-individual trust is not the focus of the thesis and is not adequate for theorising trust in institutional level. To understand the relationship between consumer, power and tap water, a more comprehensive research is required.

# Chapter 3 Theoretical Framework

## 3.1 Introduction

Chapter 1 introduced the main research theme and research rationale of this thesis, outlining three subordinate questions and the main research question. On the basis of the literature review of Chapter 2, this chapter aims to present a structure about the conceptual tools and apparatus that will be adopted in the analysis of later case studies. In so doing, the framework addresses the research questions outlined in Chapter 1.

The framework is formed with seven interlocking concepts, which will be explored in this chapter as follows:

First, the definition of semi-potable tap water was presented to differentiate the quality of end tap water supplied by urban tap water provision system from the quality of other types of tap water.

Second, this thesis will adopt a holistic research perspective and two institutional analytical dimensions to examine China's urban tap water provision system.

Third, given a holistic research perspective, two concepts, Hybrid Institutional Architecture and 'source to consumer' urban semi-potable tap water provision system, are coined and outlined. This thesis argues that the circulation of power/money/water flow constitute a Hybrid Institutional Architecture, which leads to two inevitable outcomes: the supply of semi-potable tap water, and the implementation of Consumer Coping Strategy Matrix.

Fourth, this thesis coined the concept of Consumer Coping Strategy Matrix, outlining its definition, its seven facilitating factors and consumer stratification based on it. With the production responsibility shift, consumer becomes the producer of potable tap water. Through Consumer Coping Strategy Matrix, they establish a 'consumer to sip' potable water production process.

Fifth, with introducing the concept of normalisation and the re-enforcement between normalisations, this thesis argues that the combination of 'source to consumer' urban semi-potable tap water provision system and 'consumer to sip' potable water production process has formed a stable and self-balanced 'source to sip' urban potable tap water provision system.

Sixth, in the context of consumer's powerlessness and consumer's dual identities, Consumer Coping Strategy Matrix is by itself the embodiment of consumer's institutionalised distrust in semi-potable tap water.

Seventh, this thesis argues that there is a dialectic relationship between Hybrid Institutional Architecture, Consumer Coping Strategy Matrix, and water crises. On the one hand, they are keeping a balance with each other; on the other, they also mutually stimulate the development of each other. Once this balance is thrown off by either side, a sociogenic water sustainability crisis would potentially arise.

## **3.2 The definition of semi-potable tap water**

This section aims to answer the first subordinate question: What kind of tap water is supplied to China's tap water consumer? To answer this question, this section coins a new definition for the tap water supplied from China's urban tap water provision system.

As Swyngedouw (2004) pointed out, tap water has been bestowed with not only the physical and chemical value but also the social and cultural meaning. Rather than being considered as a natural substance with purely the physical function, it, in fact, is a compound with enriched economic, political, cultural and social meanings.

However, many previous studies and government documents defined tap water solely from technical perspective through various physical and chemical indicators and standards. For example, in China's current national tap water standard, the *Standards for Drinking Water Quality*, drinking water (include tap water) was defined as the water used for people's livelihood and indoor activities. Another essential legal

document regarding urban tap water provision, the *Regulations of Urban Water Supply*, defines tap water as ‘the water supplied by urban tap water supply enterprises through public water pipeline and other associated facilities to units and residents for their livelihoods.’ Other studies presented several much more general definitions, not including tap water provision but also sewage treatment and all activities related to water (See Xu, 1996; Wang Yali and Bi Leqiang, 2011).

Such definitions have four main loopholes:

First, these definitions did not clarify the difference between the outlet tap water from water treatment plant and the end tap water received by domestic tap water consumers from their taps. Such ‘negligence’ failed in revealing the fact that the aforementioned two types of tap water can have different quality. In some cases, the outlet tap water, namely the tap water that has been treated by water treatment plant but not supplied through pipeline, is in potable quality, whereas the end tap water, namely the tap water received by consumers in their domestic taps, is always in a non-potable quality. This is due to the fact that there is a contamination risk of tap water in pipeline and secondary water supply facilities (defines in section 3.4). They are both considered as ‘blind spots’ in many previous studies (Cheng et,al., 2002; Xu and He, 2002; Tong and Liu, 2005; Zhang et, al., 2005; Chen, 2008). In other words, the tap water’s quality varies in the different stages of tap water provision system. A unified tap water definition cannot reflect such quality difference existing in tap water provision system.

Second, these definitions did not take into consideration about the influence of residual chemical compounds in tap water, such as residual chlorine and its by-products. Currently, most water treatment plants in China use chlorine or chlorine dioxide as traditional water disinfection method. Through chemical reaction in the water, they would generate hypochlorous acid and hypochlorite, which have strong oxidized ability that can eliminate a variety of bacteria and organic pollutants. In those water treatment plants who cannot afford to equip advanced treatment apparatus, this is their only disinfection method to disinfect tap water. In addition, in order to prevent the possible bacteria contamination in pipeline and water tank, water treatment plants would add chlorine into the outlet water as well. However, this

traditional water disinfection method have triggered a considerable concern on the toxicity and cancer risk of residual chlorine and its by-products in tap water, as many studies have already revealed (Morris et al., 1992; Liu and Wan, 2005; Wang, 2006; Zhang, et al., 2006; Gopal et al., 2007; PANYAKAPO, et al., 2008 ).

Besides these health risks, these chemical compounds also influence the palatability of tap water.

Third, these definitions ignore the stance of tap water consumer, who is the end user of tap water. Their perception of tap water quality has been marginalised in the general discussion of China's tap water for a long time. As a result, the discussion of tap water was confined in a context of tap water supply, rather than being situated in a more general and practical context integrating the relationship between tap water supply and tap water consumer. Such problem has been highlighted by David Harvey (2001, p.51):

For example, 'resources' can be defined only in relationship to the mode of production which seeks to make use of them and which simultaneously 'produces' them through both the physical and mental activity of the users. There is, therefore, no such thing as a resource in the abstract or a resource which exists as a 'thing in itself'.

In previous research on China's tap water provision system, little attention has been placed on such relationship, making the definition of tap water quality a stereotype definition incapable of reflecting the dynamic interaction between tap water provision system and tap water consumer. In other words, as has been emphasised in section 2.4, the previous studies ignored the social relations between consumer and urban tap water provision system.

Harvey's viewpoint also illustrates the fourth loophole: the previous way of defining tap water ignores the consumer's physical and mental activities and their associated influence on tap water quality. In his concept of socio-natural unity, Swyngedouw (2004) emphasised that tap water is integrated into the composition of the social fabric, as the tap water resources has established a series of connections to consumer's livelihood, establishing the unity between tap water and consumer. Behind this unity are social labours that have been spent on tap water production. Similarly, Ray (2007) pointed out that in primitive society the labour of fetching water is significant, occupying a large share of people's daily labour time. In today's tap water provision system, such labour was dramatically reduced, but not eliminated.

For example, the following paragraph described a typical morning of numerous Chinese family: when a couple gets up in the morning, one of them will go directly to the kitchen, turn on the water tap and fill their kettle up with tap water, then put the kettle on the gas stove and light the fire. At this period, the other person has washed face and brushed teeth. He or she will come to the kitchen to replace his or her partner so as the latter can have time to wash face and brush teeth. Hearing the sound of water boiling, he or she turned off the gas stove and filled the large thermos bottle with newly boiled water. This special bottle will keep the tap water at a high temperature for the family's whole day consumption, either for drinking or for brewing tea or instant coffee.

Apparently, the above description contains a series of works, and if considering the couple as tap water consumers, these works are their consumption work to achieve potable water from tap water. Introduced in section 2.4, the concept of consumption work was considered as consumer's physical and mental activity and social labour to make use of the commodity they have purchased (Glucksmann, 2013, p.2). When this commodity is a 'resource,' consumer then becomes the user of resource, and their consumption work becomes part of the production process of tap water. Similarly, as introduced in section 2.4, the consumer coping strategy is a series of actions to collect potable water from different sources in both the formal and informal, legal and illegal ways. When the tap water supplied by the tap water provision system cannot be drunk directly, consumers then would have to find strategies to cope this problem. As Kathryn Wheeler and Miriam Glucksmann (2016, p.46) have pointed out, 'consumption work determines what is actually consumed.' Previous definitions of tap water failed in revealing the difference between tap water with and without being treated with consumption work and consumer coping strategy.

Therefore, with taking consumption work and consumer coping strategy into consideration, a new perspective is constituted. It is necessary to present a new definition of tap water from this perspective.

From consumer's perspective, the tap water analysed in this thesis is classified into two types: semi-potable tap water and potable tap water. Urban tap water is supplied from certain water sources, treated through water treatment plant, conducted through tap water pipeline and secondary water supply facility

and finally reaches the tap of domestic tap water consumer living in urban area. Accordingly, semi-potable tap water is defined in this thesis as the tap water supplied from a 'source to consumer' urban semi-tap water provision system with a semi-potable quality that demands additional treatments to have a potable quality. The tap water that has been treated by the consumer through additional treatment to have potable quality is defined as the potable tap water. In other words, semi-potable tap water is the tap water treated by urban tap water provision system and supplied to the consumer, whereas potable tap water is the former tap water that being treated by the consumer again through consumer coping strategies.

However, since urban tap water has such intricate connection with the individual's life, a simple distinction is far to be sufficient. Unlike many other environmental resources, water resources has experienced a long history of multiple complex technical, social and cultural transformations. It is also highly symbolized in various forms in the context of different societies. Functionally speaking, there are two major factors that shape the development of the urban tap water provision system: the population growth and the process of urbanization. The dynamic interactions of such two factors pave the way for the water to be transformed from natural substance to domestic necessity. Such a way of conceptualizing tap water from object sphere to notion sphere is simultaneously a way of stripping water from the natural environment and embedding it physically and theoretically into the environment of 'second nature,' where the artificial is built upon the natural (Cronon, 2009).

### **3.3 Institutional analysis: from source to sip**

As has been explored in section 2.2, Harvey (2005) presented a 'source to sip' holistic research perspective of institutional analysis in his theoretical framework Instituted Economic Process. In section 2.3, Swyngedouw (2004) presented a framework for analysing the power/money/water nexus. This thesis adopted these two concepts to present a holistic research perspective of China's urban tap water provision system on the basis of power/money/water nexus.

Although extensive studies have been carried out on China's urban tap water provision system, few studies present a holistic optic angle to examine the operation of the whole system. Much of the research up to now has been descriptive, and restricted its analysis in the limited scope of certain laws, rules, regulations and policies (Pu, 2005; Shen and Jiang, 2005; Xu, 2006; Huang et al., 2006; Cosier and Shen, 2009; Sun, Speed and Shen, 2013). Few studies to date have explored the complex interactions and links between various agents in the whole system, especially the link between the other agents and tap water consumer, which resulted in a failure to illuminate the inherent conflicts that have profoundly influenced the development of China's urban tap water provision system.

In light of the concept of power/money/water nexus, this section considers each agent in China's urban tap water provision system as a power/money/water nexus. Except central government, all of the other agents are both the receiver of the flows of either power, money or water sending from the other agents and the sender of new flows of either power, money or water. The central government was the source of power/money flow, and water environment was the source of water flow.

Together, all these nexuses establish the channels for the flow of power/money/water. By illustrating functions of these agents and relationships between them, this section reveals that the urban tap water provision system is a socio-physical construction that is produced by both socio-political content and physical-environmental qualities (Swyngedouw, 2009; Harvey, 2015). Rather than being a simple product of a series of physical treatment processes depending solely on technology, tap water is in fact predicated on a series of interactions between agents with different socio-political and biophysical background.

In this context, this thesis argues that China's urban tap water provision system is a combination of 'source to consumer' urban semi-potable tap water provision system and 'consumer to sip' potable water production process. In the former system, various agents functioning as nexuses of power/money/water flow have constituted a Hybrid Institutional Architecture. This can be seen as a reflection of the instinctive 'hybrid' characteristic of water (Swyngedouw, 2006, p.5). Consequently, this system is only able to supply semi-potable tap water to the consumer. To cope with such semi-potable tap water, tap water consumer

is playing an essential role in ‘consumer to sip’ potable water production process, becoming the potable water producer for their potable water through Consumer Coping Strategy Matrix (its definition will be given in the next section). It is because of the existence of such ‘consumer to sip’ potable water production process that China’s ‘source to consumer’ urban semi-potable tap water provision system can be compensated into a ‘source to sip’ urban potable tap water provision system.

### 3.4 ‘Source to consumer’ urban semi-potable tap water provision system: Hybrid Institutional Architecture

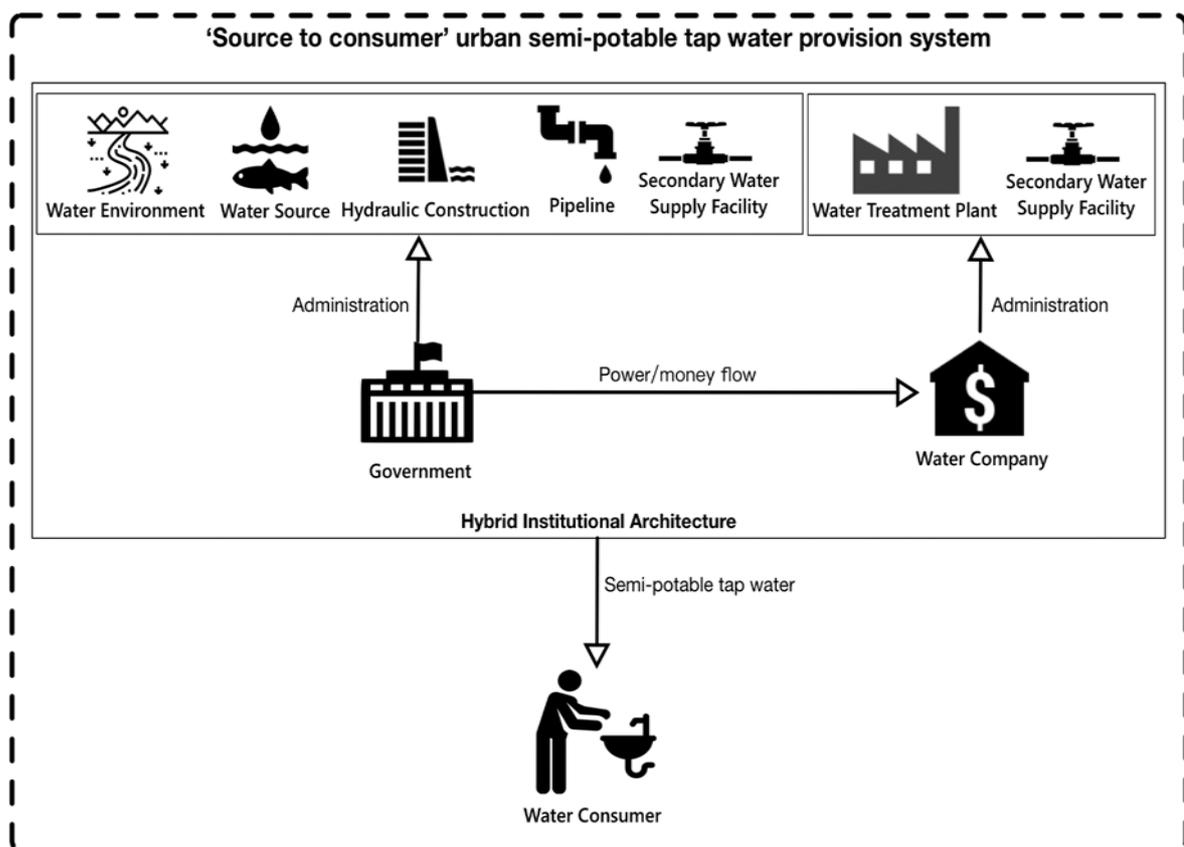


Figure 3.1: ‘Source to consumer’ urban semi-potable tap water provision system

This section aims to answer the second subordinate question: What kind of system is supplying the aforementioned tap water? To answer this question, in a holistic perspective, Figure 3.1 demonstrates a

'source to consumer' urban semi-potable tap water provision system and its main agents. Here, 'source to consumer' urban semi-potable tap water provision system is defined as a semi-potable urban tap water provision system that excludes consumers and their associated influences and functions. Different from previous ways of studying urban tap water provision system, the concept of 'source to consumer' urban semi-potable tap water provision system is established on the basis of two essential acknowledgements: the acknowledgement of the idea of semi-potable tap water and the acknowledgement of the consumer's role and function in the urban tap water provision system.

Taking a closer look at this system, the circulations of power/money/water flow between different nexus can be captured. From source to consumer, there are (at least) 16 agents functioning as power/money/water nexuses in it. They have formed a complicated Hybrid Institutional Architecture, shown in Figure 3.2.

In this thesis, the Hybrid Institutional Architecture is defined as an institutional architecture of China's urban tap water provision system that composed by different nexuses with hybrid characteristics of power (political status), money (economic benefits) and water (obligation of providing tap water). All together, these different nexuses encapsulate the institutional incoherencies in power/money/water flow. It can be seen as a practical reflection of the two concepts that have been reviewed in previous Chapter: the Swyngedouw's concept of 'the nexus of power/money/water' (reviewed in section 2.3), the Harvey's holistic analytical perspective 'Instituted Economic Process' (reviewed in section 2.2) and Bakker's argument of 'market failure' and 'governance failure' (reviewed in section 2.2). It the core and foundation of China's 'source to sip' urban semi-potable tap water provision system.

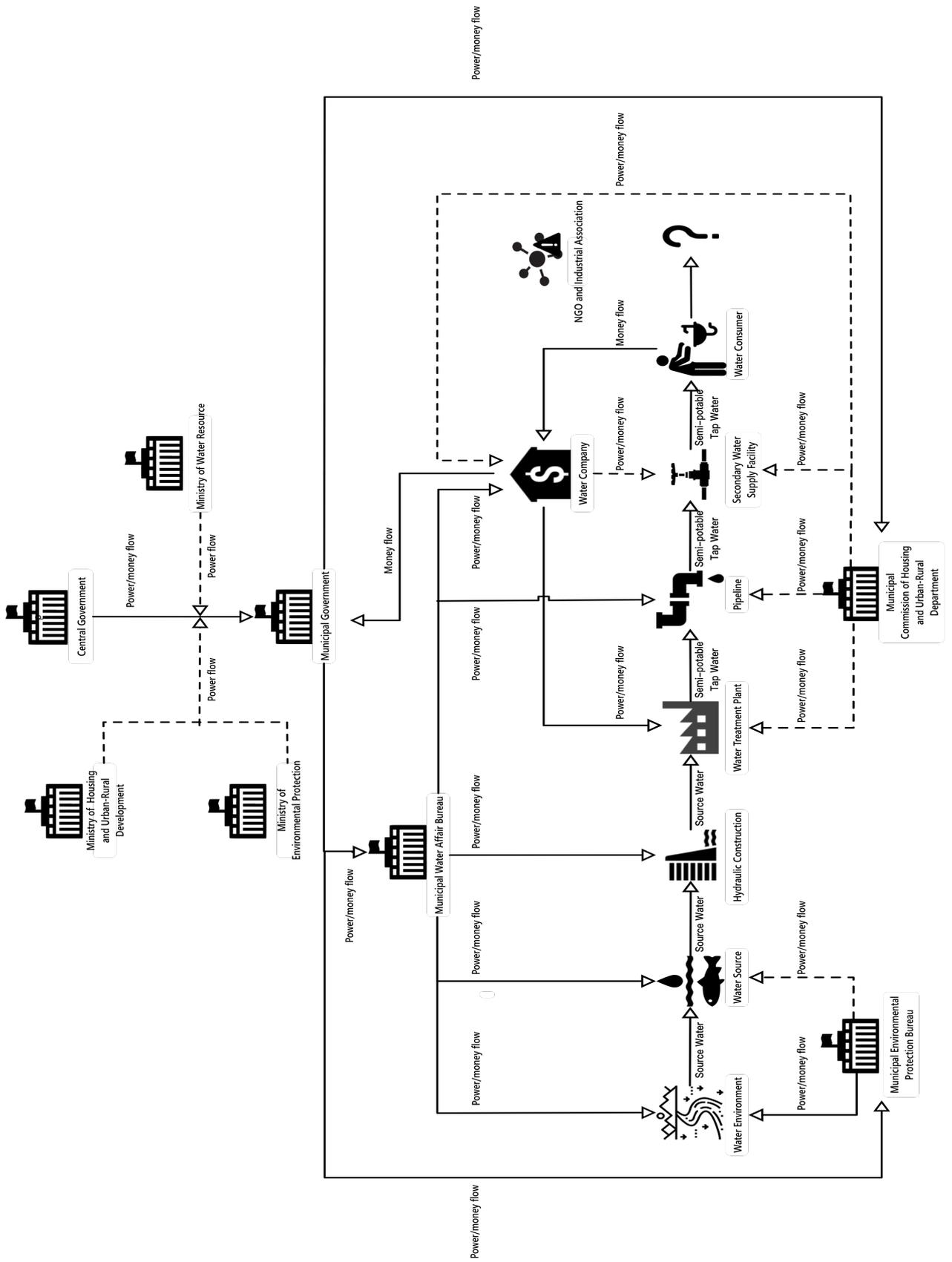


Figure 3.2: Hybrid Institutional Architecture of ‘source to consumer’ urban semi-potable tap water provision system (also see figure 3.9 for the meaning of ?)

As shown in Figure 3.2, source water (either surface water or groundwater) is extracted from the water source located in a water environment. It then was sent to the aqueduct of one or more hydraulic constructions (such as a reservoir and water transfer project).

In this process, the worst problem is water pollution, which has been transferred to the surface water body and groundwater resource. Even though water environment and water source are always located in nature reserve that under the protection of the local government, fresh water resources in China is still being seriously polluted. This will be demonstrated in section 4.2 in detail. These transferred pollutions would be further conveyed with source water through the hydraulic construction to water treatment plant.

When the source water is conveyed into water treatment plant, it would be treated with a water treatment protocol that consists four conventional processes: coagulation, sedimentation, filtration and disinfection. This protocol has been adopted in hundreds of years in China (McGuire, 2006)(Also see section 3.5.3 for more detailed analysis). In some developed cities such as Beijing, source water would be further treated by advanced treatment technology. The outlet water from the water treatment plant should meet the national tap water standard and is conveyed through the pipeline to different urban areas for various usages. The water conveyed to the domestic tap water consumers is end tap water. Given the various building height, tap water sometimes needs to be pressurised by secondary water supply facility to reach the domestic tap water consumers living on high floors.

Here it is worth to provide an explanation about these facilities. There are two types of secondary water supply facility: water tank and variable frequency pumps. Some buildings install either of the two; some install both. The variable frequency pump transforms electric power into extra pressure and pulls the water to high floors directly from either the pipeline or water tanks. The water tank is located on the roof of the building. Sometimes there are several water tanks stored on different floors of the building. They use the pull force generated either by the pumps or the gravity to create proper tap water pressure for domestic consumers. Since in water tanks tap water is keeping in still, there is a risk of bacteria pollution inside these water tanks.

In the end, tap water reaches domestic consumer's tap. However, what happened after it has long been ignored and normalised. So far as the current author has known, no previous research has examined the consumption behaviours of China's tap water consumers, not to mention revealing their distinctive Consumer Coping Strategy Matrix. This has been shown through 'question mark' in Figure 3.2. To unravel this question mark, the concept of Consumer Coping Strategy Matrix and 'consumer to sip' potable water production process will be coined in section 3.5.

As shown in the Figure 3.2, these aforementioned seven agents are in general administered by nine departments: Municipal Environmental Protection Bureau (MEPB), Municipal Water Affair Bureau (MWAB), Municipal Commission of Housing and Urban-Rural Development (MCHURD), Water Company, Municipal Government, Ministry of Water resources (MWR), Ministry of Environmental Protection (MEP), Ministry of Housing and Urban-Rural Development (MHURD) and Central Government.

MEPB is in charge of water environment, whereas MWAB is in charge of all the other agents in the urban tap water provision system. However, as shown in Figure 3.2 by the dotted line derived from MEPB, the power boundaries of the above two departments blurred in water source administration, which can either be considered as part of water environment or not. For example, the waste generated by the local people can be dumped in the bank of the lake, where the administration can be assigned to either bureau.

As shown in Figure 3.2, Municipal Government bestows its local water companies the right of building and operating water treatment plants and charging water rates from tap water consumers, forming the money flow from consumer to the water company. In many cases, these water companies are State-Owned-Enterprise (SOE). In some cases, they are privately owned or supported by private capital, and the municipal government would sign concession contracts such as BOT (Building-Operation-Transfer) contract or PPP (Public-Private-Partnership) contract with them. All water companies need to submit sewage treatment fee and water resources fee to the government, forming another money flow from the water company to the municipal government. Given urban water supply regulation, tap water consumers must sign a water supply contract with the local water company and pay their water rates on a regular

basis. With the fixed profit rate decided by the municipal and provincial governments, water rates is the major (sometimes the only) income for many water company to keep its business in operation.

However, in all cases, these water companies are not operated independently. They must operate under the supervision and administration of either Municipal Commission of Housing and Urban-Rural Development (MCHURD) or MWAB, depending on whether the local municipal government has set up MWAB and handed over it the administration power.

The management of secondary water facility is varying by cities. Owing to the lack of appropriate policies and regulations, it is managed either by the water company, MCHURD or the resident community service company. This is the reason why all power and money flows it connected are in dotted line. This situation is further complicated in recent years by the incomplete reform of the integrated administration of water affairs. Its problematic management also contributes much to the quality deterioration between outlet tap water and end tap water.

Given the goal of the Super-Ministry reform, urban tap water provision system is solely administrated by the local municipal government. As shown in Figure 3.2, municipal government is the only department that keeps the power/money flow from central government to manage urban water affairs. However, given the ambiguous power boundaries and institutional inertia, MWR, MEP, and MHURD also keep certain power to influence municipal government's administration. Therefore, all three of them impose power flow to municipal government, reflecting as the dotted lines connecting them and power/money flow between central government and municipal government. However, among these three departments, two institutional incoherencies in power flow can be observed. The first institutional incoherency is between MHURD and MWR; the second is between MEP and MWR. These will be highlighted in the next chapter. Meanwhile, since local municipal government became the only administration department of urban tap water provision system, there is a risk of distrust between local municipal government and central government, especially when the former tries to fraud the latter during water crises. This was reflected in the case study in Chapter 5.

The aforementioned two institutional incoherencies in power flow have been transmitted from ministerial level to municipal level. Thus, the administration conflict between the MEPB and MWAB is reflected in administration conflict between MCHURD and MWAB. As shown in Figure 3.2, the former incoherency is mainly about the ambiguous power boundary on water source administration, which can be either administrated by MEPB or by MWAB. The latter incoherency is primarily about the incoherent administration of water treatment plant, pipeline, water company, and secondary water supply facility. Given each municipality's different condition, these facilities are either administrated by MWAB or MCHURD. All these four power flow incoherencies will be analysed again in Chapter 4 and demonstrate in a case study in Chapter 5 and 6.

As shown in Figure 3.2, in current urban tap water provision system, the third party, such as NGO and Industrial Association, failed in bridging the power and information gap between Hybrid Institutional Architecture and tap water consumer, reflecting another institutional incoherency in power flow. Effective independent supervisions of government and water company's work are also absented. Many of the third parties are significantly marginalised regarding power and money, whereas others have chosen to combine their interests with the interests of certain government agents and/or water companies. This will be highlighted again in section 4.3.5.

In sum, because of the intricate relationships between all agents, China's urban tap water provision system can be considered as a Hybrid Institutional Architecture. Although the specific conditions of each city are different, the centre of this Hybrid Institutional Architecture is always the combination of the water company, government departments, water treatment plants and (sometimes) hydraulic projects.

The power/money/water flows and the Hybrid Institutional Architecture are causally interrelated and mutually strengthened. It is the circulation of flows of power/money/water that form the policy framework and financial energy of Hybrid Institutional Architecture, and it is the Hybrid Institutional Architecture that channeled the circulation of flows of power/money/water.

However, because of these institutional incoherencies in power/money/water flows, each agent in Hybrid Institutional Architecture has their limited conditions and problems respectively. In addition, given their interconnections, they also have several 'hybrid problems' - problems that related to multiple agents. This will be reflected in the case study of Chapter 6. All together, these hybrid problems lead to the emergence of two inevitable outcomes: the supply of semi-potable tap water and the implementation of Consumer Coping Strategy Matrix. As the result of these two outcomes, rather than being a 'source to sip' potable tap water provision system, China's urban tap water provision system is in effect a 'source to consumer' semi-potable tap water provision system. It is with the consumer's effort in producing their potable tap water by themselves that makes this system looks like a 'source to sip' potable tap water provision system. This well is analysed in detail in the next section.

### **3.5 Consumer Coping Strategy Matrix and 'consumer to sip' potable tap water production process**

This section aims to answer the third subordinate research question: what are the consumer's reactions and responses in the aforementioned tap water and tap water provision system? To answer this question, the concept of Consumer Coping Strategy Matrix and its seven facilitating factors are defined to reflect consumer's reactions to the 'source to consumer' urban semi-potable tap water provision system, whose production responsibility and power are shifted to 'consumer to sip' potable water production process. Centring around the concept Consumer Coping Strategy Matrix, there also has a consumer stratification.

### 3.5.1 Shifted potable water production responsibility

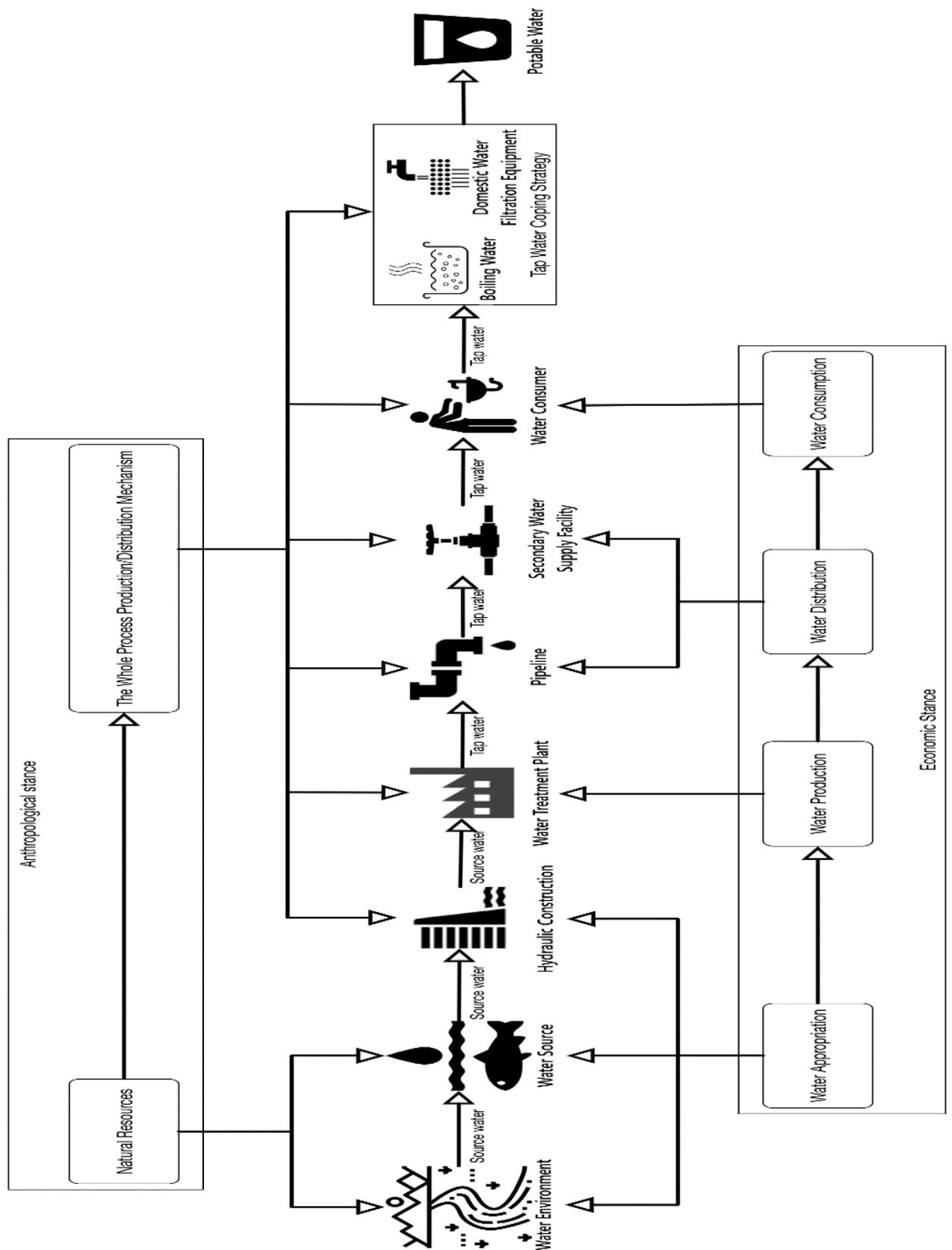


Figure 3.3: The economic stance and anthropological stances of water production

As shown in Figure 3.3, by implementing the certain tap water coping strategy, consumers have been deeply integrated into the process of potable tap water production. If inspecting the whole Hybrid Institutional Architecture from an economic stance, it can be divided into four phases: water appropriation, water production, water distribution and water consumption. Water production is merely one phase among the four and happened only in water treatment plant. However, if inspecting the whole Hybrid Institutional Architecture from anthropological stance, the production process can be seen as a dynamic process that always keep the quality of certain commodity in change. Likewise, the distribution process can be seen as a dynamic process that always keep the ownership of certain commodity in change. From this stance, there is a whole process production and distribution mechanism operated by multiple agents. As shown in Figure 3.3, in this mechanism all five agents, hydraulic construction, water treatment plant, pipeline, secondary water supply facility and consumer, are functioning both as the distributor and the producer of tap water, since their activities have changed both the quality and ownership of tap water at the same time.

This can also be seen as a restructure of traditional labour division. Using semi-potable tap water as their 'raw material,' consumers are using their unpaid labour in the form of consumption work and coping strategy to produce a new product. They are both the producer and consumer of their commodity: the potable tap water. In fact, this production process even has been acknowledged by the government for a long time, evidenced by the case study of Harbin in Chapter 5.

Along with this whole process water production and distribution mechanism, certain production responsibility is shifted from the other agents in the Hybrid Institutional Architecture to the tap water consumer. As Gluskmann (2013, p.24) has clearly pointed out:

The rhetoric of the 'responsible' individual (whether consumer, citizen, patient, worker, parent) suggests a further cascading down and spreading of 'responsibilisation', as part of the process of 'devolving' power and responsibilities to the lowest level so people become 'take ownership of' and become responsible in part for their own outcomes. There are clear parallels between the shift of tasks or responsibilities from the public sector to the citizen and the market sector to the consumer, but these need to be investigated much further.

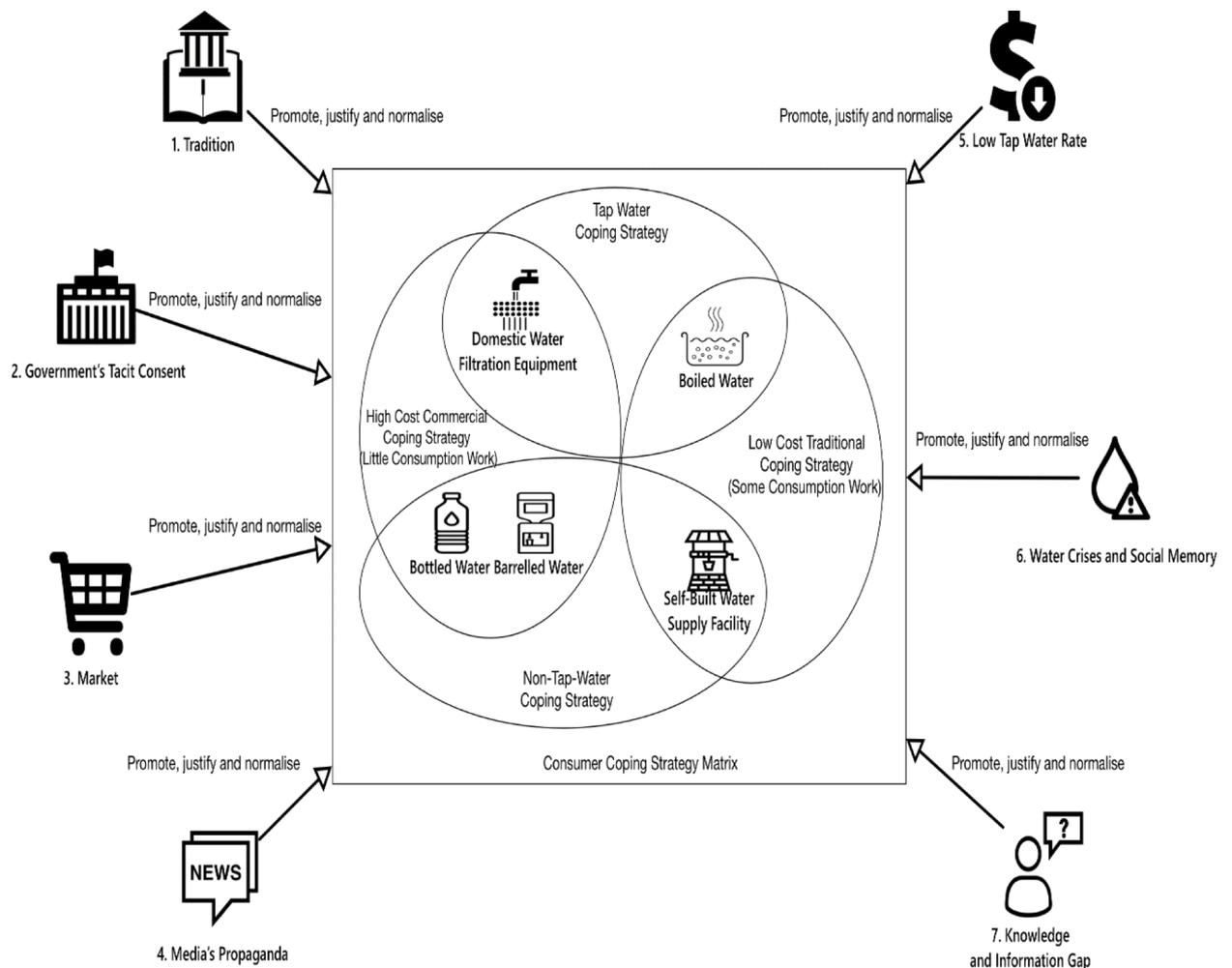
The shift of water production responsibility is exactly the 'shift of tasks or responsibilities from the public sector to the citizen' mentioned in the above quotation. Here, one of the differences between the two types (public section and market) of shifts is that the responsibility shift in public section is coming along with a 'power share'. For example, consumers will share the power of building water supply facilities with government in the context of fragmented tap water supply or non-central water supply. All these facilities will function as coping strategy to fragmented tap water distribution and semi-potable tap water. However, in the context of central water supply, the power of building self-built water supply facility would be deprived by the government, making consumers only depend on other consumer coping strategies. The Harbin's first sociogenic water sustainability crisis is an example, which will be analysed in section 5.3, Chapter 5.

Since consumers have normalised the existence of Consumer Coping Strategy Matrix, they would not have a self-awareness of about their production responsibility. Moreover, to a large extent, the whole process of water production and distribution mechanism also disguises the irresponsibility of other agents in Hybrid Institutional Architecture. What's more, this mechanism further intensifies the marginalisation consumers have suffered from Hybrid Institutional Architecture. In conclude, the power attached to consumer identity is, to a large extent, being deprived and repressed at the moment when their identities being transferred into a mixture of consumer and producer of their commodity. A detailed case about power and responsibility shift will be presented in section 5.3.1.

### **3.5.2 The definition of Consumer Coping Strategy Matrix**

To date, there has been no research discussing the missing link between the semi-potable tap water received by China's tap water consumers and the potable tap water produced by them. Many research ignored consumer by simply classifying all consumer-related issues as the dissatisfaction of 'tap water service' (Wan, 2002; Dong and Wang, 2013). However, what is behind this link is much more complicated than consumer's dissatisfaction. There is huge research gap around consumers that that deserves an in-

depth examination. As Daniel Welch (2017) has rightly pointed out, ‘consumption norms and routines are thus critical to the formation of economies.’



**Figure 3.4: The composition of Consumer Coping Strategy Matrix and its seven facilitating factors**

As shown in 错误! 未找到引用源。 , on the basis of the definition of consumer coping strategy and consumption work (both introduced in section 2.4), this thesis defines Consumer Coping Strategy Matrix as a matrix of all China’s tap water consumer’s coping strategies in dealing with semi-potable tap water. In this sense, it encapsulates the consumer consumption work functions as consumer coping strategy and the consumer coping strategy in the form of consumer consumption work. It is also the reflection of potable water production responsibility and power that shifted from other agents in ‘source to consumer’ urban semi-potable tap water provision system to the tap water consumer.

Although the Consumer Coping Strategy Matrix is as fundamental as ‘source to consumer’ Hybrid Institutional Architecture, its existence is as unnoticeable as those social norms and routines that have been widely accepted and taken-for-granted by nearly all Chinese people. In other words, it becomes the ‘ordinariness’ (introduced in section 2.4) of people’s daily life. With the prevalent of Consumer Coping Strategy Matrix, consumers are gradually alienated and marginalised in tap water provision system as a whole, since they nether have enough power nor awareness to actively stimulate modification and progress in Hybrid Institutional Architecture. This forms a quite different picture compared to what has happened in the history of tap water provision of United Kingdoms, where consumer played the role of major stimulator of systematic transformations (Trentmann and Taylor, 2005) .

As shown in 错误! 未找到引用源。 , in general, Consumer Coping Strategy Matrix is composed by five coping strategies, which can be classified into four types in two perspectives.

From the point of view of tap water usage, there are two types of coping strategies: Tap Water Coping Strategy, which includes the purchase of domestic water filtration equipment and the consumption work of boiling semi-potable tap water; and Non-Tap-Water Coping Strategy, which includes the purchase of bottled water, barrelled water and self-built water supply facilities.

From the perspective of cost and consumption work, there are another two types of coping strategies: Low Cost Traditional Coping Strategy, which includes the consumption work of boiling semi-potable tap water and the consumption work of building self-built water supply facilities, all these coping strategies demands a certain amount of consumption work; and High Cost Commercial Coping Strategy, which includes the purchase of domestic water filtration equipment, bottled water, and barrelled water, all these coping strategies only demand little consumption work.

As shown 错误! 未找到引用源。 , there are certain overlapping between the two perspectives and four types of coping strategies. All together, they composed a small matrix of consumer coping strategy in dealing with semi-potable tap water, thus being named as the Consumer Coping Strategy Matrix.

### 3.5.3 Seven facilitating factors of Consumer Coping Strategy Matrix

As shown in 错误! 未找到引用源。 , for consumer, there are seven facilitating factors that have promoted, justified and, most importantly, normalised the existence and composition of Consumer Coping Strategy Matrix. They are tradition, government's tacit consent, market, media's propaganda, low tap water rate, water crisis and social memory, and knowledge and information gap. They function together to embed Consumer Coping Strategy Matrix deeply and firmly into the fabric of Chinese society. As will be highlighted in section 3.6, the normalisation they triggered will have a re-enforcement of other normalisation: it is further transformed into the consumer's normalisation of semi-potable tap water supply, which transformed again into the consumer's normalisation of Hybrid Institutional Architecture. This will be highlighted in section 3.6.

#### Tradition

First, as section 2.4 has reviewed, Harvey observed that tap water consumer's certain norm and routine could have a significant impact on tap water provision system as a whole (Harvey, 2015, p.11). For Chinese consumers, the tradition is a major and priority factor of Consumer Coping Strategy Matrix, especially for boiling tap water. In general, it can be classified into three types: the tradition of boiling water, the tradition of Chinese medicine, and the tradition of drinking tea. All three types of traditions helped the consumer to establish, implement and normalise Consumer Coping Strategy Matrix.

The tradition of boiling water can be dated to ancient time as early as Neolithic. In his blog article, Chen Mingyuan (2009) pointed out that the shape difference between pottery from ancient China and pottery from other civilisations is an evidence of boiling water. He argued that the pottery for boiling water always have a special shape that looks like a pitcher with three legs because people need to place timber under it. This kind of pottery only exists in China, which has a series of different shapes such as Li, Gui, Zeng, Yan and Bing. Residual of mineral deposits has been observed in the debris of ancient pottery 'Gui' (see Figure 3.5) dated back to 4500 to 2500 BC, demonstrating that it had been used to boil water.



**Figure 3.5: The white pottery 'Gui' of China's Dawenkou culture<sup>7</sup> (4300 to 2500 BC)**

Surprisingly, as early as in Zhou dynasty (1046 BC–256 BC), the *Rites of Zhou* (《周礼》) has a record for special government officers in regulating water quality. They projected heated stone into the water to repel insects. In Eastern Jin dynasty (317-420 AD), a scholar specialised in health, Zhang Zhan, clearly pointed out in his book *The Essence of Health* (《养生要集》) that 'once people drink boiled water, no disease will occur.' In North Song dynasty (960-1127 AD), a doctor named Zhuang Zhuo argued in his collection of note and essay *The Chicken Ribs* (《鸡肋篇》) that 'in eastern south area (of China), even on the road, average people still insist on drinking boiled water.'

<sup>7</sup> Source: <http://theme.npm.edu.tw/selection/Article.aspx?sNo=04001122> Accessed: 12 March 2017

Western scholar also noticed this phenomenon and its implication. Fernand Braudel (1992, p.230) indicated in his work *Civilization and Capitalism, 15th-18th Century: The structure of everyday life*:

As for the Chinese, (...) but they were also concerned about the dangers of pollution and recommended boiling any suspect water. Hot drinks were in any case the rule in China (vendors sold boiling water in the streets) and this habit no doubt considerably contributed to the health of the Chinese population.

The data describing the prevalence of boiling water in today's China is rare. However, given the data from a survey about 270 Beijing citizens' drinking preference in 2012, 74% of them chose to drink boiled tap water (Zhao, et al., 2012).

The tradition of Chinese medicine also significantly influenced people's attitudes towards boiling water. In *Huang Di Nei Jing* (《黄帝内经》), the oldest doctrinal source of Chinese medicine that can be dated back to 2000 years ago, decoction medicine was considered as the major mean of medical treatment. It involves boiling water to extract and concentrate the essence of substances deemed to be curative (e.g. bark, leaves, roots). In other classic works of Chinese medicine, decoction was considered as the best choice for taking medicine, being used as the most common way for medical treatment. As shown in Figure 3.6, even until today, numerous Chinese people still adopt decoction as their way of taking Chinese medicine. In this process, boiling water was gradually being considered as a healthy water that essential for the medical care and people's daily life.



**Figure 3.6: Chinese decoction medicine<sup>8</sup>**

If the tradition of Chinese medicine can be seen as the promotion of boiling water in the sense of health, then the tradition of drinking tea can be regarded as the promotion of boiling water in the sense of domestic life. In *The Classic of Tea* (《茶经》), the world's first known treatise on tea completed in Tang Dynasty between 760 CE and 762 CE, Lu Yu, known in China as the 'Sage of Tea', named the fifth chapter as 'Boiling', listed the guidelines for preparing tea, which includes the water types, water quality and timing of boiling water. Since then, boiling water becomes the necessary procedure in tea drinking until today.

Braudel (1992) also observed the connection between tea and boiled water.

Was it the social custom of tea that spread this strange ersatz of hot water? Or was everything generally drunk hot in China, as in Japan - tea, sake, alcohol made from rice or

<sup>8</sup> Source: [http://www.360doc.com/content/16/0421/21/17293644\\_552681026.shtml](http://www.360doc.com/content/16/0421/21/17293644_552681026.shtml) Accessed: 12 March 2017

millet, and even water? When Father de Las Cortes drank a cup of cold water, he shocked all the Chinese accompanying him, who tried to dissuade him from such a dangerous practice. 'If the Spaniards, who have a passion for drinking everything iced at all seasons, did as the Chinese do,' remarks a very sensible book (1762), 'they would not see so many diseases prevalent in their midst, nor so much dryness in their temperament' (Braudel, 1992, p.254-255).

In his web article published in 2012 about tea drinking and the development of ancient East towns, Ling Wenfeng (2012) also argues that boiled water and tea drinking contributes to the prevention and cure of water-borne disease, improving Chinese people's health status. Similarly, McGuire (2014) also published a blog article discussing the interconnection between tea, boiled water, and water treatment, claiming that 'the history of tea in Chinese culture is part of the history of individuals protecting themselves from disease.'

### **Government's tacit consent**

The second facilitating factor is government's tacit consent. To compensate the systematic flaws in urban tap water provision system, for a long time the government has kept a tacit consent towards the implementation of Consumer Coping Strategy Matrix. In some cities, the local municipal government even shifted a certain amount of power to the consumer to promote their 'non-central water supply' as an option for 'central water supply'. Chapter 5 will provide a detailed example later.

Besides, it is the government who firstly initiate and promote the national propaganda for plain boiled water. As early as 1934, Chinese Nationalist Party, the China's ruling party at that time, promoted New Life Movement, which asked Chinese people to drink boiled water<sup>9</sup>. Chiang Kai-shek, the head of Chinese Nationalist Party, insisted on drinking boiled water instead of tea or coffee. In 1948, there was a news report that the mayor of Shanghai advocated citizens to drink plain boiled water<sup>10</sup>. However, such activity did not penetrate into rural areas.

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<sup>9</sup> <http://www.cqkangzhan.com:6080/kzsqsml/417.jhtml?q=index>

<sup>10</sup> Source: <http://www.dachengdata.com> Accessed: 13 March 2017

The major change only comes when Communist Party took over the ruling power. In 1952 and 1953, PRC government initiated a national-wide Patriotic Public Health Campaign. The 'State Council's Instructions of Continuing Patriotic Public Health Campaign in 1953' highlighted that people must 'not drinking unboiled water'. Given the record in the memoirs of Guan Er, an old man who experienced that campaign as a child, even in rural areas, every child would be checked before class whether they had brought the jug for drinking boiled water, and every child had to recite a doggerel including 'not drinking unboiled water' (Guan, 2015, p.24). At that time, the slogan and poster of drinking boiled water was posted everywhere, especially in classrooms. With the help of media (introduced later as Media's propaganda), even until today plain boiled water was considered in China as a kind of 'healthy' water.

### **Market**

As Glucksmann (2013, p.12) pointed out, the consumption work intensified the connections between different market players, forming a mutual cooperation between them. She further claimed that the development of market economy and commodity production is on the basis of the progress of consumption work (Glucksmann, 2013, p.24). Meanwhile, an outsourcing of consumption work to other companies has created a new market targeting on the consumption work. Her viewpoint is fully reflected in China.

When little academic attention was placed in Consumer Coping Strategy Matrix, the capsule of consumption work, numerous China's companies have already initiated to occupy the great market established solely on it since 1990s. Given the data of a 2014 survey about 30,000 Chinese urban residents in 100 major cities of China, only 59% of them drink boiled tap water as their main potable water source (Liu, 2016). For the rest 41% of urban populations, 25% drink barrelled water, 14% equip domestic tap water filtration equipment, 2% have community water treatment facility<sup>11</sup>. A survey about 270 Beijing citizens' drinking preference in 2012 shows that 78.9% of them chose to drink barrelled and bottled water

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<sup>11</sup> Source: [http://zt.h2o-china.com/report/2014/2014gs\\_charts/](http://zt.h2o-china.com/report/2014/2014gs_charts/)

directly (Zhao, et al., 2012). In 2012, the bottled water sales in China reached 9 billion US dollars, and was expected to reach 16 billion US dollars in 2017 (McGuire, 2014). Data from International Bottled Water Association (IBWA) pointed out that in 2013 China's bottled water consumption amount is 39.5 million cubic metres, accounting as number one market in the world and 15% of the global market (Liu, 2016). All these data demonstrate that the market size of bottled water, barrelled water and domestic tap water filtration equipment is massive. As Liu (2006) pointed out, 'bottled water is now one of China's fastest growing sectors in the food and drink industry'.

The booming bottled water market in China is more like the emergence of bottled water in the history of France and Italy. The former established its all-purpose tap water much later than UK with smaller coverage, leaving a chance for bottled water to function as a compensation of tap water provision system (Goubert, 1989; Harvey, 2015). The latter, even to this day, is equipped with problematic tap water that makes people distrust its safety and purity. Bottled water, as a result, becomes Italians' coping strategy to tap water (Harvey, 2015).

In the face of such a huge profit, some bottled and barrelled water companies began to discredit the reputation of tap water by various means. For example, in Sina Weibo, a China's Twitter-like website, there was a Weibo published at 5:20 16 May 2013 by China Newsweek<sup>12</sup>, an influential news magazine in China:

*#the couple who do not drink tap water for 20 years got a new idea#. The strict tap water standard is useless if the source of tap water is inferior. It is a misleading to discuss tap water from standard perspective. The transformation of 'safe water' to 'health water' can only happen in the condition that people begin to concern the source of tap water. The most superior water source is usually far away from modern pollution areas, such as a water source from the snow-capped Kunlun Mountains in Tibetan Plateau. (Translated by the author)*

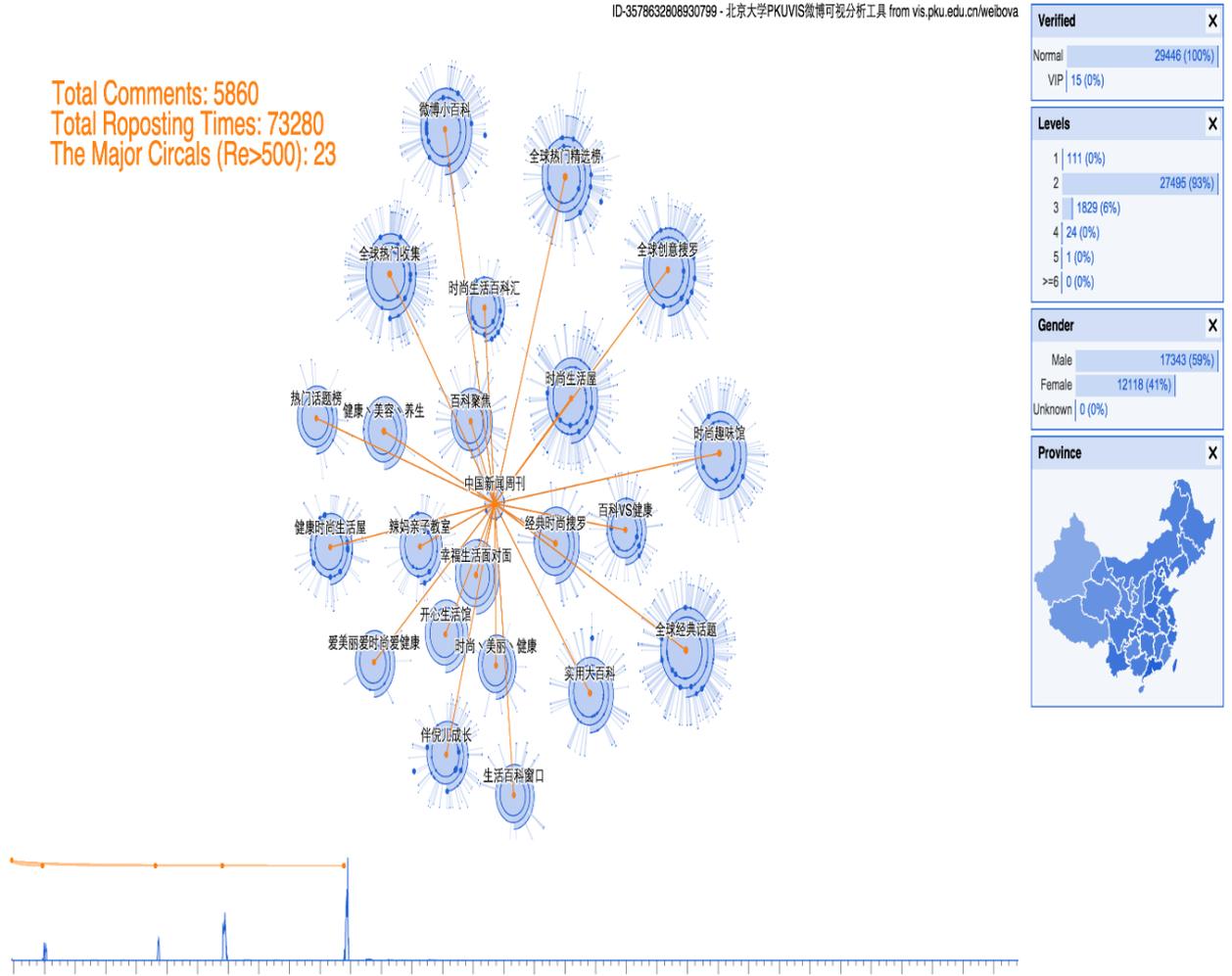
Until 12 December 2016, this Weibo has been reposted for 73280 times and commented on 5860 times.

The analytical data shown in Figure 3.7 is generated from the Weiboevent Visual Analytic System (Donghao Ren et al., 2014), an online weibo analytic tool.

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<sup>12</sup> Source: [http://www.weibo.com/1642512402/zwZB6Btj9?from=page\\_1002061642512402\\_profile&wvr=6&mod=weibotime](http://www.weibo.com/1642512402/zwZB6Btj9?from=page_1002061642512402_profile&wvr=6&mod=weibotime) Accessed: 12 December 2016

ID-3578632808930799 - 北京大学PKUVIS微博可视分析工具 from vis.pku.edu.cn/weibova



**Figure 3.7: The analytical data on Chinese Newsweek’s Weibo**

The layout in Figure 3.7 is called ‘Circular layout’. In this layout, the original Weibo is situated in the centre, formulating a circle by itself. Every node around the circle represents a Weibo that have reposted its content. The size of the node represents the number of every Weibo Account’s followers. From Figure 3.7, there are 23 major Weibo accounts that have re-reposted the original Weibo’s content and got reposted again for more than 500 times. Therefore, they can be considered as essential promoters of original Weibo. However, all of them are counts are ‘commercial accounts,’ meaning that they are highly likely to be paid to repost this certain Weibo. In fact, the original Weibo by itself is a soft advertisement for a bottled water brand called ‘Kunlun Mountain’ (昆仑山). The keyword analysis also shows that the name of this brand ranked secondary after the most mentioned keyword ‘repost’. Besides, the couple described in the Weibo

are working in a private institute called 'Beijing Public Health and Tap Water Research Institute,' which is famous for advertising bottled water.

### Media's propaganda

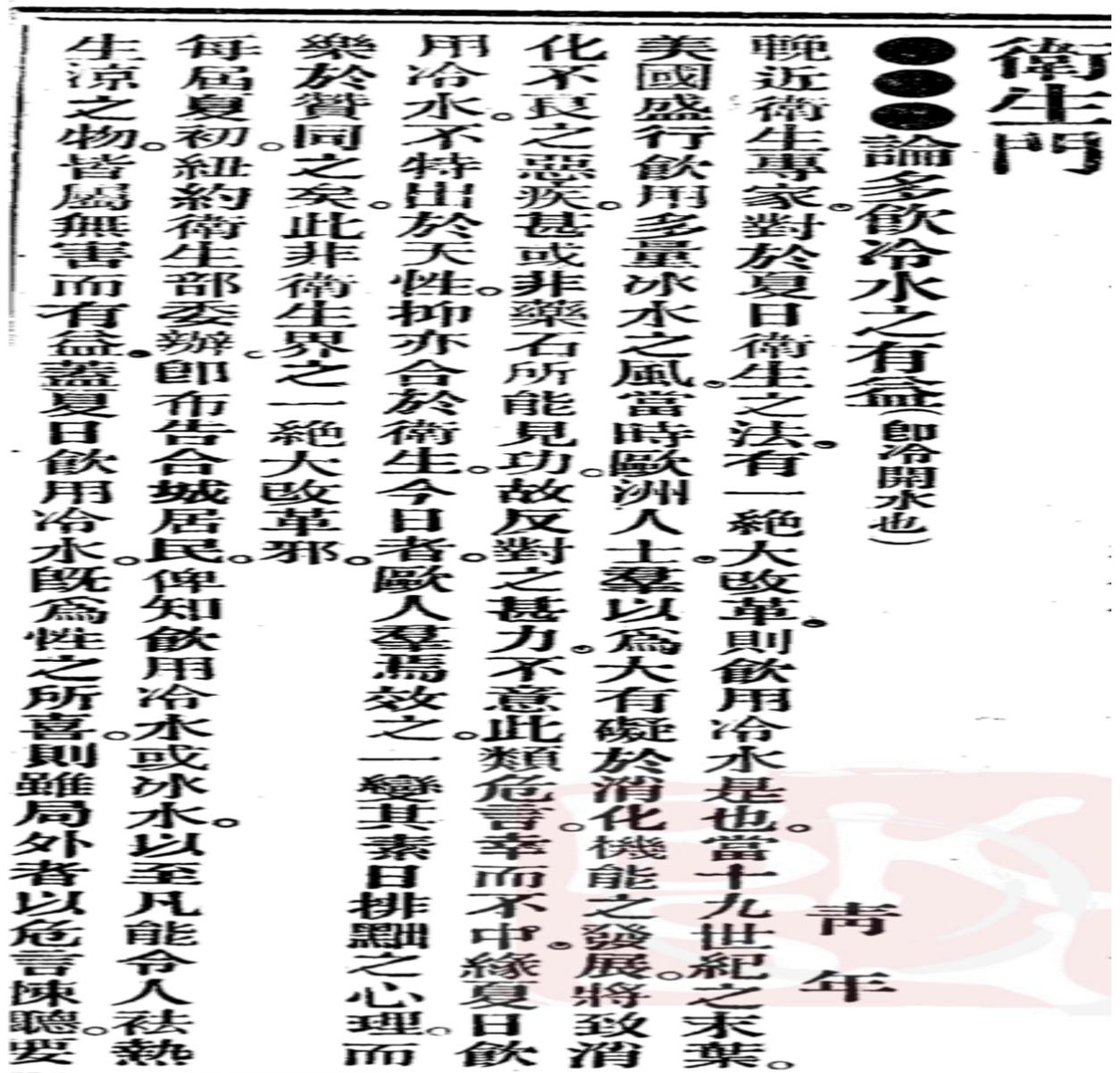


Figure 3.8: The news article about the benefits of drinking plain boiled water published in 1915<sup>13</sup>

The fourth facilitating factor is media's propaganda. As has been highlighted above, in China's history, media has played a pivotal role in advocating Consumer Coping Strategy Matrix. The media propaganda

<sup>13</sup> Source: <http://www.cnbksy.com/home> Accessed: 13 March 2017

of boiled water can be traced back as early as 1915. As Figure 3.8 shows, there was a news article about the benefits of drinking plain boiled water, which was written in classic Chinese and published in the second volume of *Xin Min News* (《新民晚报》), one of the earliest newspapers in modern China.

Later, a series of propaganda articles about the benefits of drinking boiled water can be observed all through the publication history of China's newspapers, advocating plain boiled water as healthy water. For example, given the searching result from a newspaper database<sup>14</sup>, 'plain boiled water' has been mentioned 5132 times in all news titles and contents of China's newspapers published in 2016. Among 16 most mentioned words associated with 'plain boiled water,' at least four words are associate people's health: 'weather,' 'old people,' 'food,' and 'body'. If taking web articles into account, the result is even starker: 'plain boiled water' has been mentioned 70897 times in all web articles published in 2016 with 'doctor,' 'old people,' 'hospital' and 'calculus' as the most mentioned associated words.

### **Low tap water rates**

The fifth facilitating factor is the low tap water rates. Because of the consideration of public welfare, China's urban tap water rates is always keeping at a relatively low level. This low water rates significantly influenced the water company's income, but it also contributes to the justification of semi-potable tap water. For consumer, the low water rates forms a strong justification for the semi-potable quality of tap water. With an idea that tap water 'should be' a cheap commodity with undrinkable quality, consumers turn to Consumer Coping Strategy Matrix. Meanwhile, a low water rates also confined the circulation of money flow, making water company difficult to improve its tap water quality. It is difficult to change this price, since it is not simply a reflection of supply and demand in a market that contains competitions between various companies. It is an outcome of complicated political and economic negotiation between government and water company. A more detailed analysis and related data of low water rates will be presented in section 4.4.1, Chapter 4.

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<sup>14</sup> Source: <http://wisearch.wisers.net> Accessed: 15 March 2017

### **Water crises and social memory**

Water crises and social memory is the sixth facilitating factor. In recent years, what consumers have observed and perceived were a series of water scandals and crises. For example, in March 2013, Shanghai's tap water quality was under threat after 16,000 diseased pig carcasses were found in tributaries of the Huangpu River. In April 2013, Beijing, one of China's biggest bottled-water producers accused a newspaper based in Beijing of deliberate defaming the company's reputation. In April 2014, Lanzhou's residents rushed to buy bottled drinks after authorities had said benzene had been found in tap water at 20 times above national safety levels. In October 2014, a recent report from the government official media disclosed that antibiotics had been detected in the river water of Haihe River, the Yangtze River, Huangpu River, Pearl River, Liaohe River and other rivers. It was derived from the sewage that emitted illegally from medicine company and livestock farms near these rivers. From a report about urban tap water quality published in February 2015 by the China Water Safety Charity Fund, in 14 of 29 China's major cities the urban tap water quality were below the national standard in the test (China Water Safety Charity Fund, 2015).

Having placed little attention on consumer's role and function in tap water provision system, many tap water studies in China seem to imply that consumer's behaviour will not be influenced and changed by water pollutions and scandals. In fact, the opposite is true. Consumers have tried their best to gain security feeling in terms of adopting Consumer Coping Strategy Matrix. It is just because their dependent on Consumer Coping Strategy Matrix that the market of bottled water, barrelled water, and domestic water filtration equipment began to boom in China. For those who is not wealth enough to adopt the High Cost Commercial Coping Strategy, Low Cost Traditional Coping Strategy becomes their only choice to protect their health from the threat of water crisis (See Figure 3.4). The difference in consumer's capacity of adopting coping strategy leads to a consumer's stratification, which will be highlighted in section 3.5.3 of this chapter. A more detailed evidence about the water crisis and social memory will be presented in section 5.4.

**Knowledge and information gap**

The seventh facilitating factor is consumer's knowledge and information gap. Most previous research discussed the influence of information gap between tap water provision system and consumer from political and economic perspectives, mainly focusing on issues such as regional monopoly and water rates (for example, see Zhu, 2008). No previous research has targeted the influence of such gap in a social and individual perspective, resulting the research gap of consumer's 'response' and coping strategies.

From Knowledge and information gap comprises three aspects: the rapid technology transition of modern tap water, the problematic information disclosure and the dysfunction of NGOs and Industrial Associations.

First, given the historical record, in China, the technology transition of modern tap water was mainly driven by exogenous drivers rather than endogenic drivers. In other words, it was the western colonists (Russian for example) who firstly introduced the modern technology of modern tap water from other countries to China, and 'enforced' China's society to accept it (see section 5.2.2 for detailed analysis). There is no 'endogenic power' or internal motivations in China to innovate this technology by itself. Thus, Chinese tap water consumers neither have enough time nor enough opportunities to elaborate a more 'modernised' recognition of tap water, which forms a sharp contrast to tap water consumers in the UK who have spent over one and a half century to recognise and improve tap water (Harvey, 2015). Consequently, semi-potable tap water has been recognised as an ordinariness in the process of technology transition driven by exogenous power. This will be illustrated in the case study of Harbin in section 5.2.

Second, given the complicity of Hybrid Institutional Architecture, the consumer is incapable of unraveling its structure. What they can do is to deal with the problem of semi-potable tap water independently with the help of their knowledge and experience, namely, the tradition, and the help of market, which is much easier for the consumer to get access.

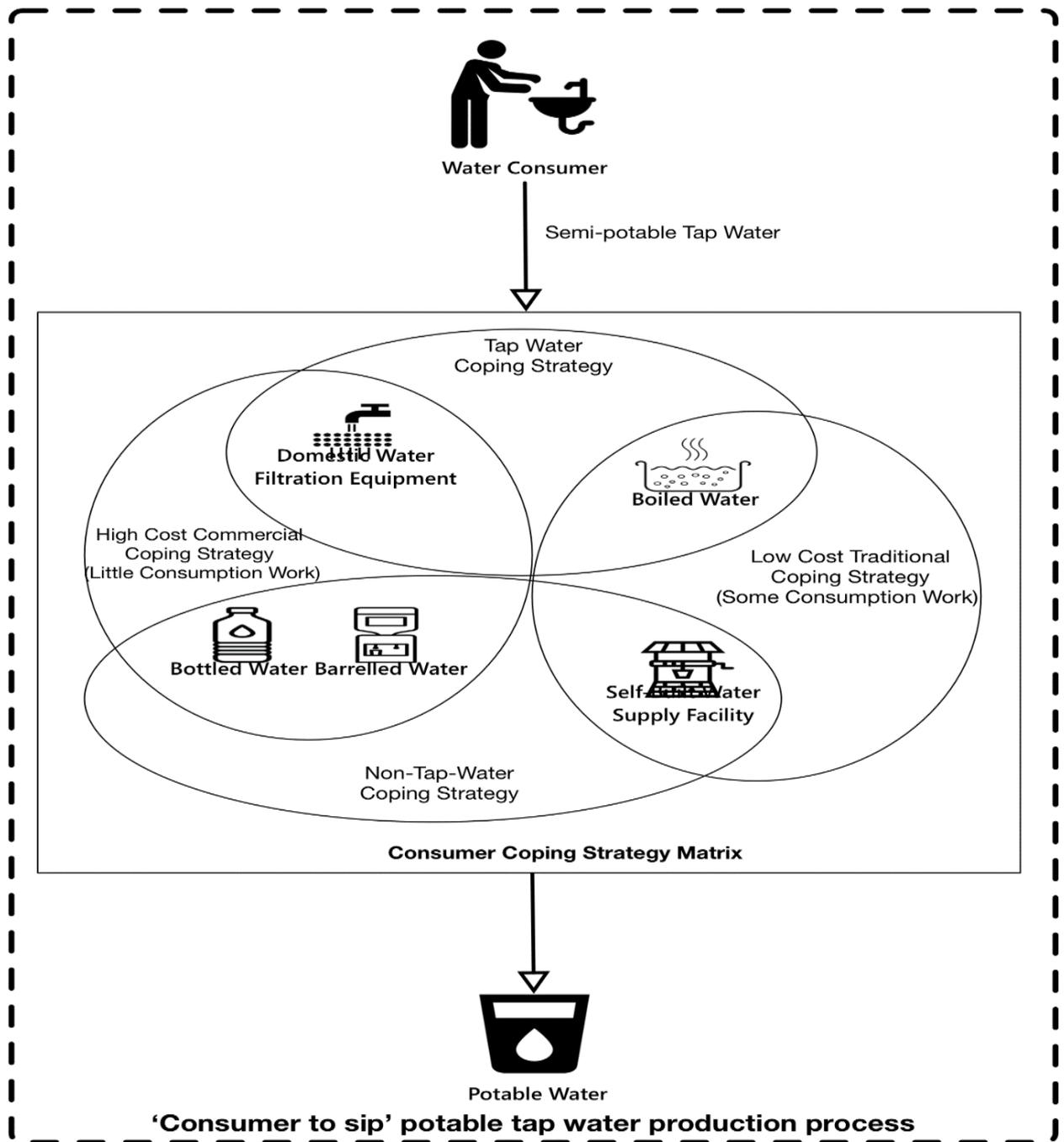
In fact, even the agents in the Hybrid Institutional Architecture have information and knowledge gap between each other, not to mention the gap between them and consumers. Section 6.4 and 6.5 will

present a detailed case study regarding problematic information disclosure between the agents in the Hybrid Institutional Architecture and between the Hybrid Institutional Architecture and consumers.

Third, in the aforementioned context, the central government still restricted the development of both overseas and local NGOs through various means. The overseas NGO's activities were mainly actively restricted by regulations, whereas local NGO's activities were mainly confined by local government and insufficient funds. Meanwhile, rather than establishing an effective communication between Hybrid Institutional Architecture and consumers, most Industrial Associations have posted their main attention on the services they provide to bottled and barrelled water companies. The dysfunction of NGO and Industrial Association will be highlighted in section 4.3.5.

### **3.5.4 'Consumer to sip' potable tap water production process**

Given the analyses above, the question mark left in Figure 3.2 now can be unraveled: what is following the 'source to consumer' urban semi-potable tap water provision system is a 'consumer to sip' potable water production process, shown in Figure 3.9.



**Figure 3.9: 'Consumer to sip' potable water production process**

From this production process, two types of potable water are 'produced' through Consumer Coping Strategy Matrix: potable tap water, produced through Tap Water Coping Strategy; and potable non-tap-water, produced through Non-tap-water Coping Strategy. All together, they function as the end water consumes in their daily life. Thus, no matter what type of potable water it is, consumers have satisfied their potable water demand through this process, which makes them normalise their powerlessness in

the Hybrid Institutional Architecture and the semi-potable tap water supplied by the 'source to consumer' urban semi-potable tap water provision system.

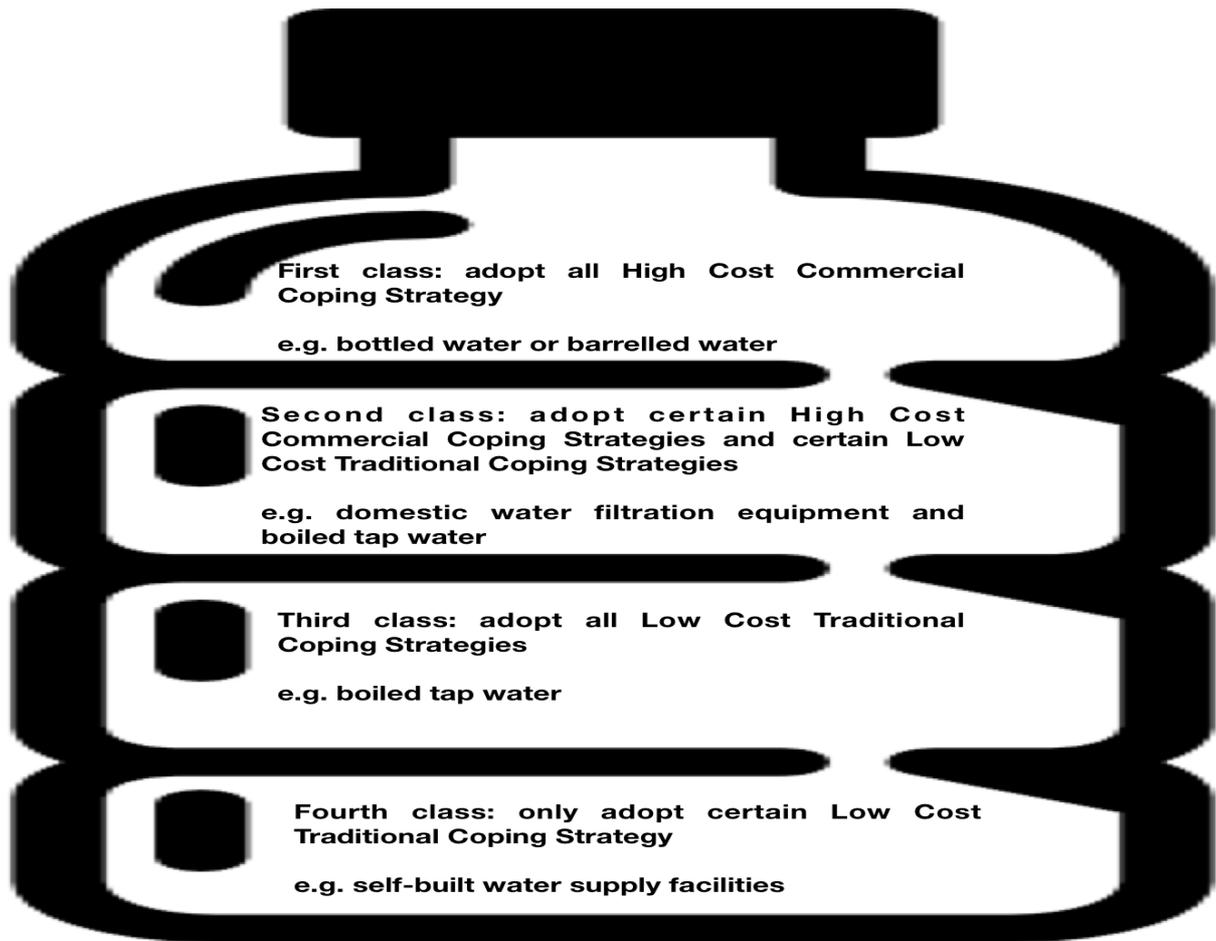
The existence of 'consumer to sip' potable water production process has long been ignored, since the traditional economic understanding of labour production rarely expand beyond consumption. However, in general the 'consumer to sip' potable water production process has imposed a profound influence on China's tap water consumers, making them stratified into different classes on the basis of water, the most basic physical need of human being, as highlighted in next section.

### **3.5.5 Consumer's stratification from Consumer Coping Strategy**

#### **Matrix**

As has been reviewed in section 2.4, tap water is commonly served as public welfare in urban areas and was considered as 'ordinariness' by tap water consumers (Harvey, 2015). However, what is masked by such commonality and ordinariness is the striking social hierarchy centring around Consumer Coping Strategy Matrix in the 'consumer to sip' potable water production process. Note here that this consumer's stratification is an original concept of this thesis. Since it is established on the basis of another original concept, namely the Consumer Coping Strategy Matrix, currently there is no archival evidence either proving its existence or describing its function in the real world. In other words, this stratification is a theoretical assumption derived from induction associated with the concept of Consumer Coping Strategy Matrix.

Here, consumer's capacity of adopting consumer coping strategies is defined as the Coping Capacity. Different coping strategies bestow consumer different Coping Capacity. Meanwhile, the more these coping strategies are, the stronger the Consumer Coping Capacity become. Since consumers' capability of adopting consumer coping strategy is conditioned by their political, economic and social status, consumers can be stratified into four classes, as demonstrated in Figure 3.10.



**Figure 3.10: Consumer's stratification from Consumer Coping Strategy Matrix**

As shown in the Figure 3.10, consumers in the fourth class can only adopt the certain Low Cost Traditional Coping Strategy, either the boiled water or the self-built water supply facilities. Although their exact situations are unknown and required more in-depth research to reveal, a certain connection between their limited Consumer Coping Capacity and their limited income and their residence locations can still be presumed. On the one hand, if they can only adopt coping strategy of self-built water supply facilities, then they are presumed to have limited incomes and live in areas where tap water is not available. On the other, if they can only adopt coping strategy of boiled water, then they are presumed to have limited income and live in areas where tap water is served. No matter which coping strategy they adopt, the limited number of their coping strategies decides their low Consumer Coping Capacity, making them the most vulnerable group of people when confronting with water crisis. This has been evidenced in the case study of Chapter 5. They are presumed to be the largest class in the stratification.

Consumers in the third class can adopt all Low Cost Traditional Coping Strategy. Since boiled water becomes their main coping strategy, they are presumed to have limited income and live in areas where both tap water and self-built water supply facilities are available. Their Consumer Coping Capacity is thus higher than the fourth-class consumers in the water crisis.

Consumers in the second class can adopt certain Low Cost Traditional Coping Strategy plus certain High Cost Commercial Coping Strategy. Since boiled water, bottled water and barrelled water are available for them, they are presumed to have a higher income than consumers in third and fourth classes and live in areas where tap water is served. Their Consumer Coping Capacity is higher than consumers from both the third and the fourth class. However, in some water crises, they have to compete for each other to adopt High Cost Commercial Coping Strategy, as evidenced in Chapter 5.

Finally, consumer in the first class can adopt all High Cost Commercial Coping Strategy. They are presumed to live in the centre areas of cities with higher income than consumers from all three classes. They have the highest Consumer Coping Capacity, many of them can even get access to self-built water supply facilities, which means that they can adopt all coping strategies in Consumer Coping Strategy Matrix. Their number is presumed to be the lowest among all four classes.

### 3.6 Normalisations and their mutual self-reinforcement

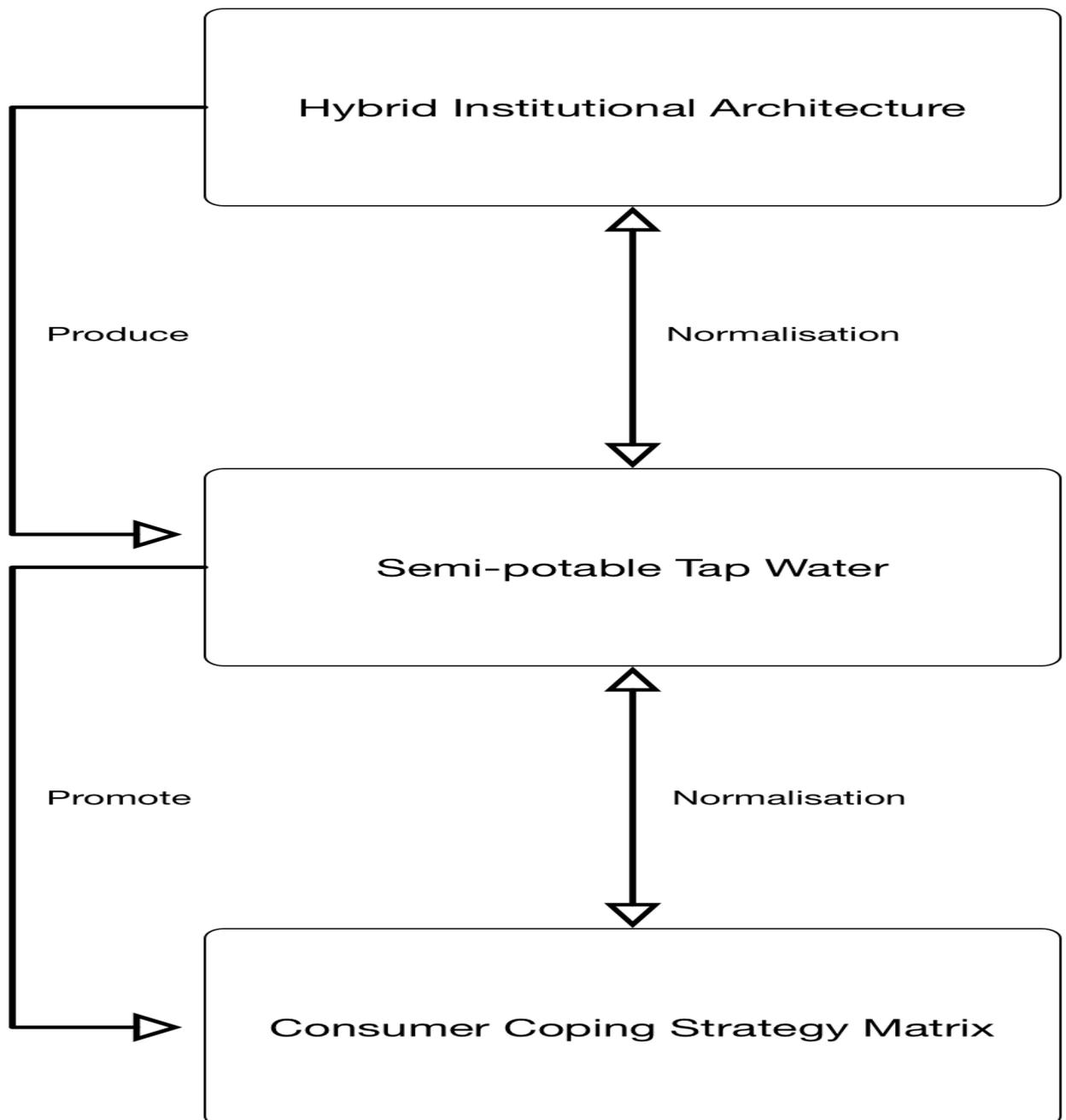


Figure 3.11: The mutual self-reinforcement of normalisation

Here, it is worthwhile to introduce two concepts: normalisation and the re-enforcement of normalisation.

Normalisation is defined as a self-reinforcing dynamic that sustains the 'normality' of certain issues. It can

be considered as a social issue that so ingrained in people's minds that they cannot notice its existence. In other words, normalisation would make people treat certain issues as 'ordinariness,' whose definition has been reviewed in section 2.4 in the literature review. This concept is used here to explain how something such as Consumer Coping Strategy Matrix, demanding extra responsibility and consumption work from consumers who purchased a commodity that supposedly can be consumed immediately, can be socially accepted with no complaints at all.

In a closed system, the normalisations of different issues can reinforce each other mutually. This is defined as mutual self-reinforcement of normalisation. Figure 3.11 demonstrates the mutual self-reinforcement of normalisation. As has been highlighted before, owing to seven facilitating factors, Consumer Coping Strategy Matrix has been normalised by the consumer as an ordinariness. As shown in this Figure 3.11, such normalisation has been transformed into the normalisation of the supply of semi-potable tap water. Meanwhile, the normalisation of semi-potable tap water also transformed into the normalisation of Consumer Coping Strategy Matrix. Thus, they mutually self-reinforce each other's existence. Nowadays, people can observe an interesting phenomenon regarding this transformation: When Chinese travelers first come to countries where potable tap water is available, most of them would still try to boil the tap water to drink. This phenomenon reflects how deeply the normalisations of semi-potable tap water and Consumer Coping Strategy Matrix have been embedded in Chinese people's mind.

Meanwhile, the normalisations of Consumer Coping Strategy Matrix and semi-potable tap water is further transformed into the normalisation of Hybrid Institutional Architecture, and vice versa. The normalisation of Hybrid Institutional Architecture not only disguises the its own problems but also enables the production responsibility shift in the achievement of potable water. Consequently, a vicious circle can be observed: Hybrid Institutional Architecture produces the semi-potable tap water, which then promotes Consumer Coping Strategy Matrix, and through mutual self-reinforcement, their existences are all normalised by the consumer, who have to bear the production responsibility to produce their own portable tap water through Consumer Coping Strategy Matrix. It would be difficult to query the

justification of either one of them because their justification is not only nourished by the normalisation of themselves, but also the normalisations of the other two.

It is worthwhile to compare such normalisation to what had happened in UK's water companies in the late nineteenth century. At that time, predicated on the tension between private water companies and public sewerage system, consumer movements became a major stimulation for the transition of industrial configuration, resulting a new integrated water-sewage organisation (Harvey, 2015). In China, there is also a tension between the semi-potable tap water supplied by 'source to consumer' urban semi-potable tap water provision system and tap water consumers. However, such a tension did not give rise to any significant consumer movements for potential transition of industrial configuration, but fostered Consumer Coping Strategy Matrix, which strengthened in further the consumer's normalisation to semi-potable tap water and Hybrid Institutional Architecture. In other words, compare to consumers in UK, Chinese consumers did not turn the tension into stimulation, but choose to cope the tension by themselves, which makes the 'source to consumer' urban semi-potable tap water provision system keep in a stable and self-balanced status. For many, such tension has transformed into another form of stimulation: the stimulation of increasing Consumer Coping Capacity through adopting high-cost commercial coping strategies.

### 3.7 China's 'source to sip' urban potable tap water provision system

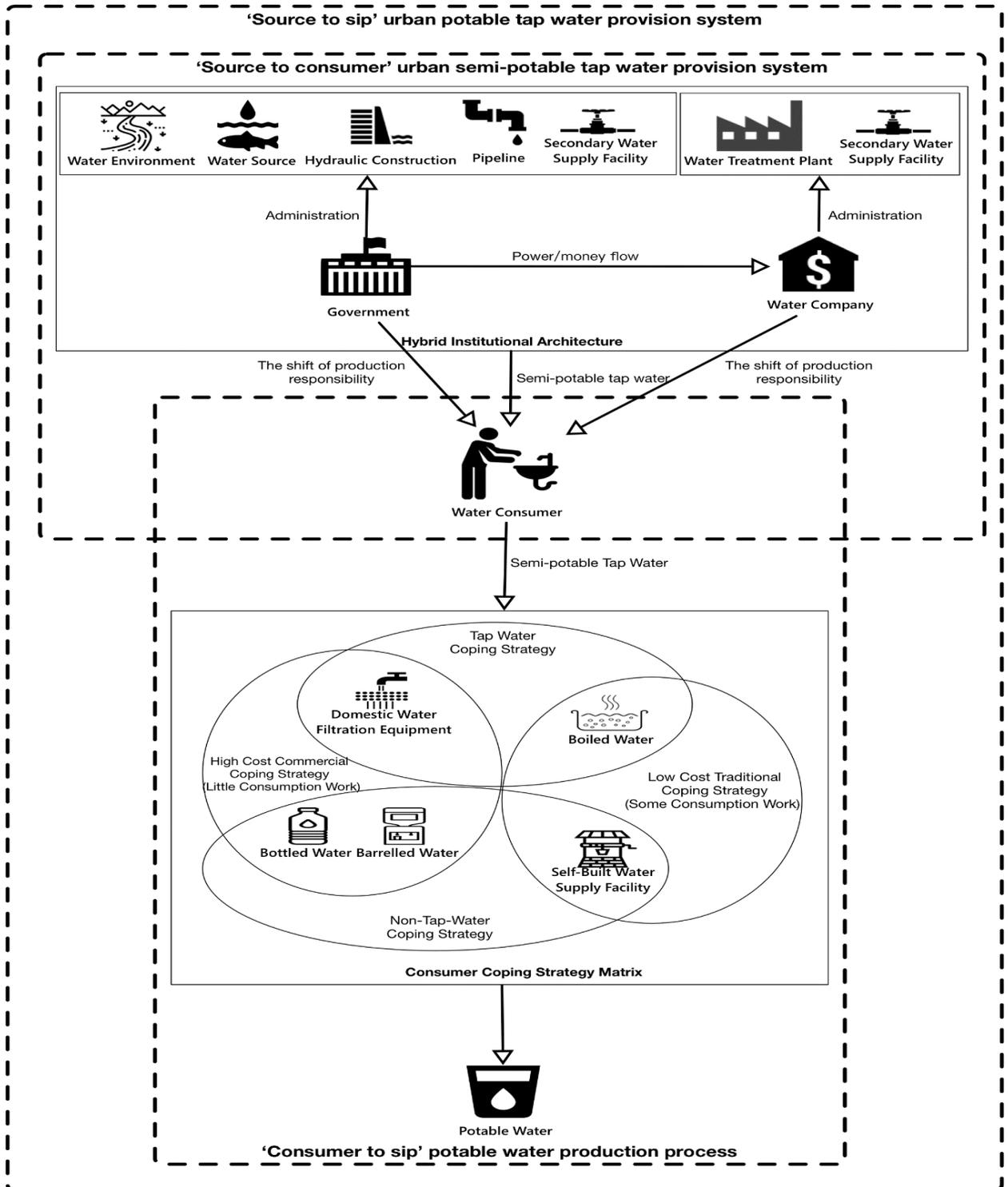


Figure 3.12: China's 'source to sip' urban potable tap water provision system

Previous sections have introduced four key concepts and their interconnections: Hybrid Institutional Architecture is the core and skeleton of 'source to consumer' urban semi-potable tap water provision system; Consumer Coping Strategy Matrix is the core and skeleton of 'consumer to sip' potable water production process. However, when observing China's urban tap water provision from holistic perspective, it appears to be a stable and self-balanced potable tap water provision system. It is just because of such observation that academia has either ignored or taken for granted the fundamental function of Consumer Coping Strategy Matrix and 'consumer to sip' potable water production process. One of the unique contributions of the thesis is to open up this idea of the consumer as part of the potable water production process. In fact, what people have observed is a combination of 'source to consumer' urban semi-potable tap water provision system and 'consumer to sip' potable water production process, demonstrate in Figure 3.12.

The aforementioned combination is a firm but unnoticeable combination, because the 'glues' between 'source to consumer' urban semi-potable tap water provision system and 'consumer to sip' potable water production process are the mutual self-reinforcements of normalisation, which have normalised any potential obstacles of combination, especially the consumer's possible dissatisfaction of potable water production responsibility and their reasonable suspicions of tap water quality and their query of Hybrid Institutional Architecture. However, it is important to emphasise that this system is only a seemingly potable tap water provision system. It cannot be seen as an equivalent to the genuine potable tap water provision system in developed countries, for its operation and function is fully relying on the connection between the 'source to consumer' urban semi-potable tap water provision system and 'consumer to sip' potable water production process. In other words, once there is a problem and/or crisis in such connection, it would also paralyse the operation of this seemingly potable water provision system. This has been demonstrated in the case study in Chapter 5.

Here, it is worthwhile to recapitulate the establishment of 'source to sip' urban potable tap water provision system. First, Hybrid Institutional Architecture was established on the basis of complex circulation of

power/money/water flows between several agents performing as power/money/water nexus. Because of institutional incoherencies in power/money/water flows circulating between various nexuses, a 'source to consumer' urban semi-potable tap water provision system can only supply semi-potable tap water to the consumer. To deal with semi-potable tap water, consumer establishes Consumer Coping Strategy Matrix with the help of seven facilitating factors. During this process, the responsibility of producing potable tap water was shifted from Hybrid Institutional Architecture to the consumer. In certain scenarios (for example, the Harbin's first sociogenic sustainability crisis introduced in section 5.3), the Hybrid Institutional Architecture also shifted certain power to consumers allowing them to initiate the coping strategy of self-built water supply facility. Relying on Consumer Coping Strategy Matrix, a 'consumer to sip' potable water production process is established. This process is capable of supplying potable water, either potable tap water or potable non-tap-water, to meet consumer's potable water demands. Meanwhile, since seven facilitating factors make consumer normalise the Consumer Coping Strategy Matrix, self-reinforcement of normalisation transforms such normalisation into the normalisation of semi-potable tap water supply, which is then transformed into the normalisation of Hybrid Institutional Architecture. All three kinds of normalisation are mutually self-reinforced. Such normalisations become the glue between 'source to consumer' urban semi-potable tap water provision system and 'consumer to sip' potable tap water production process, turning them into a stable and self-balanced 'source to sip' urban potable tap water provision system. Because its seemingly potable water provision capacity, this system disguises the existence of both Consumer Coping Strategy Matrix and Hybrid Institutional Architecture.

### **3.8 Consumer's Institutional distrust in semi-potable tap water**

This section aims to answer the main research question: What is consumer's institutional trust and/or distrust in China's tap water? To answer this question, this section coins the concept of consumer's institutionalised distrust in semi-potable tap water.

The understanding of China's 'source to sip' urban potable tap water provision system provides a foundation for the discussion of consumer's trust in tap water. In this context, three factors need to be highlighted: First, in this trust relationship, the trustor is a consumer, and the trustee is tap water. Second, consumer's trust in tap water should be interpreted within the two systems, the 'source to consumer' semi-potable tap water provision system and the 'consumer to sip' potable water production process, respectively. Third, the characteristic of consumer's trust in tap water is neither in an individual nor organisational level (introduced in section 2.5), because if so it would be influenced by too many disparate factors. Based on previous analyses, the discussion of consumer's trust in tap water needs to be predicated on an institutional level to achieve a comprehensive understanding of China's 'source to sip' urban potable tap water provision system.

#### **Consumer's powerlessness in 'source to consumer' semi-potable tap water provision system**

As Harvey (2015, p.29) pointed out, compared to the economic arrangements engendered by other commodities, the entire distribution and production process of tap water is characterised by 'technology monopoly'. For the consumer, what behind such 'technology monopoly' is Hybrid Institutional Architecture as a whole. Consequently, a dependant relationship between consumer and Hybrid Institutional Architecture is established. In other words, consumer's trust in tap water is established in a particular social milieu of 'source to consumer' semi-potable tap water provision system that trustor has to fully depend on trustee. In the interview with Professor Tian Yu of Harbin Institute of Technology, she also pointed out that consumer is extremely powerless when they confront with either government or water company. From this sense, she argued that government is more crucial in tap water provision system than water company because the former is can be more 'reasonable' when dealing with consumers.

With a significantly marginalised position in 'source to consumer' semi-potable tap water provision system, consumer's dependency in semi-potable tap water is based on consumer's powerlessness. It is important to note here that the such powerlessness derived from the power and information gap between Hybrid Institutional Architecture and consumer. This power and information gap cannot be bridged effectively

regarding the dysfunction of NGO and industrial association. With such powerlessness, consumer's institutional distrust in semi-potable tap water is hardly embodied and demonstrated into any overt emotion, attitude and behaviour, not to mention movements. It looks like that they can only hold a small amount of power of choosing and adopting coping strategy in Consumer Coping Strategy Matrix. However, as will be highlighted in the case study in section 5.4, in some extreme scenarios they would even lose this power and become extremely powerlessness. Such extreme powerlessness is the trigger of social turmoil in the sociogenic water sustainability crisis.

### **Consumer's dual identities in 'consumer to sip' potable water production process**

As has been highlighted in section 3.5.1, in the 'consumer to sip' potable water production process, the power that attached with consumer identity was deprived. Meanwhile, through power and responsibility shift, consumer is bestowed with another identity: potable water producer. Their self-awareness of their identities is changed from the independent tap water consumer to dual identities of semi-potable tap water consumer and potable water producer. How can producers doubt the quality of their production? The sense of distrust, therefore, was repressed by consumers' intertwined identifications. In other words, by involving in the production process of potable water, consumers lost their legitimate senses of distrust in semi-potable tap water as consumer. As a result, semi-potable tap water is normalised by the consumer as a producer, which represses consumer's distrust as a consumer.

### **The problematic public propaganda**

In the interviews, an anonymous expert believed that consumer's distrust in tap water is because of the problematic public propaganda.

'On one hand, general people cannot self-identify the developmental stage of China. This developmental stage is by itself a paradox of industrial development and livelihood improvement. Living in the current developmental stage, it is destined for us to have an uneasy feeling for tap water. On the other, general people's recognition of water problems is in a shallow degree. For example, every random substance in

the water can make them nervous. However, if you ask me, what substance does include in the water? I would ask the question: what substance does not include in the water? If you ask me whether water pollution is harmful, I would answer yes. However, if you ask me about the risk of this harm, I would say it is very low. This is a shift of thinking. The idea of risk is not propaganda in the society. [...] This is the problem of public propaganda. You have to admit that China's water is one of the worst water in the world, but it is not the worst water in the world. It depends on the countries with which you compare.'

In the interview with Liu Wenjun, an expert in tap water provision and a professor at Tsinghua University, he declared that the tap water in Beijing is potable tap water, but with the absent of effective government's propaganda, Beijing tap consumers do not trust its quality.

In a survey of 30,000 consumers of 100 Chinese major cities also demonstrates that among other services, consumers have the lowest satisfaction in water company's public communication<sup>15</sup>. Regarding the public propaganda, 40% of consumers thought it is enough, whereas 19% thought it is not enough. The rest 41% has no attitude. However, such figure may constitute a conflict, for when it comes to the information consumers received from water company, 23% chose water rates, 20% chose water usage amount, and 19% chose water cut-off notice. Only 20% chose consumer service information, only 12% chose tap water knowledge. Thus, it can be told that the relatively high consumer's satisfaction of public propaganda is not predicated on consumer's understanding of their service and tap water knowledge. The problem is about consumer's understanding of the meaning of 'public propaganda'. That is to say, they may identify the information of water rates, water usage amount and water cut-off notice as part of 'public propaganda'.

### **Consumer's institutionalised distrust in semi-potable tap water**

In the context of consumer's powerlessness, consumer's dual identities, and the problematic public propaganda, it can be concluded that in general, China's tap water consumer have an institutional distrust in semi-potable tap water. Such an institutional distrust embodies in the form of Consumer Coping

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<sup>15</sup> [http://zt.h2o-china.com/report/2014/2014gs\\_charts/](http://zt.h2o-china.com/report/2014/2014gs_charts/)

Strategy Matrix, becoming an unnoticeable but functional 'entity'. In other words, the existence of Consumer Coping Strategy Matrix is already persuasive enough to reflect the fact that China's tap water consumers have no expectation at all on tap water's potable quality, although given China's national tap water quality standard, tap water should be potable.

In the context of the China's 'source to sip' urban potable water provision system, it is important to note that the institutional distrust was not raised either between the consumer and the water company or between the consumer and the government, but between the consumer and the Hybrid Institutional Architecture. What is behind consumer is 'consumer to sip' tap water production process, what is behind the Hybrid Institutional Architecture is 'source to consumer' urban semi-potable tap water provision system. In essence, the institutionalised distrust is the reflection of the gap between these two systems. It is so fundamental that few people have noticed and realised it. The more this distrust is deepened, the more solid the Consumer Coping Strategy Matrix would be, and vice versa.

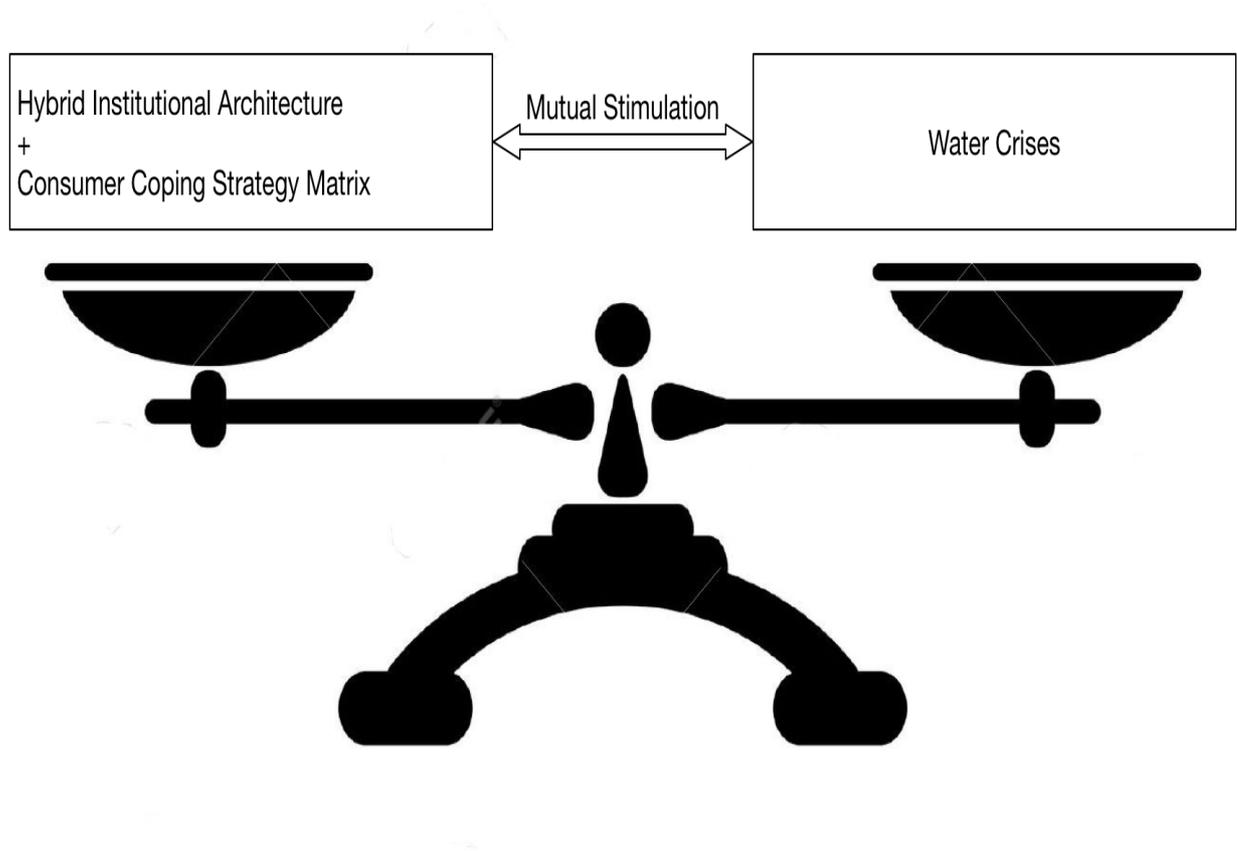
With the institutional distrust in semi-potable tap water being so fundamentally embedded into consumer's mind, when consumers are talking about their trust in tap water, the trustee is not tap water's quality but tap water's manageability. The tap water's manageability can be defined as consumers' self-evaluations on whether they can treat semi-potable tap water with their available consumer coping strategies. In other words, the expectation consumer bestowed onto tap water is not to that it can be drunk directly, but it can be coped and managed with certain coping strategies from Consumer Coping Strategy Matrix. The tap water's manageability is a dynamic concept that depends on each consumer's respective financial capacity. On the one hand, consumers with higher income can always rely on High Cost Commercial Coping Strategy, whereas other consumers with low income can only rely on Low Cost Traditional Coping Strategy. On the other, when tap water is suspended or severely polluted, such as what has happened in the case study of Chapter 5, only those consumers who have stronger financial capacity can afford the only available consumer coping strategy, namely the bottled water and barrelled water. Thus, what is behind the tap water's manageability is various Consumer's Coping Capacities (Introduced

in section 3.5.5). What is behind various Consumer's Coping Capacities is latent social injustice (See section 3.5.5 for detailed analysis).

Meanwhile, since there is a huge potential commercial interest existing behind the consumer's institutionalised distrust in semi-potable tap water, in Consumer Coping Strategy Matrix the market has offered High Cost Commercial Coping Strategy as an alternative of Low Cost Traditional Coping Strategy. Besides, market starts to consolidate Consumer Coping Strategy Matrix by stigmatising the quality of tap water. Today, it can be said that there are several huge industries, such as the industry of barrelled water and domestic tap water filtration equipment, established their business solely on consumer's institutional distrust in semi-potable tap water.

Finally, an ironic vicious circle is formed by consumer's institutional distrust: whereas consumers have institutional distrust in semi-potable tap water, the Consumer Coping Strategy Matrix they implemented further counteracts the possibility of any bottom-up consumer's movements, making this system more stable and more self-balanced, This will then intensified the institutionalised distrust again.

### 3.9 Sociogenic water sustainability crisis



**Figure 3.13: The balance of sociogenic water sustainability crisis**

Previous sections have outlined the composition of ‘source to sip’ urban potable tap water provision system. Its operation relies on two essential systems: Hybrid Institutional Architecture and Consumer Coping Strategy Matrix. This section aims to present the concept of sociogenic sustainability water crisis.

Given the Oxford Dictionary, sociogenic is defined as ‘originating in society or social interaction’<sup>16</sup>. Following this definition, a sociogenic sustainability crisis can be defined as a sustainability crisis that mainly triggered by motivations from both the natural environment and the social fabrics of certain society.

<sup>16</sup> Source: <https://en.oxforddictionaries.com/definition/sociogenic>

In other words, like Harvey (2015, p.6) has claimed, the crisis is the outcome of the interaction of sociogenic and the naturogenic, motivations, 'neither causal series being reducible to the other'.

As Figure 3.13 shows, the aforementioned two systems have formed a dialectical relationship with the water crisis. On the one hand, they keep a balance with each other; on the other, they mutually stimulate the development of each other. A sociogenic water sustainability crisis will outbreak when they lose their balance. From this sense, the outbreak of sociogenic water sustainability crisis can also be considered as the outcome of consumer's institutional distrust in tap water.

Since 'source to consumer' urban semi-potable tap water provision system is, to a large extent, immune from any stimulations either from its internal Hybrid Institutional Architecture or its external consumer and Consumer Coping Strategy Matrix, its development is stagnant. Many incoherencies in power/money/water flows are either invisible or being disguised by the complicity of the system. Thus, the accumulation of these incoherencies would foster the potential risk of water crises in various forms. Meanwhile, the outbreak of various water crises performs as the possibly only strong external stimulation for the development of Hybrid Institutional Architecture. It is the eruption of various water crises that exposes the incoherencies and problems in Hybrid Institutional Architecture, which would then be rectified, modified, or disguised by the government and the water company.

Contrary to the Hybrid Institutional Architecture, Consumer Coping Strategy Matrix is also exposed to too many stimulations, both internal or external. Consumers always single-handedly rely on Consumer Coping Strategy Matrix. Once the balance between the Hybrid Institutional Architecture, the Consumer Coping Strategy Matrix and water crisis changed, consumer will try their best to either secure their old consumer coping strategies or develop new ones. During this process, their unmanaged behaviours can become the trigger of new sociogenic sustainability crises. For example, as will be presented in the case study in section 5.3, without effective control and management, the self-built water supply facilities as consumer's coping strategy for fragmented tap water supply have caused the groundwater scarcity crisis in Harbin. Another example is the huge production of bottled water, which in effect generate huge amount of plastic waste

pollution to water resources. Note there that rather than criticising consumers as the trigger of crisis, this argument is aiming to clarify the roots of those seemingly consumer-lead sociogenic sustainability crises are their over-dependence on Consumer Coping Strategy Matrix.

As has been analysed in section 3.5.3, the outbreak of these sociogenic sustainability crisis and its associated social memory are in turn functioning as one of the seven facilitating factors that further promote, justify and normalise the development of Consumer Coping Strategy Matrix.

As Harvey (2015) pointed out, a sustainability crisis emerges from the interaction between certain societal characteristics and its natural resource environment. Different from general water sustainability crisis, the outbreak of sociogenic sustainability crises entails a contingent combination model composed by five interconnected conditions: history condition, geography condition, political condition, environmental condition, and culture condition. This sociogenic sustainability crises would trigger a series of uncontrolled and unexpected domino effects in the social sphere, which would then intensify the damage of water sustainability crisis and social turmoil. For example, when Songhua River experienced water sustainability crisis of toxic spill, a sociogenic water sustainability crisis outbreak in the form of social and market turmoil. Realising the ineffectiveness of Low Cost Traditional Coping Strategy, many people rushed to market and emptied the shelves of bottled water. Two specific cases of sociogenic water sustainability crisis will be presented in later chapters.

## **3.10 Conclusion**

The new concepts and conceptual framework coined and developed in this chapter is a necessary effort to address the distinctiveness and complexity of China's urban tap water provision system. Its complexity mirrors the reality, evidencing the fact that there is no simple and parsimonious model that could explain the paradox of a seemingly potable tap water provision system and consumer's institutional distrust in tap water.

Such distinctiveness and complexity is illustrated in three aspects: the distinctiveness and complexity of tap water is elaborated through coining the concept of semi-potable tap water; the distinctiveness and complexity of tap water provision system is elaborated through introducing the concept of Hybrid Institutional Architecture; the distinctiveness and complexity of consumer reactions is elaborated through presenting the concept of Consumer Coping Strategy Matrix; the distinctiveness and complexity of consumer's trust in tap water is developed by highlighting the concept of consumer's institutionalised distrust in tap water; the distinctiveness and complexity of water sustainability crisis is elaborated through revealing the concept of sociogenic water sustainability crisis.

Taking all these distinctiveness and complexity into consideration, China's urban tap water provision system can be seen as the combination of two systems: 'source to consumer' semi-potable tap water provision system and 'consumer to sip' potable water production process. This combination functions as a 'source to sip' urban potable tap water provision system, which, to a large extent, disguises the distinctiveness and complexity that mentioned above. To have a comprehensive understanding of this system, next Chapter will examine three institutional incoherencies existing in power/money/water flows circulating in the 'source to consumer' semi-potable tap water provision system.

# **Chapter 4 Three Institutional Incoherencies in China's Urban Tap Water Provision System**

## **4.1 Introduction**

In the 'source to consumer' semi-potable tap water provision system, the institutional incoherencies in the nexus of power/money/water flow is the foundation of Hybrid Institutional Architecture. The institutional incoherency in power flow can be captured in three relationships: the relationship between government departments themselves, the relationship between government, water company and the consumer, and the relationship between consumer, third parties, and the Hybrid Institutional Architecture. The institutional incoherencies in money flow can be captured in the setting of water rates and the operation of water companies. Finally, the institutional incoherencies in power and money flow leads to the institutional incoherency in water flow: the gap between the strict water standard and semi-potable tap water.

## 4.2 The grim situation of China's fresh water resources

China is one of the most water-strapped countries in the world. Fresh water resources in China is not only scarce in quantity but also polluted in quality (Xie, 2009; Crow-Miller, 2015). Huge government investments have been placed to prevent fresh water pollution, but the serious situation of China's fresh water resources is still hardly soothed, if not even worsened.

### **The scarcity and uneven distribution of China's freshwater resource**

Fresh water resources in China accounts for just 6% of global freshwater resources. In 2014, the total renewable internal fresh water resources in China was 2813 billion cubic meters, ranking 5th out of 177 countries (The World Bank, 2017). However, as shown in Figure 4.1, from 1962 to 2013, China's renewable internal fresh water resources per capita dropped sharply from 4225 to 2072 cubic meters, only ranking 102nd out of 177 countries. The average world figure was eight times higher than China's. As a result, China is in the group of 'water scarcity' countries, whose annual fresh water availability per capita is under 1000 cubic meters (Xie, 2009).

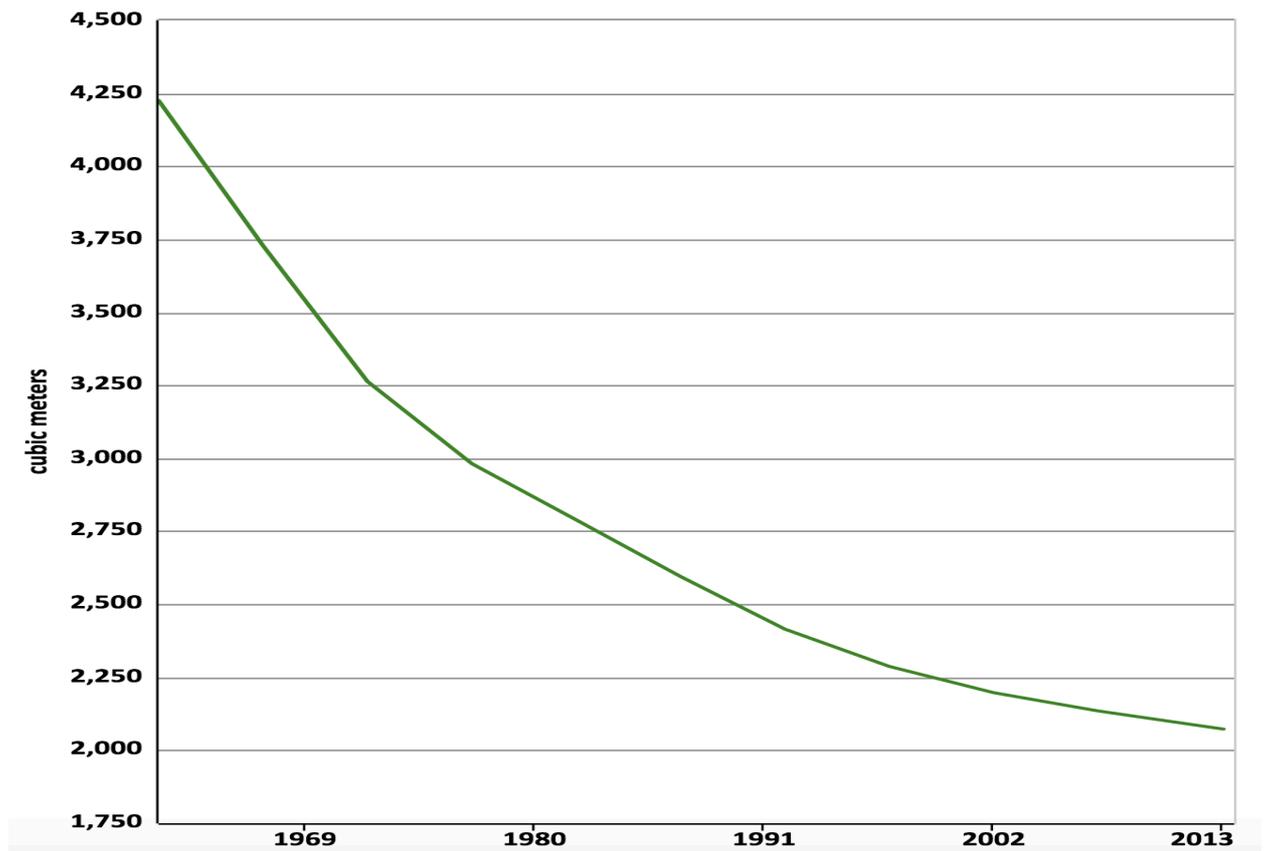


Figure 4.1: China's renewable internal fresh water resources per capita from 1962 to 2013<sup>17</sup>

Fresh water resources in China is not only scarce in its amount but also dispersed unevenly, which caused unbalanced fresh water accessibility. Given the latest data of *2015 China Water Resources Bulletin* (Ministry of Water Resource, P. R. China, 2017), in Northern China, the Songhua, Liao, Hai, Yellow, Huai and other rivers regions contain only 16.9% of China's total fresh water resource. The other 83.1% of fresh water resources is distributed in Southern China, including the Yangtze (including Tai Lake), Pearl and other rivers regions. It also pointed out that the average rainfall in Southern China, over 2,000 mm/year, was five to ten times higher than in Northern China. As a result, the fresh water availability per capita in Northern China was a quarter of the fresh water availability per capita in Southern China, one eleventh of the world average fresh water availability per capita.

<sup>17</sup> Source: <https://knoema.com/WBWDIGDF2015Oct/world-development-indicators-wdi-november-2015?tsId=1025060&origin=cn.knoema.com> Accessed: 7 April 2017

**Water quality of China's major rivers, major lakes, major reservoirs, and groundwater**

Water quality is big concern. On April 28, 2002, NEPA published *National Environmental Quality Standards for Surface Water* (Ministry of Environmental Protection P.R. China, 2002). According to this standard, water quality is classified into five levels. Note here that such classification is based on the functionality of water resource. Grade I water is in very good quality, mainly used for drinking water source and water in natural reserves; Grade II water is in good quality, primarily used for drinking water source and animal habitats; Grade III water is in average quality, primarily used for water source, aquaculture, and swimming zones; Grade IV water is of poor quality, primarily used for industrial production; and Grade V water is of very poor quality, primarily used for agriculture production. In many contexts, there is another level, namely lower Grade V, representing water in an extremely poor quality. Low Grade V water is of such a bad quality that it lost all of its functionality.

Given the official data published by MEP (Ministry of Environmental Protection, P. R. China, 2015) , Figure 4.2, Figure 4.3, and Figure 4.4 demonstrate the water quality of China's major rivers, major lakes, major reservoirs, and groundwater.

Figure 4.2 demonstrates the water quality of China's major rivers in 2014. Given their remote locations, the water quality of rivers in Southwest and Northwest China were much better than others. The water of Pearl River and Yangtze River are also of a relatively good quality, though they both have a small percentage of water in extremely poor quality, 3.7%, and 3.1% respectively. For Yellow River, Songhua River, Huai River and Rivers in Zhe and Min Areas, most of their water was of average quality, which means that they were barely used as water sources. For the Liao and Hai, most of their water was of a quality below the average level, which meant they were only used for industrial and agriculture production purposes. To conclude, among all these rivers, only 2.8% of their water was very good quality, 36.9% of good quality, 31.5% of average quality, 15% of poor quality, 4.8% of very poor quality and 9% of extremely poor quality. It means that only 71.2% of China's major rivers' water can be used for tap water supply, and only 39.7% of China's major rivers' water could be considered as source water in good quality.

Figure 4.3 demonstrate the water quality of China's major lakes and reservoirs in 2014. Among 62 major lakes and reservoirs, seven had water in very good quality, 11 had water in good quality, 20 had water in average quality, 15 in poor quality, 4 in very poor quality and 5 in extremely poor quality. The main pollutant was phosphorus from the intensive usage of fertiliser and organic pollution derived from water eutrophication. In conclude, only 61.3% of China's major lakes and reservoirs' water can be used for tap water supply, and only 29% of China's major lakes and reservoirs' water could be considered as source water in good quality.

Figure 4.4 demonstrates the water quality of China's groundwater in 2014. There was a significant difference between ground water quality in Northern China and Southern China. In Northern China, the groundwater quality was much worse than it was in Southern China. Because of the intermingling between surface water and ground water, 86.1% ground water was from surface water, which implied that the pollutions in both the groundwater and the surface water were transferable (Ministry of Water Resource, P. R. China, 2014). Given the latest data published in 2016, 80% of groundwater resources has been polluted by the transferred agriculture and industrial pollutant existing in the surface water resources (Shan, 2016). Therefore, the pollution in major rivers located in Northern China was transferred into groundwater. The monitoring data of groundwater in the Northern 17 provinces showed that only 0.5% of groundwater was very good quality and only 14.7% of groundwater was in good quality, 48.9% of groundwater was of poor quality, and 35.9% was in very poor quality. The main pollutant was the toxic organic pollutant, heavy metal pollution, and nitrogen pollution.

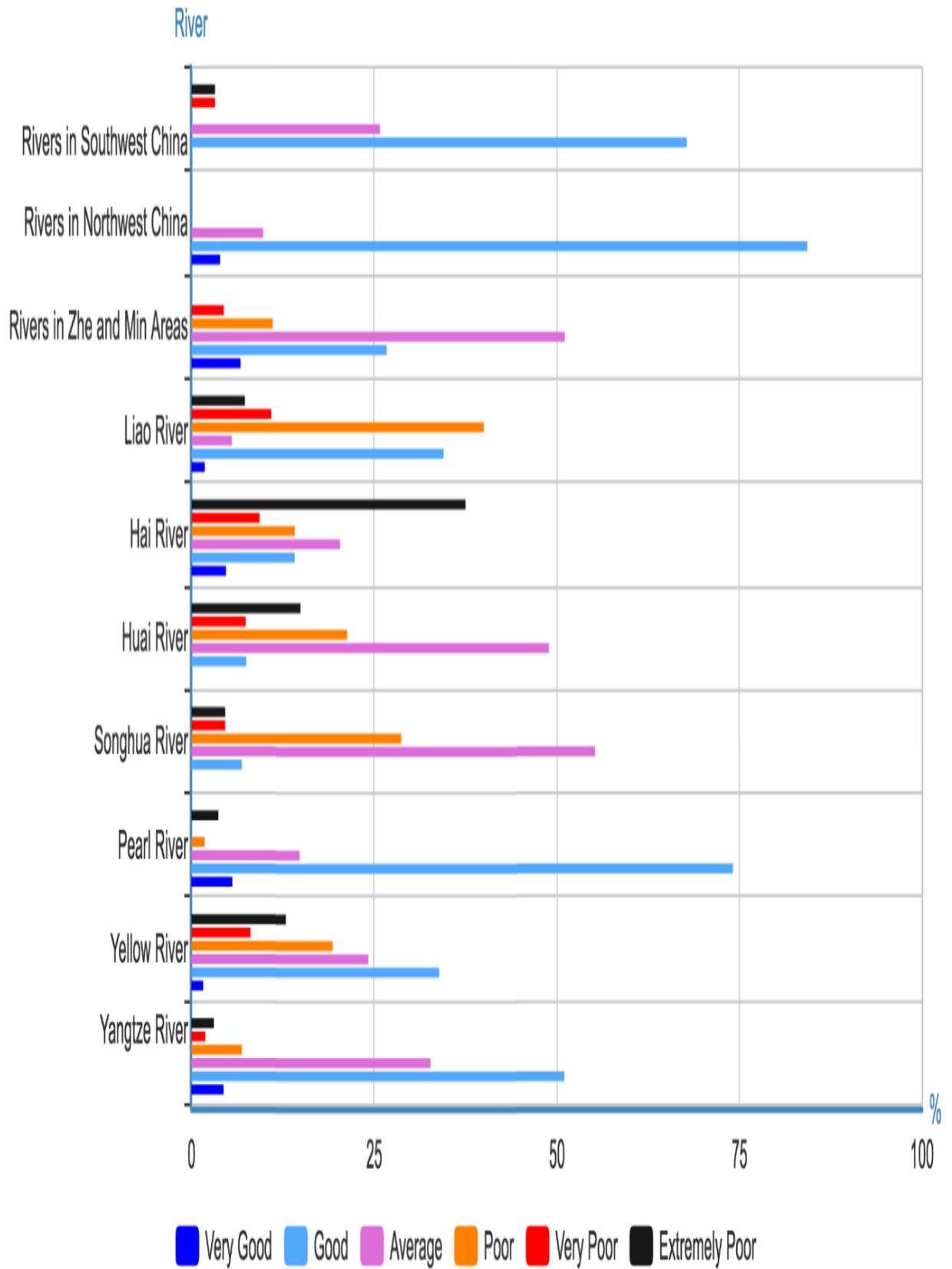


Figure 4.2: Water quality of China's major rivers in 2014

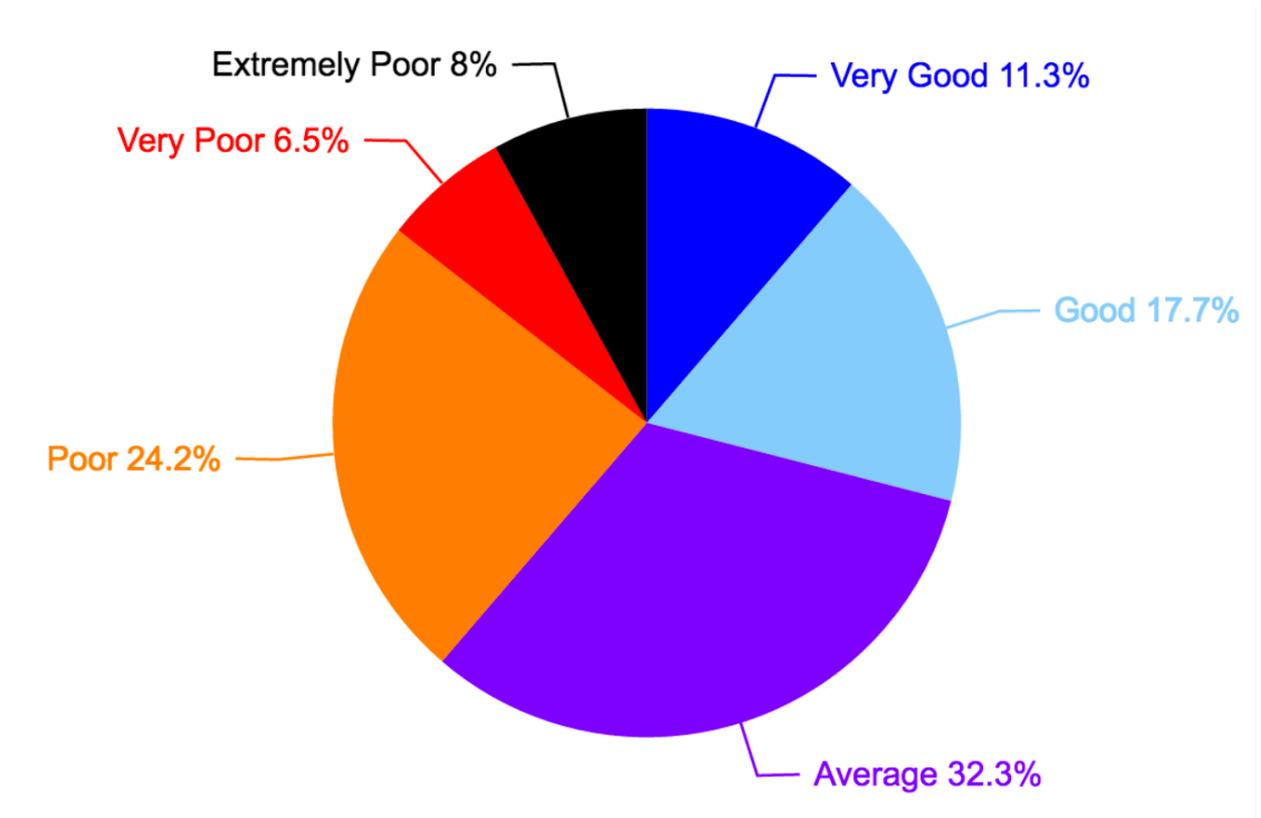


Figure 4.3: Water quality of China's major lakes and reservoirs in 2014

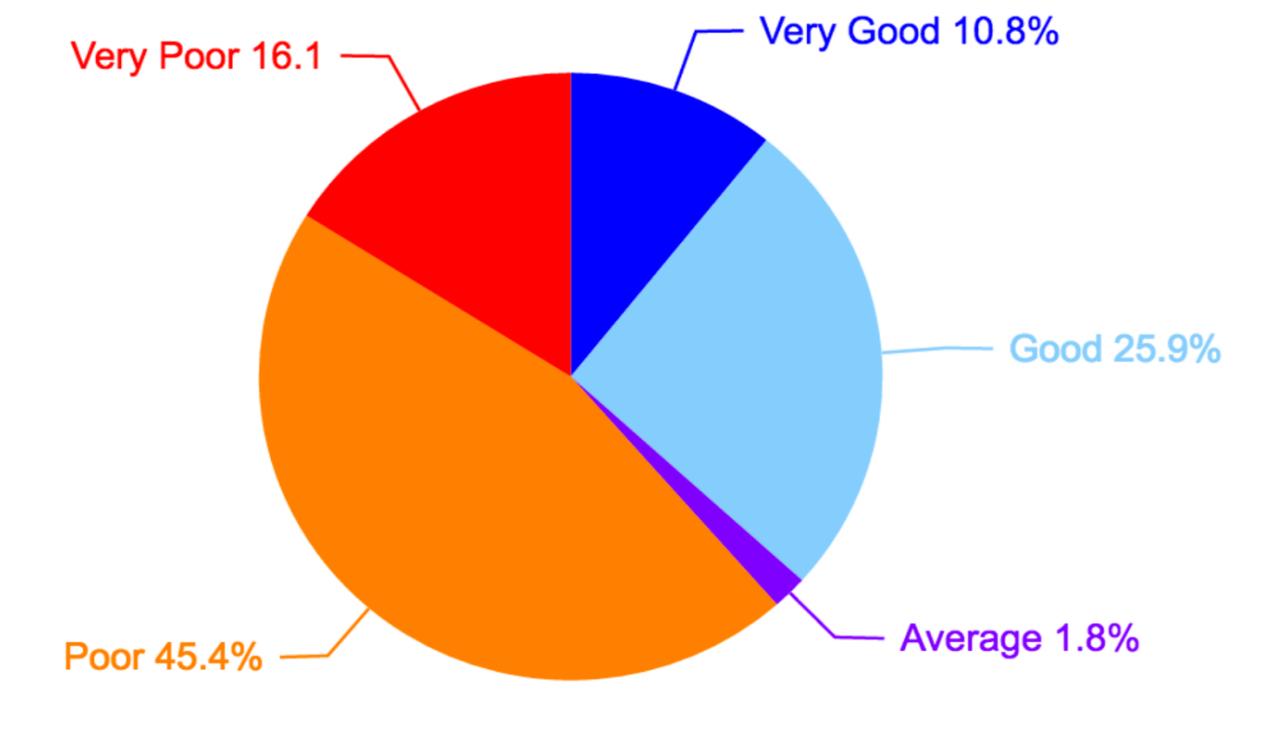


Figure 4.4: Water quality of China's groundwater in 2014

### The rapid expansion of China's water-served population

In the face of the water resource's poor quality, the percentage of the population of people using safely managed drinking water services (water-served population) increased rapidly. Given WHO's definition<sup>18</sup>:

Improved drinking water source is a source that, by nature of its construction, adequately protects the water from outside contamination, in particular from faecal matter. Common examples: piped household water connection, public standpipe, borehole, protected dug well, protected spring rainwater collection.

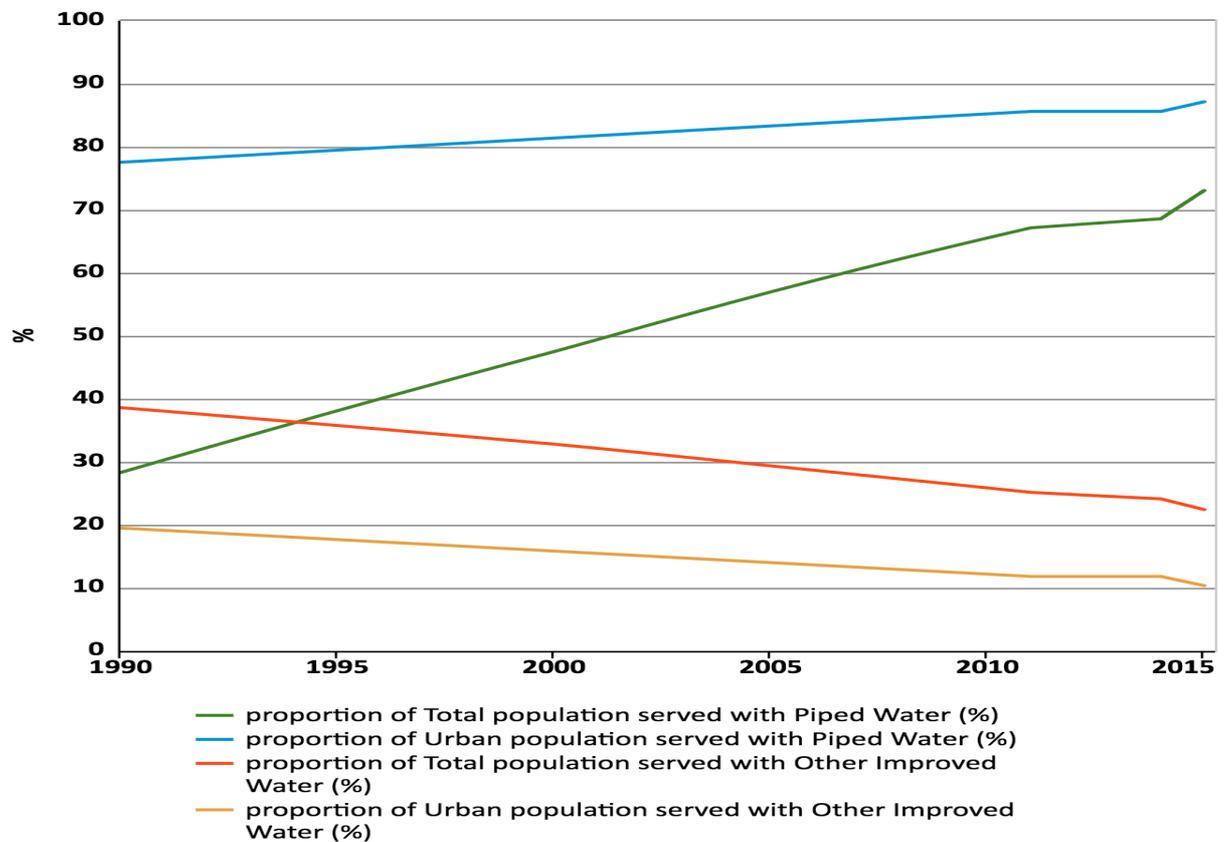
As Figure 4.5 has shown, given the data from WHO/UNICEF Water Supply Statistics in 2015<sup>19</sup>, in China the proportion of total population served with piped water increased from 28.3% in 1990 to 73.07% in 2015. It surpassed the percentage of total population served with other improved water in 1995, which means that since 1995 there are more Chinese people being served with piped water than those who fetched water from other sources, such as wells. With the development of piped water, the proportion of total population served with other improved water decreased from 38.61% in 1990 to 22.43% in 2015. In urban areas, the change was not as significant as in the whole country. The proportion of urban tap-water-served population increased from 77.55% in 1990 to 87.15% in 2015, whereas the percentage of the urban other-improved-water-served population decreased from 19.50% in 1990 to 10.35% in 2015.

From this Figure 4.5, two crucial facts can be observed: first, the government's efforts of developing tap water have been placed on expanding piped water supply. Second, such efforts were achieved through replacing the other improved water supply with piped water supply. In other words, during the 25 years between 1990 and 2015, the tap water has been embedded in most Chinese people's lives in both urban and rural areas. Such rapid expansion did not come without a price. As Tao Tao and Kunlun Xin (2014) pointed out, diseases caused by water pollution, such as liver and gastric cancers, lead to the illness of 190 million people and the death of 60,000 people every year in China. The catastrophic outcomes of water-borne diseases have caught the government's attention. In the same paper, they indicated that as much

18 Source: [http://www.who.int/water\\_sanitation\\_health/monitoring/jmp2012/key\\_terms/en/](http://www.who.int/water_sanitation_health/monitoring/jmp2012/key_terms/en/)

19 Source: <https://knoema.com/WHOWSS2014/who-unicef-water-supply-statistics-2015> Accessed: 7 April 2017

as four trillion RMB has been invested since 2011 as part of the central government's Five-Year Plan, which aimed to upgrade water supply facilities such as pipelines and water treatment plants.



**Figure 4.5: The proportion of China's total and urban population served with piped water and other improved water from 1990 to 2015**

The grim situation of China's fresh water resources has contributed to the formation of institutional incoherency. On one hand, the serious water pollution, especially water source pollution, has formed a difficult challenge to both water administration and water treatment in terms of power and money. It is also directly incoherent with the strict standards of tap water quality. On the other, the rapid expansion of water-served population brings up a huge burden to every agent in the system, making them prioritise stability of the tap water provision system over all the other tasks, including the task of produce potable tap water.

## 4.3 The institutional incoherency in power flow

Circulating in the 'source to consumer' urban semi-potable tap water provision system between various power/money/water nexuses, the institutional incoherencies in power flow can be observed in three types of relationships. In respect to the relationship between government departments themselves, there is an institutional incoherency in power flow of the transformation of administration mechanism and the power redistribution between government departments. In respect to the relationship between government, water company and consumer, there is an institutional incoherency in power flow that demonstrates in the water supply contract. In respect to the relationship between consumer, third party and Hybrid Institutional Architecture, there is an institutional incoherency in power flow leads to the dysfunction of the third party.

### 4.3.1 China's legal and policy framework for water administration

In China, legal and policy documents regarding water affairs can be classified into a nine-level legal and policy framework. As demonstrated in Figure 4.6, in each administration level there are laws, rules, regulations or measures of managing water affairs published by the regulatory department. In their study, Liu and Speed (2009) did not integrate measures issued by the municipal government and its subordinate department into their water management policy framework. However, these measures are also essential components of the general legal system, especially given the fact that the municipal government became the main administration department of municipal water affairs after the Super-Ministry Reform. As a result, it is departments from the last three levels in Figure 4.6 that implement administration of water affairs at the local level, and measures published by them are always inspired and set by their local specific conditions. As a contrast, legal documents issued by agents of the first six administration levels do not include any details of tap water provision, but they have established a general legal context for the publication of detailed legal documents.

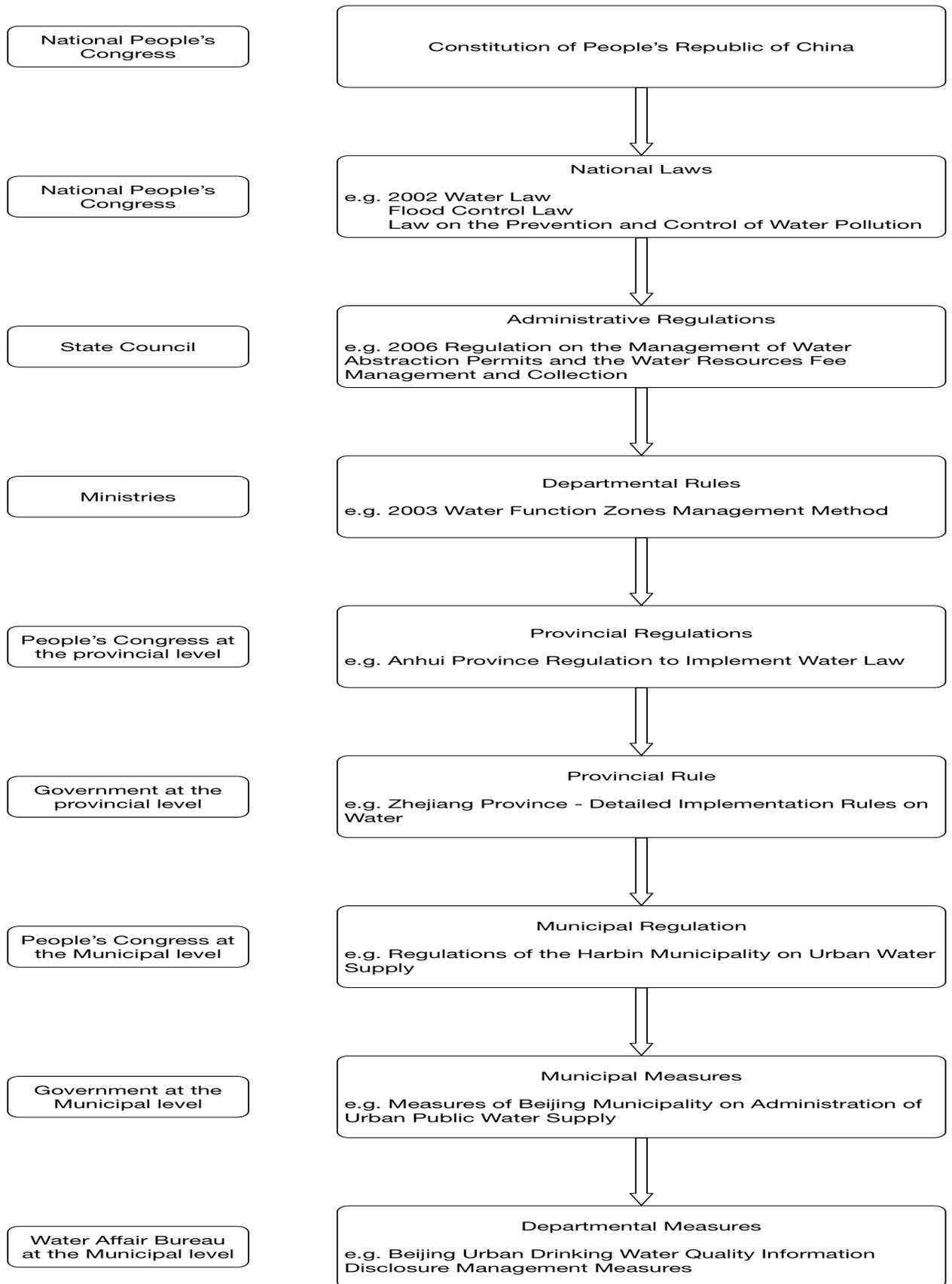


Figure 4.6: China's nine-level legal and policy framework of water affairs

### China's five major government plans

Centring around a nine-level legal and policy framework of water affairs, there are five types of major plans associated with urban tap water provision. These are urban comprehensive plan, water resources allocation plan, water resources use and supply plan, drought contingency plan, and water saving plan. Given the fact that the administration power of urban water affairs has been separated from the administration power of governments and departments in national, provincial and river basin level and bestowed to municipal government (this will be revealed in detail in section 4.3.3), these plans can be roughly classified into two levels: one is national, provincial and river basin level, the other is municipal level, as demonstrated in Figure 4.7. Cosier and Shen (2009) did not integrate the water saving plan as a major component of the policy framework. However, the proposal of constructing a water saving society is a crucial interaction between the government and the consumer, as will be demonstrated later. For this reason, the author integrates the Water Saving Plan into this system.



Figure 4.7: Five types of government plan related to urban tap water provision

The Urban Comprehensive Plans, including the national, provisional and municipal comprehensive plan, constitutes the general framework to decide the urban development in the next one, five or ten years, which includes the development of urban tap water provision system.

The Water resources Allocation Plans are made on the catchment-based river basin level. They are constructed on the basis of water rights theory, a theory promoted by the central government and developed rapidly in recent years and a mechanism of establishing water sharing rights in and between provincial level, especially for trans-provincial river (Sun, 2009, p.190). Given both the Constitution of the People's Republic of China and the 2002 Water Act, water resources in China is owned by the state on behalf of the people. Thus, what is controversial is not the ownership of water resource, but the right of accessing and using it. The power of managing and allocating water resources in a national scale belongs to central government, which uses *Water resources Allocation Plan* to determine the distributed amount of water resources of each administrative region within the same river basin.

The Water Use and Supply Plans, as the name suggested, are plans that predict water demand and water usage in both the short-term (annually) and long-term (five to ten years).

In periods of extreme drought, the *Drought Contingency Plans* function with the priority over other plans. It aims to guarantee the basic water supply to urban citizens.

*The Proposal of Constructing Water-Saving Society* is an essential developmental goal that has been claimed for more than 30 years. Since it has a deeper connection with consumers than other plans, here it is worthwhile to elaborate a little bit about the analysis of this plan.

Hu and Wang (2003, p.464) believes that it is the fundamental solution for China's water resources scarcity crisis. The goal of constructing water-saving society is to 'reduce the cost of water management and build up the incentive mechanism stimulating water-saving' (Hu and Wang, 2003, p.464). This proposal demonstrates that the central government is trying to mould the consumer to a certain behavioural mode.

China initiated its water-saving project in the first urban water-saving conference in 1983. This is also the first time that central government combines the water affairs with society in the form of a political slogan. Later in 1990, the term 'water-saving city' was coined and proposed by the central government, which was then developed into 'water-saving society' in the 10<sup>th</sup> *Five-Year Plan of National Development* in 2000 (Hu and Wang, 2003, p.470). This term was emphasised from time to time in the later 11<sup>th</sup>, 12<sup>th</sup> and 13<sup>th</sup> *Five-Year Plan*. This situation, on the one hand, demonstrates central government's determination in achieving the goal of 'water-saving' society. However, on the other, it also implicates the difficulty of reaching this goal. In December 2006, Chinese Minister of Water resources (MWR) published an essential plan, *Water-Saving Society Eleventh Five-Year Plan*, aiming to shift the whole society from the water consuming society to water saving society with the help of a series of water-saving and water-using technologies. This plan asked every province and every direct-controlled municipality to publish a water saving plan on the basis of their respective water condition and situation. However, the implementation of this plan is problematic. This is due to the institutional incoherency in power flow, particularly in respect to the communication between different agents. It could have been an opportunity for the government to cooperate with third parties, such as NGOs and Industrial Associations, to promote the administration of tap water. However, in light of their dysfunction, demonstrated in section 4.3.5, this proposal is only implemented in the governmental and departmental level rather than consumer level. The only regulation regarding water saving was published by MHURD in 1988 and has never been revised since then.

In sum, these five types of water plans have formed the legal basis for the circulation of power/money/water flow from central government to the other agents. These five policy frameworks are updated annually, which provides the latest modifications on the basis of the condition of water resources storage and usage.

### **4.3.2 The re-scaling of water resources governance**

Water Law has been considered as one of the most significant milestones in the developmental trajectory of legal policies over China's water affairs. Located in the second most senior administration level, it is the

foundation of the other legal and policy documents. However, in respect to the issues regarding urban water provision, a legal incoherency can still be observed in its development trajectory. The English translation of the articles of the laws analysed in this section is from the official website of the China's Ministry of Commerce<sup>20</sup>.

Aiming to discipline chaotic water usage and flood prevention work at that time, on 21 January 1988, the Standing Committee of the National People's Congress published China's first water law, the *1988 Water Law*, which constituted the core system of China's water affair management. Regarding this law, four main points are worth mentioning here. First, water resources was defined as the combination of surface water resources and groundwater resource. Second, it regulated that all activities regarding water resources development, utilisation, protection, and management must comply with this law. Third, it clarified the ownership of China's water resources in its article three: 'water resources is owned by the state, that is, by whole people.' Fourth, it clarified the administration mode of China's water resources in its article nine: 'The State shall, on water resources, adopt a system which combines unified administration with the administration at various levels and by various departments. The department of water administration under the State Council shall be in charge of the unified administration of water resources throughout the country. Other relevant departments under the State Council shall, by the duties assigned to them by the State Council, be in charge of the administration of water resources related to them in coordination with the department of water administration under the State Council. The departments of water administration and other relevant departments of the local people's governments at or above the county level shall be in charge of the administration of water resources related to them in accordance with the duties assigned to them by the people's governments at the corresponding level.' This administration mode had caused numerous conflicts over the power of water resources administration between different government

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20 Source: <http://english.mofcom.gov.cn/article/lawsdata/chineselaw/200211/20021100053796.shtml> Accessed: 17 April 2017

departments. Many departments, such as the environmental protection department and forestry department, claimed that they had been bestowed with the 'legal power' to administrate water resource.

The catastrophic flood disaster outbreak in Yangtze River in 1998 can be seen as the turning point of the development of China's Water Law. Being considered as the worst Northern China flood in the recent 40 years, it resulted in 3,704 dead, 15 million homeless and 26 billion dollars of economic loss. After this tragedy, China entered into the epoch of constructing extensive large-scale hydraulic facilities. Experts from the Ministry of Water Resources Development Research Centre presented the following data (h2o-china.com, 2003): from 1998 to 2002, the total investment from the central government on hydraulic projects reached 178.6 billion Yuan, which was 2.36 times higher than the total amount of government investments in hydraulic projects between 1949 and 1997. 125.8 billion Yuan state treasury bonds, one-fifth of its total value, were specifically spent on the hydraulic project. As a result, dozens of thousands of hydropower plants, water reservoirs, and other hydraulic facilities have been built across the country. Between 2010 and 2012, China's central government conducted its first national survey of water, including the survey of hydraulic facilities (Bulletin of First National Census for Water (Text in Chinese)). According to its result, there were 98,002 water reservoirs in China with a total capacity of 932.312 billion cubic meters. There were 46,758 hydropower plants with the total installed capacity of 333 million kilowatts. There are 268,476 water gates along rivers, lakes, and ponds, which are surrounded by dams of a total length of 413,679 kilometres.

In the face of such massive and unprecedented investments, the *1988 Water Law* was calling for a new revision. Meanwhile, to straighten the unified administration of the MWR, the State Council adjusted the duties and powers of a series government departments in 1998, aiming to transfer the administrative power over water resources from several other departments to the MWR. This reform paved the path for the incoming *2002 Water Law*. On 29 August 2002, the Standing Committee of the National People's Congress passed the *2002 Water Law*. Purposed on October 1 in the same year, it replaced the previous *1988 Water Law*. Only two articles with two clauses in the *1988 Water Law* were retained in *2002 Water*

Law, whereas the other 40 articles with 61 clauses were revised and the rest of the 16 articles and 23 clauses were deleted. Another 43 articles with 63 clauses are added in the *2002 Water Law*. The chapter about flood control was deleted in the *2002 Water Law* since there is another law covering it. Two new chapters regarding water resources plan and water dispute resolution, supervision and inspection were added. This can be seen as a re-scaling of governance of water resources, a transition to new political structures.

Several major changes in the *2002 Water Law* are worth noting. First, the new water law puts the water conservation and water protection in prominent positions. Three new essential concepts were added in it: water conservation, sustainable use of water resources and water-saving society. All of them were derived from *National Economic and Social Development Plan for Tenth Five-Year Period 2000-2005*, a strategic and fundamental guidance for China's government administration published on 11 October 2000. In this seminal guidance, it emphasised the importance of sustainable use of water resources, highlighting its strategic position in China's economic and social development. Also, it pointed out that the core means to achieve this goal is to improve the efficiency of water use, to promote water conservation measures, to develop water-saving agriculture, industry, and services, and to establish a water-saving society. This is the first time for central government to officially present a concept combining water and social development, representing the intricacy between them.

Here, there are another two changes that deserve to be highlighted. First, in the *2002 Water Law*, the description of water resources ownership was changed: 'Water resources are owned by the State. The State Council, on behalf of the State, exercises the right of ownership of water resources.' The word 'people' was omitted from the law. This means that no people in China have any legal right to claim the ownership of water resource. The state's power over water resources is further strengthened and clarified.

Second, the old water resources administration mode from the *1988 Water law* was deleted. The *2002 Water Law* presented a new administration mode to replace the administration mode of a combination of unified administration, hierarchical administration and departmental administration presented in the

*1988 Water Law*. Due to the ambiguity of the previous administration mode, in 1997 the National People's Congress organised an inspection over the implementation of the *1988 Water Law*. As a result, they concluded that 'the appropriate water resources administration mode is the combination of unified administration and hierarchical administration but not departmental administration. It is necessary to constitute the administration structure in accordance with river basin. The new administration mode should make river basin as the unit to implement unified planning, configuration, supervision, and administration.' (Huang and Chen, 2000, p.218). As a result, article 12 of the *2002 Water Law* defined the new water resources administration mode: 'For water resources, the State applies the system under which management of river basins is combined with management of administrative regions.' In its article 13, it also redefined the duties and responsibilities of related departments, emphasising that 'the relevant departments under the State Council shall, in conformity with the division of their duties, be responsible for work relating to the development, utilisation, conservation and protection of water resources.' The *1988 Water Law* allowed other relevant departments to be integrated into the administration of water resources, resulting in the power conflict. The *2002 Water Law* clarified that the powers of other government departments over water resources were limited in the scope of exploration, utilisation, conservation and protection.

The *2002 Water Law* confirmed the legal position of the MWR and its sub-department. Seven major sub-departments were established to administrate seven major river basins: Changjiang Water Resources Commission; The Yellow River Conservancy Commission; Huaihe Conservancy Commission; Haihe River Water Conservancy Committee; Pearl River Water Resources Commission; Songliao water resources commission; and Taihu River Basin Management Bureau. All of those seven sub-departments have the power to manage and supervise the water resources within their administrative regional scope. They are also responsible for making related plans in river basin level, as has been demonstrated in figure 4.7.

In general, the *2002 Water Law* is China's key water legislation and provides a comprehensive framework for integrated water management. It defines and strengthens the power of river basin commissions,

replacing the old water resources administration mode with the combination of administration of river basins and administration of administrative regions. It also paves the way for the establishment of water resources ownership, water abstraction rights, water resources plan, water resources development and utilisation, the conservation of water resources and dispute settlement.

However, the departmental administration is hard to replace. Some departments are reluctant to hand over their administration power. Some departments still have significant influences on the administration of certain fields even after they handed over their administration power. As will be revealed in next section, in the case of the administration of urban tap water, the MHURD, though has been asked to hand over all its power to municipal government by the central government, still keeps its influences through regulations, standards, and Industrial Associations, which brings inconsistency to the power flows circulating in Hybrid Institutional Architecture.

### **4.3.3 The institutional incoherency in administration of urban water affair**

One important aspect of the power/money/water nexus is the way various agents have been affected by, and the extent to which they have tried to implement, three important government administration reforms - the Institutional Reform of the State Council in 1998, the Integrated Water Affair Administration Reform in 2000, and the Super-Ministry Reform in 2008. Some studies discussed the effects of the first reform, but few have analysed the effects of the second reform, not to mention examining the combined effects of the two reforms together. This section aims to analysis the effects of two reforms together, so as to reveal the internal institutional incoherency in the administration of urban tap water provision system.

From 1998 to 2008, these three administration reforms of urban tap water provision system have triggered two institutional incoherencies in power flow between three departments in ministry level. The first one

is between the MWR and the MHURD, and the second one is between MWR and MEP. These incoherent power flows dramatically complicate the administration mechanism of urban tap water provision system.

As has been highlighted in the previous section, given the article 9 of the *1988 Water Act*, 'the state shall, with respect to water resources, adopt a system which combines unified administration with administration at various levels and by various departments' (Water Act of the People's Republic of China 1988 (Text in Chinese)). Since then, China has gradually established a hierarchy and departmental administration mechanisms to manage all water affairs, including urban tap water provision. Before 2000, urban tap water provision system was mainly administrated by municipal construction department instead of water resources department. This is due to the fact that the operation of this system depends on the construction of water treatment plant and pipeline, which is the responsibility of municipal construction department.

A hierarchy and departmental administration mechanism is also emphasised in the *National Urban Water Supply Regulation*. Published by the State Council on 19 July 1994, this regulation is still valid until now. It claims in article 7 that 'In the national level, the urban tap water provision is administrated by the construction department of State Council; In provincial and autonomous level, the urban tap water provision is administrated by the construction department of provincial and autonomous government; In municipal level, the urban tap water provision is administrated by the urban water provision administrative department decided by the local municipal government' (translated by the author) (National Urban Water Supply Regulation (text in Chinese)). From this regulation, this hierarchy and departmental administration mechanism contains three levels: the top level demonstrates the administration mechanism of central government. The middle level demonstrates the administration mechanism of provincial government. The bottom level demonstrates the administration mechanism of municipal government. Note here that even in municipal level the administrative department is decided by the local municipal government, the latter would usually rely on municipal construction department in the

administration of urban tap water provision system, so as to connect this department with its superior departments in provincial and national level.

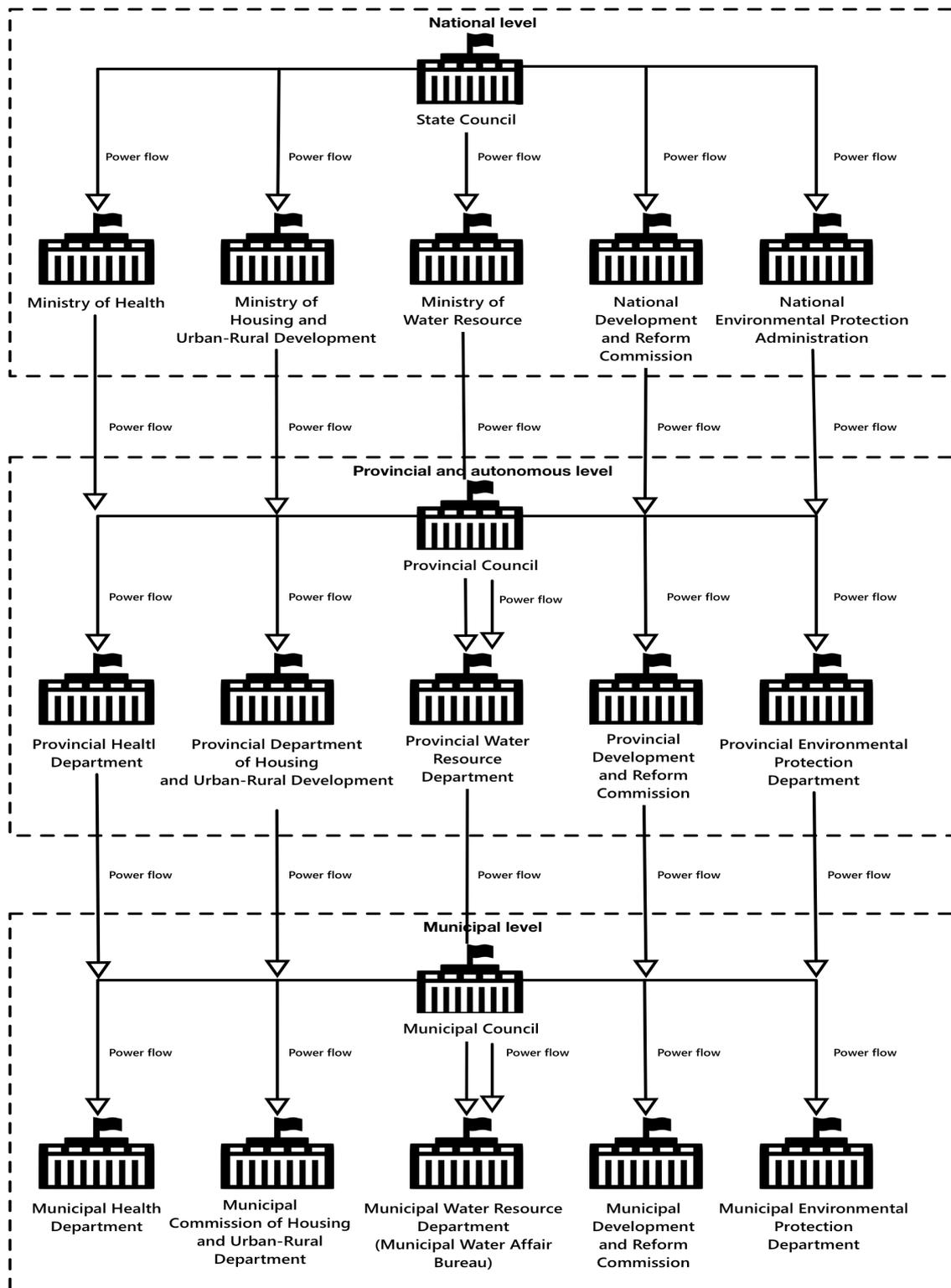


Figure 4.8: The hierarchy and departmental administration mechanism of China's urban tap water provision system before Super-Ministry Reform

As shown in Figure 4.8, in the national level, the central government can be considered as the original source of flow of power circulating in the urban tap water provision system. Within each administration mechanism, there are five major departments involved in the administration of urban tap water. In the national level, they are the Ministry of Health (MH), Ministry of Housing and Urban-Rural Development (MHURD), Ministry of Water resources (MWR), National Environmental Protection Administration (NEPA), and National Development and Reform Commission (NDRC). They were all managed by the State Council, which bestowed flows of power to each of them respectively. These ministries then bestow their flows of power to their subordinate departments at the provincial level, which then bestow flows of power to their subordinate departments at the municipal level.

Note here that the money flow is not circulating in a same top-down manner as the power flow. On December 27, 2002, MC published the *Opinion on Promoting Marketisation Process of Municipal Public Utility Industry* (Opinion on Promoting Marketisation Process of Municipal Public Utility Industry (Text in Chinese)), which permitted the franchise of urban tap water provision. It claimed distinctly that the franchised public utility companies should 'assume sole responsibility for its profits or losses'. Also, on October 30, 2003, MWR published the *Provisional Regulation of Investment in Capital Construction of Water Conservancy* (Provisional Regulation of Investment in Capital Construction of Water Conservancy (Text in Chinese)). In its article 5, it classified urban tap water provision as one of the commercial projects of water conservancy. In its article 13, it claimed that 'the capital of central government's water conservancy would be mainly invested in public welfare and semi-public welfare projects of water conservancy. For commercial projects of water conservancy, the central government may arrange the proper amount of initial capital in accordance with specific policies to promote the development of water conservancy.' In other words, the central government would not invest heavily in the construction project of urban tap water provision system, since its attribution is 'commercial project of water conservancy'. For example, in 1988, the capital of constructing Huaya tap water treatment plant in Henan province was partially from the loan of Canada government and partially collected by the local municipal utility

department and municipal tap water company (Jia, 2000, p.105). There was no capital from central government investing in this project.

Regarding water resources administration, the most powerful ministry is the MWR, but before 2000, its administration only covers hydraulic construction, flood control and drought control and cannot expand to administration of urban tap water provision. Thus, it did not publish any standards regarding urban tap water in its name. In contrast, since the quality of tap water demands certain supervisions, MH and MEP are involved in the administration of urban tap water provision. The former has published a series of significant regulations, rules, and standards regarding the quality of tap water (introduced in detail in section 4.5). The latter is mainly in charge of the protection of the environment of tap water source. Meanwhile, NDRC and its subordinated departments in provincial and municipal level are responsible for setting urban water rates.

As shown in Figure 4.8, in the hierarchy and departmental administration mechanism, superior departments have a strong influence on their subordinate departments, to which they can directly assign flow of power. Meanwhile, as shown in three squares of dotted line in the figure, in each level, government council also play a pivotal role in administration. In some research on Chinese political science, these two different administration modes have a metaphorical jargon: 'the stripe and block pattern' (Xu, 1996; Ma, 1998; Liu, 2002; Wu, 2003; Zhou, 2005). This is because the former administration mode makes the departments from national level to municipal level composing a 'stripe' of administration, whereas the latter administration mode makes the departments at each level composing a 'block' of administration. The inevitable conflicts between these two administration modes is named as 'the segmentation of stripe and block' (ibid.).

Therefore, for the central government, the most serious problem in administrating urban tap water provision is to reconcile the dispersed flows of power between 'stripes' and 'blocks'. Given this situation, the central government and the MWR attempted to initiate an Integrated Water Affair Administration Reform. In 1998, the First Plenary Session of the Ninth National People's Congress of CPC granted the plan

of Institutional Reform of the State Council, which redefined the functions of each ministry. In this reform, the administration power of urban water groundwater, urban flood control, urban water usage plans and urban water saving was deprived from MHURD. The former two administration power was bestowed to MWR, whereas the latter two was bestowed to municipal government. As a result of this reform, MWR finally had a chance to be involved in the administration of urban water affairs. Meanwhile, the municipal government was also for the first time to be the main administer of municipal urban water affairs. However, MHURD still keeps certain amount power in administrating urban water affairs in this reform, because this reform bestowed MHURD the power to instruct urban tap water provision, urban water saving, and urban groundwater exploitation and protection. Moreover, since this reform did not overthrow the hierarchy and departmental administration mechanism established in the aforementioned *National Urban Water Supply Regulation*, construction department was still held the main power in urban water affair administration.

The Institutional Reform of the State Council also bestowed the NEPA the political position of a ministry. However, its function was still limited in many areas, hence was incapable of competing with MWR and MHURD. Not until the Super-Ministry Reform in 2008 does it possess enough power to be paralleled with the former two ministries.

The Institutional Reform of the State Council was the first step for State Council and MWR to launch a new water resources administration system. This effort was finally embodied in the plan of Fifth Plenary Session of the 15th National People's Congress of the CPC in 2000. In this session, the central government for the first time made a strategic decision to 'reform the administration institution of the water resource' (Ministry of Water Resource, P. R. China, 2005, p.1). As introduced in the previous section, this reform was aiming to replace the hierarchy and departmental administration mechanism through establishing a combined administration mechanism between river basins administration and regional administration. In other words, it attempts to modify the 'stripe and block pattern' of water affair administration (see Figure

4.8) into a more integrated administration pattern, centralising all related power into one department in ministry, provincial, river basin and municipal level.

As has been highlighted in the previous section, the publication of *2002 Water Law* reflected such effort in ministry, provincial, and river basin level. At the municipal level, State Council and MWR have promoted the Integrated Water Affair Administration Reform, aiming to integrate the administration power of urban water affair into a newly established municipal department, the MWAB.

Historically speaking, the MWR has never mastered any power regarding urban tap water provision, nor has it published any regulation and standard on this field. In contrast, the other ministries, especially the MHURD, had issued several regulations and standards. Besides, the *National Urban Water Supply Regulation* is still valid, which clearly confirms the administration power of MHURD in national and provincial level. Given that, the MWR initiated the Integrated Water Affair Administration Reform not from the top-down, but from bottom-up direction. In other words, this reform is not undertaken at the national and the provincial level, but at the municipal level. Thus, the administration power of municipal water provision becomes the arena of the power conflict between MHURD and MWR, which contributes to the form of the Hybrid Institutional Architecture introduced in section 3.4.

In fact, the Integrated Water Affair Administration Reform was initiated much earlier than 2000 in some large cities. In July 1993, Shenzhen established China's first MWAB. However, its function did not extend much from the urban water supervision and flood control (Pu, 2005). Admittedly, it is still unclear that it was Shenzhen's political reform that prompted the MWR to initiate the reform of Integrated Administration of Water Affair, or it was the MWR who chose Shenzhen as the first city of its reform. However, what can be confirmed is that there are numerous political considerations behind this decision. Firstly, Deng Xiaoping, the most significant political figure, and the 'the architect of China's economic transformation' in China at that time, visited Shenzhen city in 1992 during his famous political tour, the Southern Tour of China. This provided Shenzhen the political environment for reform. Secondly, as the first of the five Special Economic Zones, Shenzhen's innovative political reforms are more acceptable and

tolerable for the central government than they were in other places of China. Following Shenzhen's breakthrough, another important city in China, Shanghai, established its MWAB on 13 May 2000, the same year of Fifth Plenary Session of the 15th National People's Congress of the CPC.

However, and understandably, since this reform aimed to redistribute the power flow, it confronted with numerous obstacles. For example, an urgent notice published by the Organisation Commission of Central Government on 18 September 2002 impeded the momentum of reform. In the third article, it asked that 'if the newly-established water affair agencies have not granted by their superior department, they shall be annulled'; In the fourth article, it asked that 'those municipal governments who have not yet established new water affair agency shall not establish new water affair agency' (translated by the author) (Organization Committee of Central Government, 2002, p.1). It is important to point out that this urgent notice published just 20 days after the *2002 Water Law*, delivering a strong political signal to municipal governments that the publication of the *2002 Water Law* may not counteract the institutional incoherency in power flow. One explanation for the publication of this abrupt notice is that on 27 December 2002, as a milestone of marketisation reform of urban public utility, MHURD published *Opinions on Promoting Urban Public Utility Marketisation Process*, the first legal document in China's history to advance the franchise operation in urban public utility industry. Obviously, the promotion of Integrated Water Affair Administration Reform would, to some extent, counteract the implementation of marketisation reform promoted mainly by MHURD, because the former reform would negatively influence the MHURD's administration of urban public utilities in water provision system. Consequently, there is a disjunction between the reform in power flow and the reform in money flow.

Until March 24, 2004, besides Tibet Autonomous Region, 52% of administration areas in China has established their local MWAB (Shen and Jiang, 2005). It seems like an impressive record. However, another fact needs to be emphasised: since the establishment of Shenzhen Municipal Water Affair Bureau in 1993, the MWR has spent 11 years in promoting this reform. This low efficiency implicates the difficulties of

redistributing the power flow. Moreover, many MWABs are still under the influence of construction department in provincial and national level.

Some literatures have discussed the difficulties on the municipal level. Given the data of a survey about China's 1097 Municipal Water Affair Bureaus, only 68% of them have the power to administrate local water provision issues (Zhang, 2004, p.35). For example, in the case of Chongqing, many county governments subordinated to Chongqing only transferred the power of administrating water company to their local water affair departments, leaving many other powers, such as the power of administering sewage, drainage, water resources protection and water saving, still in hands of other departments (Xu, 2006). In another case, the MWAB of Zibo was established on the basis of its former water resources department, and are guided by the local construction department (Huang et al., 2006). Compared with these studies, other types materials may present more information. For example, an anonymous government investigation report<sup>21</sup> about the implementation of the reform of Integrated Administration of Water Affair in an unnamed province of China discussed how municipal departments resisted the reform<sup>22</sup>. For example, given the problem happened in the processes of the pipeline construction and road construction, local MWAB has to give back the administration power of tap water pipeline to the local MCHURD.

However, all of these difficulties in municipal level are merely the reflection of the incoherencies in power flow in institutional level between MWR and MHURD. In general, four incoherencies can be noticed:

First, the hierarchy administration mechanism, which has been developed for more than 12 years since 1988, functions in many areas. They already formed a system where every department was assigned with a certain power. It is extremely difficult to redistribute the power flow.

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21 Source: [http://blog.sina.com.cn/s/blog\\_425cff370100b842.html](http://blog.sina.com.cn/s/blog_425cff370100b842.html) Accessed: 22 December 2016

22 This report was published in a blogger on 15 December 2008. The publisher noted at the beginning of this report that 'given the sensitivity of its content, all names and data appeared in the report are anonymous.'

Second, this reform does not have any support from the current legal framework. The *National Urban Water Supply Regulation* was still valid. Until today, the central government has not published any regulations and laws to support the Integrated Water Affair Administration Reform. All of the backing of the reform is from government notice, guidance, decision and other types of document. Many of them are published by the MWR itself. In 2011, the State Council published the *State Council's Decision on Promoting the Hydraulic Reform*. It claimed to 'improve the administration mechanism of water resource' and 'strengthened the integrated administration of urban and rural water resource' (translated by the author) (The State Council's Decision on Promoting the Hydraulic Reform (Text in Chinese), p.4). This statement was believed to be evidence supporting the reform (Lv, 2015), but it has no legal power as the *National Urban Water Supply Regulation*.

Thirdly, the administration system of MWAB is problematic at the provincial level. Given the data of 2003 (Zhang, 2004, p.31), in total there were 912 MWAB being established in provincial, municipal and county level. Another 185 municipal governments just transferred the power of administration water affairs from the other departments to the local water resources bureau. In addition, most MWAB is established only by changing the name of local water resources bureaus (Zhang, 2004). All these water resources bureaus were previously subordinate to the administration of provincial water resources department. However, since they have been transformed into MWAB and responsible for administrating urban water provision, given the *National Urban Water Supply Regulation* they should subordinate to the administration of provincial construction department. In other words, the MWAB has two conflicted administrators: provincial water resources department and provincial construction department. What's worse, since this reform is a bottom-up reform, there is no corresponding administration arrangement in provincial and national level. As a result, the administration power of urban water provision, which was deprived from construction department in the Institutional Reform of the State Council in 1998, is back to the hand of construction department again.

Fourth, when the redistribution of flow of power influences departmental interests, some departments would have resistance to the reform. The redistributed power flow enables MWAB to take over the power of charging different fee, which previously belongs to other departments. Thus, such redistribution may trigger departmental conflicts. For example, in Zibo, the conflict between the MWAB and the MEPB is around the power of charging pollution discharge fee (Huang et al., 2006).

To further promote the reform, in February 2005, the MWR published a notice, the *Guidance on 'Deepen the Water Administration Institution Reform'*. It defines the water affair administration as:

In the context of integrated administration of water resource, water affair administration is an integrated administration of all water associated affairs. It includes the integrated administrations of water resources in both the urban and rural areas, of flood control, water resource, water supply, water usage, water saving, sewage, waste water treatment and recycle, farming hydraulic construction, conservation of water and soil and even the affairs of rural hydropower (The guidance on 'deepen the water administration institution reform' (Text in Chinese), p.2).

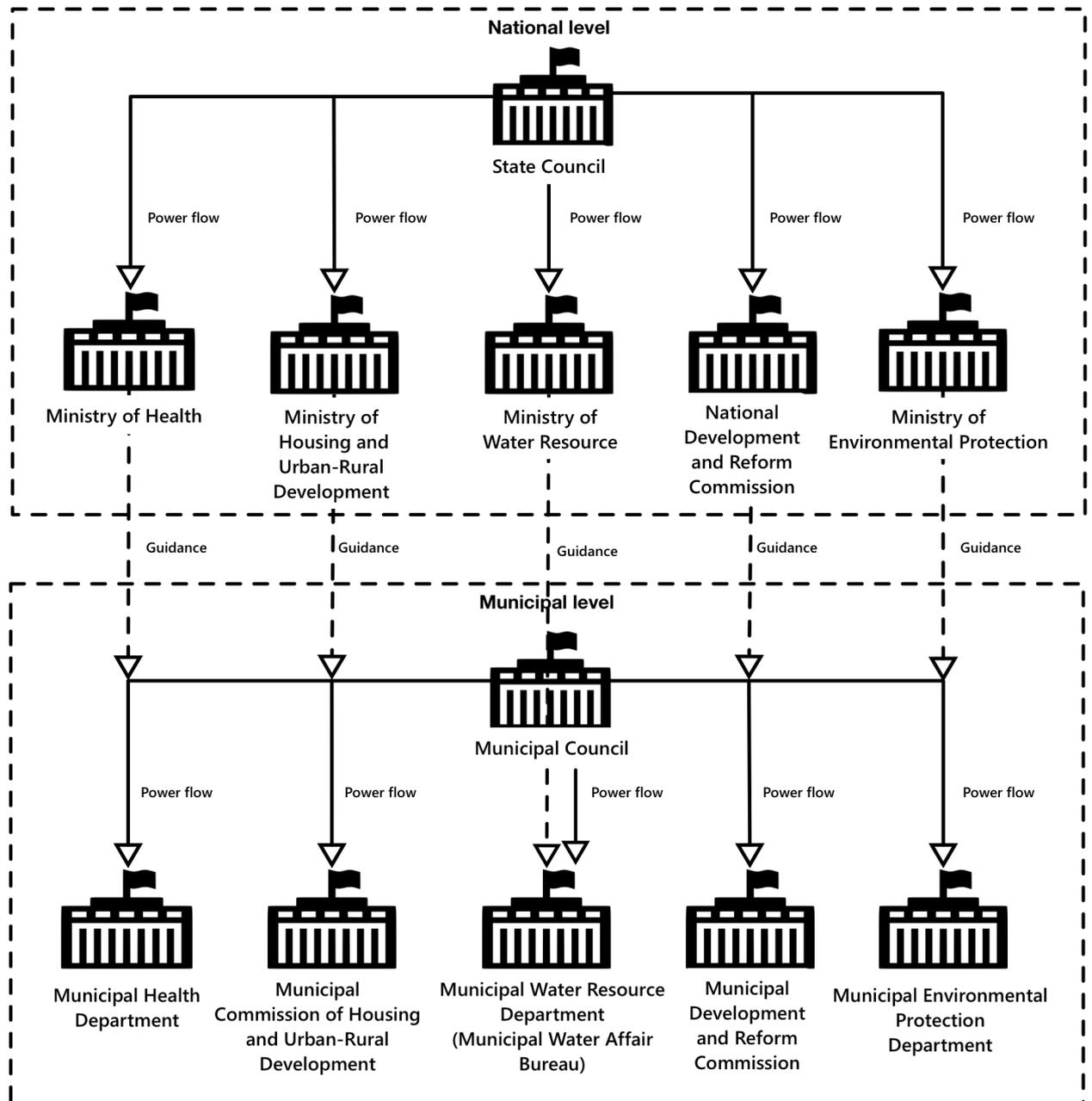
Given this definition, the MWR attempts to seize the administration power from the hands of several other departments, especially the MHURD, who has been in charge of the administration of urban water supply and waste water treatment. The publication of this guidance intensifies the power conflict between the MWR and MHURD. As a response, in the same year, the latter published at least three legal documents regarding urban tap water supply to strengthen its power, including two standards, the *Urban tap water Quality Standard* and the *Water Quality Standards for Fine Tap Water*, and one plan, the *2010 Urban Water Supply Sector Development and Technological Progress Plan*. The power conflict over urban tap water supply seems to have reached a stalemate.

However, this confrontation did not last for long. In 2008, the central government initiated another institutional reform, the Super-Ministry Reform, which redefines the administration areas of each major ministry again. Different from the Institutional Reform of the State Council in 1998, this reform deprived power of administration urban water affairs from both MWR and MHURD. Given the article of the *Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Water Resources*, published on 10 July 2008, the MWR needs to '[...] hand

over the administration of urban water affair to the local municipal government, who is in charge of the administration of water supply, water saving, sewage treatment, and waste water treatment. The relevant ministries and departments are only responsible for providing operational guidance' (Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Water Resources (Text in Chinese), p.3). Given the article of the *Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Housing and Urban-Rural Development*, the MHURD needs to '[...] hand over the specific administration responsibilities regarding urban administration to municipal government, who shall decide the administration mechanism on municipal public utilities, afforestation, water supplying, sewage, waste water treatment' (Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Housing and Urban-Rural Development (Text in Chinese), p.1). Both notices have clearly described the power that needs to be handed over, which highlighted the central government's determination in promoting this reform. Both MWR and MHURD now only have the power to offer guidance on municipal water affairs. Municipal government becomes the only administrator of municipal water affairs.

In this reform, the MH keeps its power of supervising the quality of tap water, but has to hand over the power of evaluating the technology of products associated with tap water, domestic water treatment equipment and other new material and chemical compound in touch with tap water to the public institutions (Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Health (Text in Chinese), p.1). Another department, NEPA, has been transformed into a ministry, namely the MEP (Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Water Resources (Text in Chinese), p.3).

The integrated administration mechanism is shown in Figure 4.9.



**Figure 4.9: The integrated administration mechanism of China's urban tap water provision system after Super-Ministry Reform**

As Figure 4.9 shows, compared to the hierarchy and departmental administration mechanism before Super-Ministry Reform, the new integrated administration mechanism makes all of the flows of power concentrated in the municipal government. The other departments have lost their administration power. They can only provide guidance to the work of municipal government, as shown by dotted arrows in the figure.

In general, the influence of Super-Ministry Reform on the administration of municipal water affairs can be summarised into three points:

First, this reform can be seen as an attempt to solve the institutional incoherencies in power flow between MWR and MHURD. The central government has observed the problematic power flow in administration system of MWAB in provincial level. This level is the mediation level between the municipal level and national level. Taking into account the dynamic of inertia of hierarchy and departmental administration mechanism, if central government bestows the administration power of municipal water affairs to provincial department, the hierarchy and departmental administration system would still survive. As a result, it would be extremely difficult to promote the Integrated Water Affair Administration Reform from municipal level. Therefore, since the provincial level of administration has been proved problematic, the Super-Ministry Reform directly deprived the administration power from provincial departments.

Second, owing to this reform, many problems at the municipal water affair administration can be solved. For example, the cooperation problem between various departments in the municipal level now can be settled by municipal government.

Third, this reform paves the way for promoting the marketisation of urban public utility. With the centralised administration power, the municipal government now is capable of attracting private capital to invest in tap water supply system and sewage treatment system. In fact, in the interview with the investment officer of BEWG, he admitted that private capital is more interested in sewage treatment system than tap water supply system.

However, the Super-Ministry Reform also transferred many problems from the national and provincial level to the municipal level. It is now municipal government's responsibility to answer the difficult questions as followed: how to deal with the problem of departmental interests in the process of promoting Integrated Water Affair Administration Reform? How to differentiate the 'guidance' from the superior department and the 'administration' from the municipal government? How to prevent the potential

conflict between the local interests and the national interests? These new problems, in some senses, are even more challenging than the old ones.

Also, since the goal of the Integrated Water Affair Administration Reform has yet been thoroughly achieved, a new dramatic reform in water affairs administration have triggered new incoherency in power flow. For example, in this reform, MWR is asked to be 'responsible for water resources protection,' whereas MEP is asked to be 'responsible for water environment quality and water pollution control' (Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Water Resources (Text in Chinese), p.3). Here, the power boundary between water resources protection, water environment quality, and water pollution control is ambiguous. When water resources is polluted, the responsibility can be assigned to either ministry. This new institutional incoherency in power flow leads to the incoherency in power flow between MEPB and MWAB in water administration, which will be highlighted in Chapter 6.

In conclusion, to some extent, all of the three reforms, the Institutional Reform of the State Council in 1998, the Integrated Water Affair Administration Reform in 2000, and the Super-Ministry Reform in 2008, share the same goal: they all try to redistribute the power from construction department to other departments, either water resources department or municipal government. What is behind this process is the fact that administration mechanism has been transformed from hierarchy and departmental administration mechanism to integrated administration mechanism. In the second reform, the power is integrated into the hand of water resources department, whereas in the third reform, the power is integrated into the hand of municipal government. However, from a legal sense, this power redistribution conflict with the *National Urban Water Supply Regulation*. In a practical sense, MHURD has published a series of tap water standards. All these documents are still valid now, which means that MHURD still can impose its influence on urban water affairs. Moreover, as will be highlighted in section 4.4.2, MHURD became the leading department in the marketisation reform, which, to a large extent, further strengthened its control of and influence on public water supply utilities.

Meanwhile, in respect to the administration of water source, the MEP and the MWR now has a new institutional incoherency. These two institutional incoherencies reveal an essential weakness of China's central command mode of economy and administration: once there is an institutional incoherency in departmental administration at the Ministry level, it would transmit to departmental administration at the municipal level, resulting in the constitute of Hybrid Institutional Architecture of semi-portable tap water provision system.

#### **4.3.4 China's urban water supply contract**

In the Hybrid Institutional Architecture, water company occupies a special position: it is the intermediary between the government and the consumer. It helps the government in fulfilling its obligation of providing tap water to its citizens. It charges water rates from the consumer as its income to sustain the operation of water treatment plants and the company. During these processes, the water company established two different relationships with government and consumer respectively. Their different characteristics reflect the institutional incoherency in power flow in China's urban tap water provision system. To further illustrate this incoherency, it is worthwhile to examine China's urban water supply contract.

China's urban water supply contract is a legal document signed by the water company and consumer, which lists their responsibilities and obligation. It can be seen as a nexus between the government, the water company, and the consumer. By signing this contract, the consumer and water company officially establish a reciprocal balanced flow of power and money between each other. Such flows are rarely be seen in the consumers' relationships with other agents in the tap water provision system.

In this balance, both sides have the certain power to influence the other's behaviours. Accompanying these influences, the money can flow from the consumer to the water company as either water rates or fines, or from water company to consumer as the compensation for inconsistent water supply. In some cities, such as Beijing and Shanghai, this contract is legally mandatory for tap water service. The government plays the role of intercessor in the conflict between the water company and the consumer.

Although it is a crucial component of the relationship between the water company and consumer, in China's academia, the study of water supply contract is absent for long time. Given the searching result in China National Knowledge Infrastructure<sup>23</sup> (CNKI), the largest academic publication database in China, only a handful papers regarding tap water supply contract have been published. Such neglect is another piece of evidence reflecting the dominance of physical and managerial research on water affairs in China (see Swyngedouw, 2009). It also exposes the lack of considerations of relationships between different agents in current urban tap water provision system.

For water supply contract itself, some articles are unequal to the consumer. The fact behind these articles is that water companies try to take advantage of their monopoly in water provision to infringe consumer's legal rights, either through the mean of exempting themselves from their legal obligations or through the mean of strengthening the obligations of the consumer. A typical example of this is the abolishment of Beijing's water supply contract.

On November 1 1999, the MHURD and the State Administration for Industry and Commerce published a template of urban water supply contract, asking their subordinated departments to adopt. However, this template triggered the conflict between Beijing Waterworks Group (BWG) and Beijing Consumer Association (BCA). In 2001, the BCA delivered their critical opinions through pointing out five problems in the contract. First, this template is only for the contract between the water company and other organisations, but BWG adopted it as a contract between the water company and tap water consumer. Second, the contract claimed that it was '[...] building on the basis of negotiation between water supplier and consumer' (Beijing Consumer Association, 2001). However, there is no room for negotiation between the water company and the consumer at all. Third, it did not mention the consistency of the tap water flow and quality, which should be the obligation of every water company. Fourth, it asked the consumer to install the water meter but did not mention the quality and other relevant issues about it. Fifth, it asked

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23 Source: <http://www.cnki.com.cn/index.htm> Accessed: 1 March 2017

the consumer to pay the overdue fine on the daily basis if they failed to pay the water rates on time. It also bestowed the water company the improper right to stop supplying water after the water users fail to pay the water rates for four months, which violated the basic right for a citizen to have water. Given all these criticisms, the Beijing Municipal Commission of City Administration and Environment, the administrator of BWG, abolished the water supply contract on May 30 2001.

What can be observed from this case is that the establishment and implementation of the water supply contract were both problematic. This is due to the hybrid characteristic of the water company as being a semi-commercial and semi-government entity. Although BWG was trying to transform itself from such an entity into a company in marketization reform of urban public utility, which will be introduced in section 4.4.2, it still kept certain dynamic inertia of power flow that influenced its attitude towards the consumer.

Taking a closer look about the relationship between government and water company, this thesis believes that it is still by and large command-driven, even though it may not be as direct as it was before the marketisation reform of urban public utility (introduced in section 4.4.2). For instance, water companies have to undertake the supervision of at least five government departments: the MWAB, which is their direct superior; the MEPB, which monitors the quality of water source; the MHB, which oversees the quality of tap water; the MCHURB, which, in some cities, supervises the operation of water treatment plants and pipeline; and the PDRC, which is in charge of the modification of water rate. Thus, although the water companies can enjoy a certain degree of independence as being an independent company, they still have to be subjected to the government commands and supervision, functioning to some extents as external government departments. In the case above, although BWG was trying to transform itself from a hybrid entity into a company in marketisation reform of urban public utility, it still kept certain dynamic inertia of power flow that influenced its attitude towards the consumer. Thus, to a water company, the water contract template they received from MHURD is not only a commercial document but more like a government protocol. Due to their dynamic inertia of power flow of being SOE, water companies is not as sensitive as the other companies to the legal and ethical risks behind the water contract.

Meanwhile, this thesis believes that the relationship between the water company and consumer is semi-command-driven and semi-commercial-driven. This is due to two factors: the water company's monopoly of tap water provision in the certain area, and the consumer's confusions on the characteristics of both the water company and its service. They have mutually affected each other.

Without the stimulation from free market competition, water company is mainly focusing on financing and construction but not improving the quality of their water supply service (China Water Supply Service Promotion Alliance, 2013). From the consumer's perspective, water company's monopoly is recognised as a defining characteristic of governmental department rather than a commercial entity. Thus, few consumers can distinguish the business characteristic from governmental characteristic. Such a confusion also influences their recognition of the governance of urban tap water provision. For consumers, this service can be seen either as a public service provided by the government department or as a commercial service provided by the commercial entity.

Taking a closer inspection, it can be observed that this confusion is nourished by two facts:

First, in China's academia, little attention has been paid to the theoretical analysis of individual's water right. Most of the discussions around water right are predicated on a national, provincial and municipal level regarding the allocation and trade of water. Therefore, the question of 'who should control and manage the water resource' is not as pivotal as it is in many western scholars' works (Swyngedouw, 2009; Bakker, 2013; Harvey, 2015). The central government has been legally appointed and widely accepted as the only legitimate controller and manager of China's water resource. Although in many remote areas of China people can enjoy free groundwater from self-built water supply facilities without considering much about the water right, in general level the water right is so tightly controlled in the hands of the government that few would call on the water right at an individual level. As has been introduced in section 4.3.1, in China, the awareness of property right on the water resources is established only in a national level (Wang, 2000; Shen and Chen, 2002; Sun, 2009). It has never has been fully established at an individual level.

Second, most consumers are not well-informed by either the government, the media or the third parties about the institutional and marketization reform. As a result, they still believe that the water company is, as it used to be, a department of the government. Moreover, both the water company and the government have no intention of clarifying this confusion. For the water companies, this confusion helps them to take advantage of the power and money flows circulated between water companies and the consumer. For the government, this confusion can strengthen their regulation on the water company. On the one hand, this confusion makes the water company rely more on the government. On the other, even if the water company triggers some troubles, the government can easily escape from taking responsibilities by claiming that the water company is an independent commercial entity.

The ineffective communication and the resulted knowledge gap between the government, the water company and the consumer have sustained for a long time. As will be demonstrated in the next section, the third parties are also dysfunctional in either promoting the communication or bridging such knowledge gap between these agents, making it become one of the seven facilitating factors of Consumer Coping Strategy Matrix introduced in section 3.5.3. In this sense, it can be said that this confusion contributes to the form of Consumer Coping Strategy Matrix.

In sum, this confusion strengthens consumers' powerlessness in their relationship with the Hybrid Institutional Architecture. The monopoly of water company means that consumers cannot have alternative access to water if they refuse to sign their name on the water supply contract. In other words, even being conditioned by a series of water resources and provision management regulations, monopolisation has bestowed a dramatic bargaining power to the water company. Consumers have no power to choose another water company if their current water company violate certain articles in the contract. In contrast, the water company has the power to refuse to provide water service to consumers if the latter violate certain articles in the contract. In most cases, the cost of legal action is unaffordable for consumers to enforce the water company to pay compensation, but water company has the power to enforce the consumer to pay the fine by cutting off the water supply. Thus, with the absent of certain

neutral and external supervisions on water company, this contract can be seen as, by and large, a reflection about the imbalanced power between the Hybrid Institutional Architecture and the consumer, making the relationship between the water company and consumer semi-command-driven and semi-commercial-driven.

### 4.3.5 The dysfunction of the third party

One serious problem of the Hybrid Institutional Architecture of the urban tap water provision system in China is the problematic information disclosure between the agents in the system and consumers. What is behind this problem is the institutional incoherency in power flow in the relationship between consumer, third party and Hybrid Institutional Architecture.

Tap water consumers who wish to seek answers to their concerns regarding the water supply always have to interact with the powerful Hybrid Institutional Architecture. This reveals the fact that there is an absent of neutral and independent institutional representation for tap water consumer. This representation ideally would be provided by a third party separate from the government and water company that could operate with some independence from the influences of both the water company and the government. Such an independent third party would, if it existed, play a pivotal role in monitoring and regulating the system, as well as in representing the consumer's interests.

Examples exist in other countries. A third party can be an independent regulator in the government, such as the DWI<sup>24</sup> (Drinking Water Inspectorate) in the UK; it can be an NGOs, such as those that are deeply involved in the construction of water provision system in some towns in African countries<sup>25</sup>; it can be an industrial associations, such as the IWA (The International Water Association).

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24 Source: <http://dwi.defra.gov.uk/about/index.htm> Accessed: 10 March 2017

25 Source: [http://www.unicef.org/somalia/wes\\_1069.htm](http://www.unicef.org/somalia/wes_1069.htm) Accessed: 10 March 2017

However, China has a unique situation: it would be extremely hard, if not impossible, for an organisation such as DWI to function in China with certain independence from Chinese water companies and the various government bodies involved in the water provision system. The Red Cross Society, one of the most influential independent regulators, is operated in China with a pattern of GONGO (Government-Organized Non-government Organization) (Huang, Deng, Wang and Edwards, 2013). Certainly, it cannot operate in China as a 'third party' independent from the water company and government.

Both the overseas and local Chinese NGOs have made some efforts to monitor Chinese tap water provision systems, but their efforts are limited (as discussed below), and their findings and information about their work are not available to the public. As for industrial associations, they receive political and financial supports from various government ministries and water companies. As a result, their independence is doubtful.

This section explores in detail these limitations in the monitoring and representation for the consumer by NGOs and Industrial Associations. It argues that the consumer has been alienated in the system and has no information sources to inform them of any changes to the tap water provision system. This alienation deprives the consumer of power they should have by national law, municipal regulations and water supply contract. The interview materials of two interviewees, one from NGO and one from Industrial Association, are integrated into the analyses. For confidentiality, the interviewee from Industrial Association is anonymous and is referred to and quoted as he/she. All interview quotations in this section are translated by the author from Chinese into English.

### **The dysfunction of NGO**

China's tap water NGOs have to confront two troubles. On the one hand, the development of NGOs is restricted by government regulations. On the other, their developments are limited by little publicity and social support. 82% of China's NGOs are established after 2000, 56% of them have fewer than 10 staff, 72% of NGOs' annual budget is less than 100,000 US dollars, 39% did not register as NGOs but either as 'Private Non-enterprise' or did not register at all (Shieh and Brown-Inz, 2013, p.4). This phenomenon occurs in

China because the registration standard for Social organizations is much higher compared to the registration standard for Enterprises. Only those who have connections with local registration agencies can be registered as social organizations (Shieh and Brown-Inz, 2013, p.12).

The threshold for registration of overseas tap water NGOs is gradually getting higher. In May 2015, the government published a controversial draft of China's Overseas NGOs Management Law (National Peoples Congress Standing Committee, P. R. China, 2015). It required that overseas NGOs have to be registered and supervised by the Ministry of Public Security rather than the Ministry of Civil Affairs as they previously were (Article 7). These NGOs also have to be managed by the 'related agencies' on the national and provincial level (Article 7). Permission for all their temporary activities has to be granted by their supervisory agencies unless they are labeled as China's official cooperative NGOs (Article 19). Besides the restricted government regulations, overseas NGOs face other problems as well. Even though many NGOs have done numerous works on issues regarding tap water security, their research is to a large extent inaccessible for most of China's tap water consumers. For example, an overseas NGO based in Hong Kong, China Water Risk, does not even have a full Chinese version of its research resources on its website. At the same time, those few reports that have been translated into Chinese are not widely publicised on China's web search engines at all.

The situation of local tap water NGOs is much more complicated. For example, in the interview of Liu Chunlei, the founder and leader of Qingyun Environmental Information Technology Service Centre (QEITSC), a small local NGO based in Shanghai, he admitted that to have a legal identity, he had to register his organisation as 'Private Non-enterprise'. Organisations so registered are required to have a supervision agent from the government. Their supervision agent is the Environmental Protection Bureau of Minxing District of Shanghai Liu explained.

'This situation is conditioned by the policy and laws. Before 2014, if you want to be registered as an organisation you have to find a supervision agent. Many organisations cannot find supervision agents, so they failed in registering.'

Liu further admitted that this supervision agent must be the government agent and it 'has certain impacts' on QEITSC's activities. The supervision agent must review and approve the annual inspection of the organisation, as well as all of the procedures of the organisation's activities. While emphasising that this kind of interference is 'relatively infrequent', Liu Chunlei at the same time pointed out that organisation would have to compromise when finding out any problems associate with Shanghai City. Liu explained that if QEITSC identify a problem in the water of Shanghai City, the organization would not conduct a further investigation of the problem.

Under such government supervision, QEITSC has still managed to collect, organise and publish existing government data on urban tap water provision systems. In this way, the organisation has sought to make this data more widely accessible. They have also established an environmental data centre offering public access to data about various themes, such as tap water, sewage, and hazardous waste. However, few people have accessed these reports and data. For example, in 2014, QEITSC published a report named *Research on the Situation of Information Disclosure of Beijing's Domestic tap water*. This report focuses on the relatively low transparency of information regarding tap water in Beijing. However, when searching for the title of this report in article titles in Baidu, China's biggest internet search engine, it shows zero results, which means that no web news articles have the title of this report in their titles. Repeating the search by looking up the title of this report in article content, Baidu shows three results, the first one is from a website which advertises water filtration equipment, whereas the other two results are from articles analysing the stocks of the water utility industry. Only the first result introduces the general situation of the research project and mentions the name of QEITSC. In the information listed on its website, there is only one news report about this research by any major media, which does not show in the results in Baidu's search. Meanwhile, some of their data has only been downloaded less than ten times, among which 80% are from different universities, academic institutes and even government departments such as Central Meteorological Administration Bureau of China.

Besides the fact that their activities are supervised by the government, their research is also not accessible to the public. This situation results in an even bigger problem: local NGOs can hardly earn any public financial support (which may not be a major issue for overseas NGOs). Some of the most well-known NGOs in China have not given much attention to tap water affairs. For example, Friends of Nature, one of the earliest and largest NGOs in China, does not integrate the tap water affair in its agenda even though it sometimes holds activities regarding hydraulic facilities and water pollution<sup>26</sup>. Small NGOs like QEITSC which have conducted remarkable research on tap water cannot receive much public attention, not to mention support. This may explain the reason why this kind of research is rarely funded by general people: no public attention, no public funding. In fact, the QEITSC's research on information disclosure was funded by two charities, both of which have certain commercial backgrounds, one is from e-commerce giant Alibaba and another is from Beijing Entrepreneur Environmental Protection Foundation.

Taken together, these results highlight the reciprocal causation of the problems for NGOs and tap water consumers. On one hand, there is a dysfunction of both overseas and local NGOs in bridging the information gap between the tap water consumer and the tap water provision system; and on the other, since tap water consumers have not been informed about the work of NGOs through the media, they may not offer them much support.

Here, it is essential to point out that the root of this reciprocal causation is the flawed power circulation, which in turn triggers the inadequate money and information circulation. The power of managing environmental issues is still centralised in the hands of the government, who is unwilling to share it with other organisations. As pointed out by a Chinese expert, when it comes to the propaganda of 'public participation', there is a cognitive dissonance between the government and the NGOs: from the government's perspective, the meaning of public participation should be the public's participation in specific activities without playing a role in decision making; from the NGOs' perspective, the meaning of

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<sup>26</sup> Source: <http://www.fon.org.cn/index.php/Index/topic/id/12> Accessed: 11 March 2016

public participation should be the public's participation not only in specific activities but also in decision-making and management processes (Liu, 2015). However, since the positions of NGOs have been consistently marginalised in the general power circulation, their activities are either gradually restricted to certain fields or being ignored by the media and the public. The flawed power circulation leads to the problematic money circulation, which results in the fact that only 26% of environmental protection NGOs have a stable income, of which 78.9% are an industrial association and student societies (Liu, 2015).

### **The Dysfunction of Industrial Association**

Differing from tap water NGOs, which are relatively alienated from the government and the market, tap water Industrial Associations are situated at the intersection between the interests of the government and the market. They are backed by the government and financed by the market, but to a large extent remain uncommitted to the public issue of tap water. This has significantly undermined their capacities in connecting themselves with the tap water consumer, pushing them gradually to embrace the government's and market's positions.

In an interview with a staff member of the Drinking Healthy Committee of China National Health Association (DHCCNHA), an Industrial Non-profit Social Association subordinate to the China National Health Association, which is directly regulated by the MH, the interviewee clarified that the constitution of China's industrial water associations is different from the constitution of industrial associations in western countries. He/she pointed out that traditionally, many government ministries in China had set up their official industrial associations. Only recently these industrial associations became independent from their superiors by registering in the Ministry of Civil Affairs as independent organisations. They are now 'as a company'. Founded on 3 March 2010, the World Water Day, the DHCCNHA's remit covers all types of 'package water,' which includes bottled water, barrelled water and other drinking water production with commodity packaging. It is also in charge of the domestic water-related equipment, such as domestic tap water filtration equipment. 'Because the name of our association is health water,' the interviewee said,

'so everything that relates to the water you drink, as well as every production chain regarding the water you drink, is within our remit.'

'The motivations for establishing the DHCCNHA were to disseminate knowledge of healthy drinking water among the public, and to develop the industry standard to help our country regulate the water industry,' he/she said. Meanwhile, he/she also admitted that 'the aim of the Association is to serve its members'. Here, member means those water companies that joined DHCCNHA by paying membership fee annually.

The DHCCNHA has five major areas of interest: high-end bottled water, standard bottled water, barrelled water, water purification equipment, and rural water supply. Within these, it functions as a research and technology organisation, a mediator between the government and the market, and a consulting agency that provides technical training for its members.

The DHCCNHA has conducted several research projects initiated by its former superior, the MH. Its working pattern, however, is not the same as the NGOs', for it is highly dependent on the cooperation between its members. For example, as the interviewee reported:

'The water in Tongzhou (a district of Beijing) contains a remarkable amount of fluoride, which can cause diseases such as dental fluorosis and skeleton fluorosis. Older people are especially vulnerable in the face of these diseases. Many elderly members of the public, suffering from deformed joints, have drunk such water for their whole lives. It is the government's obligation to guarantee them the healthiest water. The MH always claimed that they want to do something to amend the water condition in rural areas, but they do not have any technology, so they turned to our association with an inquiry regarding what technology can be used to eliminate the fluoride in the water. There are many members of our association, and they tried to provide answers in cooperation with each other. Finally, they found a technology that can eliminate the fluoride.'

From this description, it can be seen that the Industrial Association here has functioned as an intermediary between the government and the market. It becomes a consulting platform that can organise the resources from different market actors and connect them with the government projects.

Functioning as an intermediary, the DHCCNHA also shares some power with the government. For example, it participates in the work of establishing the national and industrial standards of bottled water as an intermediary between the government and the drinking water industry. The DHCCNHA has also been

involved in initiating and establishing the industrial standard of high-end bottled water, an idea derived from western countries. It held a national expert committee to construct China's national definition of high-end water production. After five meetings, the experts finally reached a conclusion that this standard must include several factors, such as the source of the water, the production process, and the brand reputation. They also designed a series of detailed specifications for each factor. Companies can apply for an evaluation from The DHCCNHA to earn the certificate of high-end water production.

The DHCCNHA also provides consulting services for its members, such as industrial training courses. For instance, the interviewee mentioned a training project conducted by the DHCCNHA - the water school. In his/her words, 'since many employees who deliver barrelled water are not well educated, [...] the DHCCNHA established a special school for to inform them about industrial and sanitary standards.'

To conclude, from the perspective of power circulation, the tap water Industrial Associations does not receive much extra power from the government, especially given that they have been officially separated from the government systems. However, compared to NGOs, their position is much closer to the government, which enables them to play a role as a mediator and negotiator between the tap water market and the government. This unique position helps them to win some special powers, such as the right to participate in the process of establishing national and industrial tap water standards. From the perspective of money circulation, most of the DHCCNHA's work is closely connected to specific problems in the tap water industry, such as providing paid industrial training to its members, which brings it a much more stable income compared to NGOs. From the perspective of information circulation, DHCCNHA has focused its main attention on drinking water industry, but it has not undertaken any independent research on sensitive problems regarding tap water like what some NGOs have done. Additionally, even though it possesses a significant amount of information that directly relates to tap water affairs, it does not take the initiative to make it accessible to the public in the same way as NGOs.

Another comparison between the DHCCNHA and the QEITSC can reveal more details of the difference between Industrial Associations and NGOs. From November 2015 to March 2016, the DHCCNHA initiated

a large-scale investigation project named *The Blue Book of Chinese People's Healthy Water Drinking*. There were extensive online promotion campaigns for this project, especially in March 2016 when the publication of this book was announced. Given these promotion campaigns, this project has collected hundreds of thousands validated questionnaires about tap water. In Baidu News Search the relevant news can be seen in dozens of mainstream websites. In reference to the news reports, this project was hosted by government organisations such as the Regulation Committee of Jilin Changbaishan Conservation Developing Zone and the Baishan Municipal Government, and People's Government of Antu County of Yanbian Korean Autonomous Prefecture. It was co-organized by the Evergrand Group, a large natural spring bottled water production company in China. However, the investigation and data analysis were not conducted by the DHCCNHA, but by the Kaidi Data Research Centre.

However, even though these news reports claimed that the book was published, there is no online access or publication details provided for it. When the author of this thesis consulted the DHCCNHA about the problem of accessing the book, they provided two pieces of information: firstly, they did not participate in the investigation and data analysis of the book project; and secondly, the Kaidi Data Research Centre claimed that the book data is not open to public access. This information directly contradicts the statements in the media, which claimed that DHCCNHA is one of the main hosts of the investigation and the book has been officially published. However, when taking a closer look at these news sources, nearly all of them use the same quotation from the book stating that '46% participants choose natural spring as their primary tap water'.<sup>27</sup> This statement is immediately followed with a complementary reference to natural spring bottled water production from the Evergrand Group. This scheme demonstrates that the book investigation project is, in fact, a successful public relations marketing event held by the Evergrand Group, as pointed out in an online article (TOM, 2015). The reason for the Evergrand Group to invite the DHCCNHA and government organisations to lead the project is to use their names to make it appear less

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<sup>27</sup> Source: <http://news.cjn.cn/gnxw/201603/t2799891.htm>; [http://bjcb.morningpost.com.cn/html/2016-03/23/content\\_392197.htm](http://bjcb.morningpost.com.cn/html/2016-03/23/content_392197.htm);  
<http://house.njdaily.cn/2016/0322/1352312.shtml> Accessed: 1 July 2016

commercial but more official. The main aim of this project, therefore, was not to publish the book, but to highlight a specific piece of information (46% people in the investigation choose natural spring as their primary tap water) with the backing of 'dozens of thousands of questionnaires'. This constitutes a successful public relation marketing event advertising the natural spring bottled water production, rather than a genuine initiative to publish tap water data available for public access.

### **A comparison between NGO and Industrial Association**

Compared with the QEITSC's case, five points of difference can be highlighted. Firstly, there was a differentiation in focus point. QEITSC focused on the systematic flaws of the tap water provision system, whereas DHCCNHA focused on the marketing of tap water production. Secondly, there was a differentiation in their roles in the investigations they conducted. QEITSC led the whole 'Research on Beijing's Disclosure of Domestic Tap Water Information' investigation by itself, whereas DHCCNHA was the host of 'The Blue Book of Chinese People's Healthy Water Drinking' investigation only in name. It did not participate in the investigation and data analysis but instead devised various advertising campaigns. Thirdly, there was a differentiation in support. The QEITSC earned limited financial and media support, whereas the DHCCNHA attracted much more support from the government, the companies, and the media. Fourthly, the data of QEITSC's investigation was, and continues to be, open to public access, whereas the data of DHCCNHA's investigation was closed for public access. Fifthly, the QEITSC's investigation gained more credibility than the DHCCNHA's, since the former was independently conducted, whereas the latter cooperated with several agencies whose interests were closely associated with the investigation.

Here, it is important to point out that both the QEITSC and the DHCCNHA to some extent failed to bridge the general information gap between the tap water consumer and the tap water provision system. For QEITSC, their investigation was not widely publicized in the media, and given the concern regarding financial and public support, their investigation's scope was limited. For the DHCCNHA, their investigation was not accessible to the public, and given its commercial links, the credibility of its investigation was questionable.

This forms a sharp comparison to what happened in the UK. The Metropolitan Parochial Water Supply Association, a water consumer association established during the cholera outbreak period and developed into a powerful association that attracted representatives from ninety parishes who represented 1.25 million people, played a pivotal role in not only connecting water consumers, mostly middle-class citizens, and the government, but also integrating the former into the administration of tap water provision system with the latter in 1855 (Trentmann and Taylor, 2005). Moreover, during this process of connecting, it promoted the citizen's transformation from water users, those who used tap water, to modern water consumers, those who were willing to confront with the social conflicts triggered by tap water. In China, however, both the QEITSC and the DHCCNHA did not manage to build a connection between consumer and government, not to mention triggering a transformation between water users and water consumers.

Another problem for NGOs and Industrial Associations is their dysfunction in urging cooperation between the tap water consumer and the government, particularly regarding supervising tap water data and promoting information disclosure of tap water provision system. For example, QEITSC's website offers open environmental monitoring data about the quality of urban tap water in 10 major cities. However, none of these data have been downloaded more than ten times<sup>28</sup>. On the DHCCNHA's website, there is no content associated with tap water quality data; the main news is all about the commercial activities it has held recently<sup>29</sup>.

Furthermore, NDRC (Guidance on experimental work of water rates cost disclosure (Text in Chinese)) published a legal document to promote the disclosure and supervision of the urban tap water rates adjustment, the *Guidance on Experimental Work of Water Rates Cost Disclosure*. However, no NGOs and Industrial Associations have published any articles to advocate these legal documents, nor do they participate in disclosing and supervising the water rates adjustment. All of the relevant information about these legal documents comes from local government websites or research papers in academic journals.

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28 Source: [https://data.epmap.org/drink\\_waters](https://data.epmap.org/drink_waters) Accessed: 22 June 2016

29 Source: <http://www.chinadhcc.org/> Accessed: 1 July 2016

Without the effective contribution of NGOs and Industrial Associations, the cooperation mechanism between government and tap water consumer is paralysed. As a result of this situation, even though the government may have disclosed the information regarding tap water affairs and advocated public supervision of the tap water provision system, the tap water consumer neither has any access to information nor has a chance to participate in any activities to implement their supervision. It is possible that some NGOs and Industrial Associations have done some work, but their efforts are still largely invisible to consumers.

In sum, from the analysis above, currently, in China the 'third party' can be seen as a dysfunctional component of the 'source to consumer' urban tap water provision system. NGOs and Industrial Associations in China, to a large extent, have failed in playing a role of monitoring the system, promoting the communication between different entities, and bridging the knowledge and information gap between consumer and the Hybrid Institutional Architecture. Meanwhile, there is no institutional representation for the consumer to protect their legal right. They have to solely depend on themselves to deal with all the problems in the tap water provision, which stimulates the emergence of Consumer Coping Strategy Matrix.

## **4.4 The institutional incoherency in money flow**

As has been highlighted in the previous section, the incoherency in power flow is intertwined with the incoherency in money flow. Therefore, the institutional incoherency in money flow is mainly demonstrated in the political, economic and social variations of setting water rate, and the disconnection between money flow and water flow in marketization reform.

### **4.4.1 China's tap water rates and its composition**

In China, water rates have been officially fixed at a level so low that it nearly makes water treatment plants operate at a loss. Given the data from Research Report on Pricing Policies for Water Pollution Prevention

& Control, a national research project held by MEP and Remin University of China, the average water rates of 36 large and medium sized China's cities in 2009 is around 0.42 US dollars per ton (Ma et al., 2014). Meanwhile, this project also pointed out that water rates varies dramatically by provinces and cities. The highest water rate, 0.574 US dollars per ton in Tianjin, is 5.6 times higher than the lowest water rate, 0.164 US dollars per ton in Lasa. Such variation is due to the fact that there are numerous political, economic and social considerations behind the water rates, which further complicate its formation.

There are four factors that need to be taken into account. First, tap water is a commodity with a price but also a public necessity. Second, tap water rates has a close link with water resources conservation and environmental protection. Third, tap water provision system is a monopoly system without the competitive mechanism to determine its water rate. Fourth, since water is the raw material of industrial production, the water rates will influence the costs of numerous other commodities. All these four factors make water rates one of the most complicated rates in China.

### **Measures for Price Administration of Urban Water Supply**

Although tap water rates is important for both social and industrial development, its relevant research was only initiated in the late 1990s in China. Before the publication of the *Measures for Price Administration of Urban Water Supply* on 23 September 1998, China's water rates was set according to the principal of low profit. The publication of this measure signals the change of this principal. It replaced the water rates that was driven fully by social welfare to the water rates that were driven partially by the market and partially by government regulation.

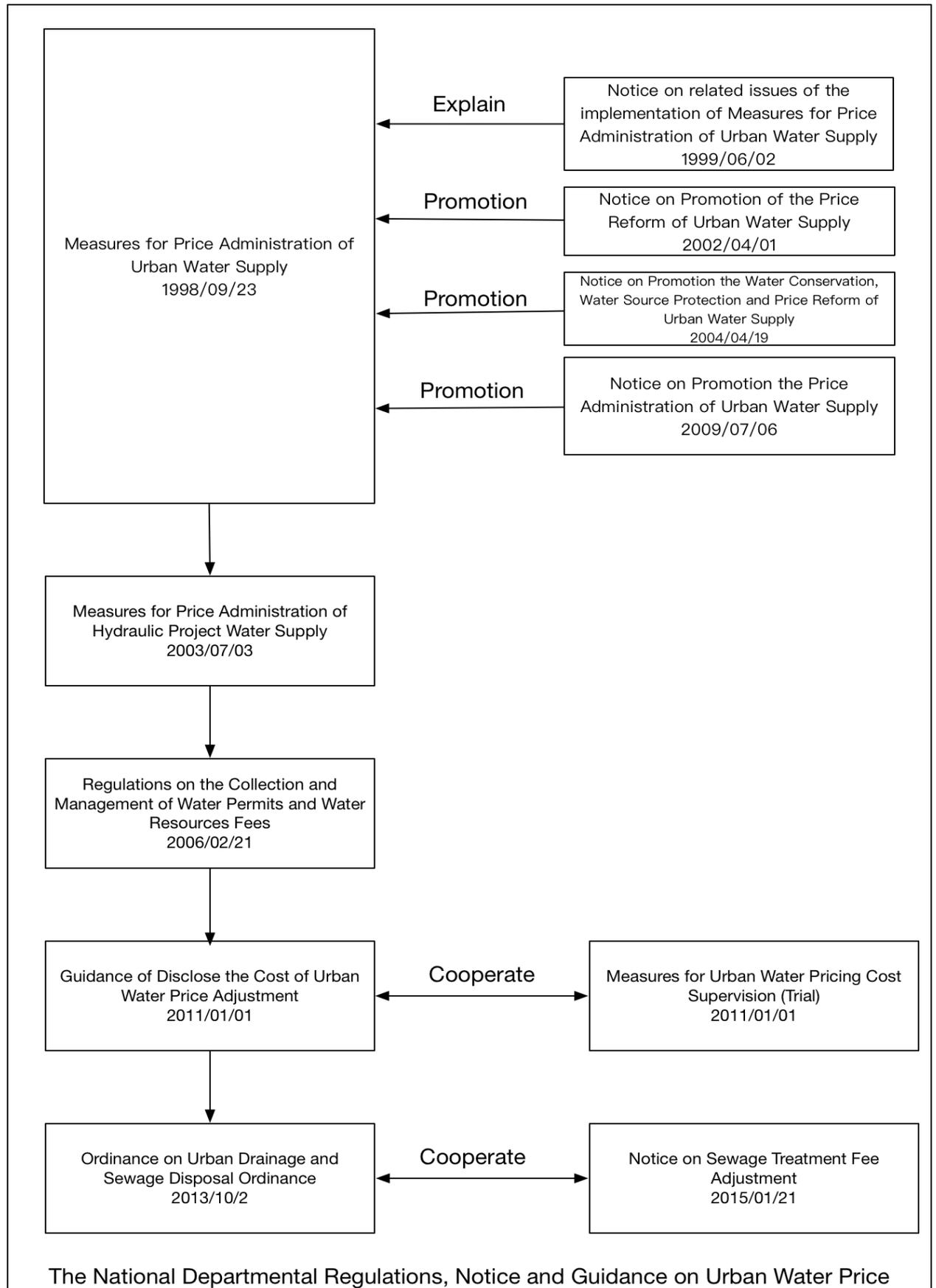


Figure 4.10: The National Departmental Regulations, Notice and Guidance on Urban water rate

As shown in Figure 4.10, this measure was explained and promoted in another four public notices between 1999 and 2009. They were issued by three bodies: NDRC, whose work is to regulate market prices in China, MHURD, whose work is to regulate construction activities, and State Council. Their involvement illustrates two important facts: first, the water rates is crucial for the central government's political agenda; and second, since it is highly connected with the industrial development, any change of water rates was so difficult that it required three important government departments to promote.

According to article 4 of the measures, the water rates is set by the local branch of the NDRC, which is under the administration of local government. This article highlights the fact that in China the water rates is varied by provinces, cities, and counties. This is because, unlike electricity which can be transferred at a low cost, water transfer is not only costly but also risky. Therefore, it is impossible to have a uniform rates. The water rates is set by the local government on the basis of their circumstances.

Here, several articles are worth mentioning. According to articles 6 to 9 of the measures, water rates is a terminal price, composed of four elements: the cost, fee, tax and profit. The cost includes the cost of the water source, electricity, material, maintenance, salary, water monitoring and testing, asset and other relevant costs. The fee includes selling fee, regulation fee, and transaction fee. It also includes the sewage treatment fee, the water resources fee and the fee for transferring water through hydraulic projects. The tax is the tax that the water company has to pay to the government. The profit is the legally limited profit the water company earned from its tap water supply service.

According to article 11 of the measures, the profit margin has to be confined in a range between 8% and 10% of the net asset. For those water companies mainly relying on government funds, profit margins cannot go above 6% of the net asset. For those water companies mainly relying on non-government funds such as bank loans, foreign capital, bonds and stocks, profit margins cannot go above 12% of the net asset during their repayment period. The sewage treatment fee and the water resources fee, though being part of the water rates, would be assigned to other government departments but water companies, hence the latter cannot use these fees as their income to cover operational costs.

### **The composition of tap water rate**

Figure 4.10 demonstrates that the development of water rates reflects the development of the water provision system. At the initial stage, the water rates only accounted for the operational cost of the water company. Later, since water resources began to dwindle, its value became more obvious and thus was transformed into water resources fee and became a part of water rate. In addition, with the advance of industrial development, sewage pollution has repressed water body's capacity for self-cleaning, resulting in the emergence of sewage treatment fee (different from water resources fee). When local water resources storage cannot meet the urban water demand, the local government begins to transfer water resources from other areas, making the fee for transferring water through hydraulic water projects a part of water rate.

Besides visible cost, fee, tax and profit, the water rates is also influenced by some invisible economic concerns. Since water is the raw material of industrial production, any abrupt water rates increase would cause a chain reaction that simultaneously increases the general cost of nearly every commodity, resulting in the increase of CPI (Consumer Price Index) and the trigger of cost-push inflation. This would damage the national economy as a whole. Therefore, CPI is one of the major concerns in water rates adjustment in China. NDRC request local municipal governments to supervise the correlation between water rates with the CPI so as to prevent any CPI increase led by water rates increase. From 2009 onward, owing to the decreased CPI caused by the global financial crisis, the cost-push inflation triggered by water rates increase could be counteracted. Many cities took this chance to increase their water rates, such as Beijing and Harbin (Ji, 2010).

To the consumer, the water rates are measured by two models: the two-part pricing model and the ladder water pricing model. The two-part pricing model is composed of the volume price and the measurement price. The volume price is measured by the value of the fixed assets of local water companies. The measurement price is set depending on the local water company's operational cost. The ladder water pricing mode includes three levels with two factors each: the elementary index and the level price. The

first and second levels have a standard tap water consumption amount respectively. At every level, the price is the result of the elementary index multiplied by the level price. When the consumed water amount surpasses the standard tap water consumption amount of the first level, the surplus part would be priced at the second level, and the same process repeats in the third level, the consumed water amount surpasses the standard tap water consumption amount of the second level. The total water rates would be the sum of all three levels. The price of the first level is set in the consideration of social welfare, the price of the second level is set on the consideration of improving people's lives, and the price of third level is set on the consideration of special requirements of some businesses, such as car-washing, SPA and golfing facilities. The 1998 measures only set the price of the first level: it equals the number of households multiplied by the average water consumption per person per month. The prices of the second and third level are set by local municipal governments on the basis of their respective situations.

#### **Six reasons for the low tap water rate**

With the integration of waste water rate, water resources fee, hydraulic project fee and the cost of the water company, in reality tap water rates is still kept at a low level. The reason for this is that tap water rates has been detached from the market for many years in six aspects. First, it is set by both the central and local government instead of the market. Second, its adjustment is not decided by the water company or market demand and supply, but by government departments. Third, its adjustment concerns not only the operational cost of the water company, but also other factors such as social welfare and CPI, making every adjustment lag behind or even violate market fluctuation. Fourth, its regulation is on the basis of the special situation of every province, city and county. Fifth, numerous invisible political factors have imposed their influences on the adjustment of tap water rate, such as political events, personnel arrangement, and capital attraction policy. Sixth, since the tap water rates has been kept at a low level for a long time, every increase of it would trigger a strong social resistance, which would damage the relationship between the consumer, local tap water company and local government. According to all six

concerns above, it can be said that tap water rates is economical, politically and socially 'fixed' at a low level.

### **The disorder in water company's cost management**

Given the aforementioned analyses, for the water company, their only income from tap water rates is the part associated with their operational cost and profit. Since the latter is fixed by policy, the operational cost becomes the only 'manageable' factor for the water company to increase their income. In other words, for the water company, with a higher operational cost comes a higher income from the tap water rate.

This fuels the disorder in water company's cost management. To achieve a higher income from the water rate, the water company needs to demonstrate a higher operational cost to local government, which makes them try their best to boost their expenditure through different financial operations such as income transfer, depreciation acceleration, and improving staff welfare.

The water company's problematic operational cost is a difficult problem for governments to solve. From 2006 to 2007, NDRC had published two administration documents regarding the evaluation of a company's operational cost. However, these two documents only targeted those companies who offered items and services. They had no articles for addressing the problematic operational cost in water companies. Moreover, since the water provision system has intricate political and economic connections with local government, the information on local water company's cost is often obscured. For example, since most of China's local water companies are State-Owned-Enterprise (SOE), some municipal governments used the water company's income as a guarantee to apply for bank loans for their other projects, such as urban construction projects. In other cases, to save funds, some other municipal governments forced the local water companies to afford all of their operational costs. All of these would make the local tap water rates be set on the basis of inaccurate operational cost information from the water company.

As Figure 4.10 shows, on January 1 2011, another two administration documents regarding public monitoring and supervision of the water company's costs were published. However, due to the

dysfunction of NGOs and Industrial Association, analysed in section 4.3.5, there was a stark information gap between two administration documents and tap water consumers. Most people are not even aware that they have been bestowed the right to supervise tap water rates and operational costs of the water company. In fact, given the disclosed information of the water company's operational cost, many water companies have been operating at a loss or barely covering their costs for many years. Since such information was not widely recognised by tap water consumers, it did not help with relieving the water company's stress from the consumer's occasional criticisms and complains about tap water quality. Such information gap in the interaction between the consumer and the water company also contributes to the construction of both the Hybrid Institutional Architecture of urban tap water provision system and Consumer Coping Strategy Matrix.

In general, since semi-potable tap water has become an everyday reality for more than 90% of China's urban citizens, the low water rates has imposed a profound influence on consumer's behaviour. For many urban residents, the supply of tap water was always sufficient and cheap, making them hardly notice the scarcity of water resources and the deficit of the water company. Therefore for them, the water rates was no worth supervising. By failing to do so, they are alienated from the flow of power and money running in the urban tap water provision system. Meanwhile, a low water rates to a large extent justifies the semi-potable quality of tap water. Rather than focusing on the situation of urban tap water provision system, consumers began to place more attention on establishing a Consumer Coping Strategy Matrix to deal with the semi-potable tap water.

#### **4.4.2 China's marketisation reform of urban public utility**

In the context of uneven water resources storage and distribution, the marketization reform in water industry initiated in 1990s. Qin Hong and Qian Pu (2008) classified the development of China's urban public utility into three periods. The first period is from 1978 to 1992. It is a period for public utility enterprise to explore their operation modes. The second period is from 1992 to 2001. It is the period for public utility enterprise to establish modern enterprise operation mechanism, as well as the period for

foreign and private capital to invest in these enterprises. The third period is from 2001 until now. It is the period for the central government to promote the marketization reform for urban public utility.

In the first period, water companies began to adjust its operation mechanism to attract more funds other than government funds. On 16 July 1992, the *Decision of the Central Committee of the Communist Party of China and the State Council On Accelerating Development of Tertiary Industry* was published by the central government. It asked the urban public utility industry to implement independent operation and enterprise-oriented management. This transformation paves the way for the later reform.

In the second period, water companies attempted to separate from the government departmental administration and began to operate independently as SOE. On 29 December 1993, China published *Company Law of the People's Republic of China*. In 1994, Shenzhen water supply companies established a hybrid operation mechanism; its property is administrated by SOE, its business is administrated by MWAB.

In the third period, the marketization reform of urban public utility was implemented on the basis of the publication of a series of important government documents. On 1 December 2001, the State Development Planning Commission published *Several Opinions on Promoting and Guiding Private Capital*, which opened the market of urban public utility. On 27 December 2002, MHURD published *Opinions on Promoting Urban Public Utility Marketization Process*. For the first time in history, this document claimed to establish China's franchise system. In March 2003, the Third Plenary Session of the 16th Central Committee of the Communist Party of China made the official decision to promote the marketization of urban public utility. On 19 March 2004, MHURD published the *Franchise Operation Measure of Urban Public Utilities*, which further strengthened the implementation of franchise operation in urban public utilities. Later on 12 August, the State Council published the *Several Opinions of the State Council on Encouraging, Supporting and Guiding the Development of the Individual, Private and Non-Public Ownership Economy*. This document can be seen as the final brick to build the foundation of marketization reform.

Here, it can be seen that one of the main promoters of the marketization reform of urban public utility is MHURD. Owing to its effort in promoting marketization reform of urban public utility, it at the same time

took back some of its power in urban tap water provision system that had been deprived in the government administration reforms (introduced in section 4.4.2).

In general, the marketization reform of urban public utility was promoted with the expectation of effective administration, finance, and management. The operation and management of water facilities have been separated by private companies that claimed to deliver a more efficient service. Meanwhile, water companies as SOE began to try to transform their characteristics from the hybrid of government department and enterprise to independent commercial entities. One remarkable example of such transformation is the changing name. Around 90% water companies in the capital cities and 60% water companies in the large and middle size cities changed their name from the 'Water Company' to 'Water Group Ltd' (Zhou, 2014, p.3).

With the strong support from the central government, this marketization reform made urban public utility a capital hotspot. Many water companies were listed or even back-door listed in Hong Kong stock market. They injected a significant amount of 'quick money' to the government, who then used this money to invest water provision projects or other infrastructure projects. Those who are backed by abundant capital began to purchase or merge the other smaller water companies' assets, such as the water treatment plants and the sewage treatment plants. For private water companies, their service is directly associated with full-cost recovery (sustainable cost recovery). Thus, water rates became the arena between local government and water company. As a result, those water companies who have certain connections with government are the fast-growing ones, especially those based on and backed by developed cities. Among them, Beijing Enterprises Water Group Limited (BEWG) is a typical case.

BEWG introduces itself as 'a large-scale group that provides a broad range of water services and environmental protection services in China'.<sup>30</sup> It is subordinated to the Beijing Enterprises Holdings Limited (BEHL), the most influential public utilities and facilities enterprises in China. Its main businesses range

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<sup>30</sup> Source: <http://www.bewg.com.hk/eng/global/home.htm> Accessed: 11 March 2017

from the investment of environmental protection technologies and facilities to consulting service of water engineering. Through the investment models such as TOT (Transfer-Operate-Transfer), BOT (Build-Operate-Transfer), entrusted management and service concession arrangement, the BEWG has managed 282 water treatment plants in total in 21 provinces of China, Malaysia, and Portugal. There are 226 plants of sewage treatment, 51 plants of water supply, four plants of reclaimed water treatment and one plant of seawater desalination.

However, the limitation of BOT and TOT is that they only target water and sewage treatment plants. In an interview with the investment officer of BEWG, he/she admitted that the focus of most water utility companies in China is 'water treatment instead of water distribution and water provision'. As the China's biggest private manager of water treatment plant, BEWG has no plan to expand its business to other sections in urban tap water provision system, such as pipeline and secondary water supply facilities.

However, the separation between water company and its governmental characteristic is difficult. Before this reform, the water company is a government-affiliated department, their cost is covered, to a large extent, by the government finance. Moreover, it has monopolised the tap water provision in certain areas. Thus, the water company has no motivations to modify its service and improve its efficiency. During the marketization reform, water companies began to be gradually independent of the government. It has its legal representatives and has to be registered in government to achieve a business license now. However, given their public utility characteristic, they also have to be monitored by a government department, whose position may have been retreated from the front-stage to the backstage. Therefore, the water company's characteristic, as well as its management framework, become a hybrid between government department, SOE, and private company.

Such a hybrid nature has triggered a series of troubles. As has been analysed before, the only income of water company is the water rates from tap water consumer, which barely covers the cost of tap water production. For some water companies, they are sponsored by the local government to cover the loss in their operation. For many other water companies, there is a paradox in their operations: on one hand,

given the goal of marketization reform, they have to be responsible for their management, profits, and losses by themselves. On the other, they have no power in setting the price of their only product. Therefore, even if they are a monopoly in the certain city regions, their incomes are, to a large extent, restricted by the local water management agencies. As a result, the insufficient funding is another important dimension. The revenue sources coming to most water companies are insufficient. Water rates is below its cost, which makes water company rely on government subsidies. Meanwhile, they have no control over the money flow which would enable them to invest in infrastructure, which would be able to produce the potable tap water. A more serious problem is that given the latest data, the majority of China's water company was still relying on government subsidy, which means that there is a disconnection between money flow and water flow. In other words, on the cost basis, the flow of money fails to directly secure the flow of water.

Given the 2014 data from China's Economic and Social Big Data Research Platform<sup>31</sup>, there are 1047 water companies in China in total. Among them, 292 are running in loss, accounting for 27.89% of the total water companies. Their total annual losses are only 46,800 Yuan, which looks like a not significant figure. Meanwhile, the total annual profit for rest water companies is as small as only 59,200 Yuan. However, a problem emerges in the other data: for all water companies, their total annual debt loads are 3,899,400 Yuan, but their total annual bank interests are as high as 6.53 billion Yuan. This sharp comparison may reflect the fact that there is a huge amount of bank loan functioning as government subsidy rather than debt of water companies. However, they still need to pay back the interests of these loans. With such small profit, its impossible for water companies to pay back their bank interest, not to mention the huge loan they are bearing. Water companies have to keep running in a paradoxical situation that on the one hand they have earned small profits and losses every year, on the other, they have to bear huge bank interests and loan at the same time. This data proved the disconnection between money flow and water flow. The marketization reform did not solve the serious financial problems in China's water companies.

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31 Source: <http://data.cnki.net> Accessed: 11 April 2017

With the problematic marketization reform of urban public utility, some political cautiousness on the development of franchise operation in urban public utility has been highlighted in some government documents. On 10 September 2005, MHURD published another document, the *Opinions on Strengthening the Regulation of Municipal Public Utilities*. It stresses that the public water service was an important part of public welfare. Thus the marketization reform should not replace the responsibility of municipal government. It also highlighted the importance of public participation. Other documents emphasised the increased quality of tap water provision and the enforced monitoring system. However, even the information of public participation and water quality monitoring was published both online and offline, most of them had not been updated for a long time. For example, MHURD established a government website called 'China's urban tap water quality supervision website'.<sup>32</sup> It claims to disclose the tap water quality in China's 36 cities. However, the last update date for these data October 2002.

In sum, the marketization reform was triggered by the demands of more efficient water service. However, such reform only covers certain sections in the whole urban tap water provision system. With the disconnection between money flow and water flow, and with the water rates being fixed at a certain level, there is a dilemma to construct the adequate flow of money to support water company. Meanwhile, information disclosure and public participation are also problematic. Such institutional incoherencies in money flow make the existing urban tap water provision system inadequate to present potable tap water.

## 4.5 The institutional incoherency in water flow

In 2006, the central government published a new national tap water standard to replace the old standard published in 1986. In contrast with the old standard that only has 35 indices, the new standard includes 106 indices, which makes it nearly as strict as those water standards in developed countries. The tap water should be potable once its quality reaches the new standard. However, 11 years have passed since the

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<sup>32</sup> Source: <http://www.nwqc.gov.cn> Accessed: 3 March 2017

publication of the new national tap water standard, even citizens of Beijing and Shanghai, the most developed cities in China, are still treating their tap water with the Consumer Coping Strategy Matrix before drinking. This fact reflects the institutional incoherency between the strict water standards and tap water's semi-potable quality.

This section uses the tap water standard to demonstrate the institutional incoherency in water flow. Few studies have investigated and delineated the development of China's tap water standard from the perspective of power/money/water nexus. From this perspective, the developmental trajectory of tap water standard is also the developmental trajectory of power and money flow from different government departments in the urban tap water provision system. Moreover, since the water standard can function in the long run, their documentation, modification, and publication also function as the symbols of the power and money flow in these departments.

The three government administration reforms (introduced in section 4.3.3) failed in taking the water standards into consideration, resulting in the fact that the power of producing and implementing water standards is dispersed in the hands of different ministries, causing a series of administration and cooperation problems. In this sense, the flow of power and money is circulating in the urban tap water provision system in a patchy way. To demonstrate this problem, it is worthwhile to illustrate the developments of China's major water standards.

China is adopting a four-level standard system<sup>33</sup>. The highest level is National Standard, which refers to standards that have national economic and technological influence. These standards are required to be applied throughout the country. Other standards at all levels may not conflict with them. The second level is Industrial Standard, which refers to standards about uniform technical requirements within certain industries which do not have national standards. They are complementary to national standards but more professional. They should not be inconsistent with National Standard and would be abolished once there

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33 Source: <http://www.bjjs.gov.cn/bjjs/xxgk/zthg/bzjs/xgzi/373686/index.shtml> Accessed: 12 April 2017

are National Standard being published. The third level is Local Standard, referring to standards published in certain administrative regions in the absence of National and Industrial Standard. The fourth level is Enterprise Standard, referring to standards published by enterprises to organise their production and operation in the absence of all three higher level standards. In all four levels, standards are also divided into compulsory standard and recommend standard. Here, a certain power hierarchy can be concluded from this system: the power of National Standard outweighs the power of Industrial Standard, and the power of compulsory standard outweighs the power of recommend standard. The water standards discussed in this section are all from the first two levels of the four-level standard system.

In September 1927, Shanghai published the first tap water standard in China, the *Water Standard of Shanghai City*. This standard included 21 indices in the beginning. One year later, it added coliform as another index. Shanghai is also the city that published the first urban tap water standard after the foundation of People's Republic of China in 1949. In 1950, it published the *Shanghai City Water Quality Standard*. Compared to the previous standard, this standard only had 16 indices, but it is stricter on several indices, such as residual chlorine, bacteria count and coliform count.

In May 1955, the central government published China's first national tap water standard, the *Interim Water Quality Standard*. It was set exclusively by the MH and only applied to 12 large and medium-sized cities. In December 1956, a new National Compulsory Standard, the *15 Indices Standard of Water Quality* was published. This standard was published by both the State Infrastructure Commission and the MH. This is the first time for construction department to be involved in the setting of water standard.

In the same year, the first tap water source regulation was published as well, the *Interim Regulation on Collective Water Source and Water Quality Evaluation*. However, this regulation did not clarify the responsibility for tap water source regulation among different government departments. This problem remains until today.

In November 1959, the State Infrastructure Commission and the MH co-operated with each other at the first time to publish another tap water regulation. However, their cooperation ended in 1976, when they

issued another interim tap water standard with 23 indices together. From then on, these two departments initiated a covert 'standard conflict' with one other through publishing overlapping tap water standards under their separate names until 2006. In 1988, the State Infrastructure Commission was replaced by Ministry of Construction (MC), the predecessor of MHURD. In the Super-Ministry Reform in 2008, MC was replaced by MHURD, but it is still in charge of setting tap water standards, especially for standards regarding water treatment plants.

In October 1985, the MH published its first National Compulsory Standard, the *Standard for Drinking Water Quality*. This standard included five sections: the principal, the water quality and hygienic requirement, the choice of the water source, the protection of water source, and the water quality test. It had 35 indices and was adopted for 21 years until 2002. Two changes can be observed in this standard: first, the MH began to preside over the setting and publication of national tap water standard with other departments except for MC. Second, it has expanded its power to the regulation of tap water source. Since then, the other ministries began to publish their industrial and departmental standards.

The publication of the 1985 *Standard for Drinking Water Quality* signals the power shift between the MH and MC: the power of the former has overshadowed the power of later in tap water administration. However, in November 1992, MC published a plan named *Urban Water Supply Sector Development and Technological Progress Plan In 2000*. In this plan, it asked first-class<sup>34</sup> water companies to follow 88 water quality indices, second-class water companies to follow 51 indices and third and fourth-class water companies to follow 35 indices. The publication of this plan demonstrates that MC was trying to strengthen its power through publishing industrial standards that overlapped with MH's universal standard. On January 1 1993, MC published another industrial tap water standard, the *Water Quality Standard for Water Source*. This standard specifies five issues regarding water source: its quality indicators,

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<sup>34</sup> The daily water supply capacity has been used by the government to classify the water company. For the first class water company, they can supply more than one million tons per day; the second class water company can supply 500 thousand to one million tons per day; the third class water company can supply 100 thousands to 500 thousand tons per day; the fourth class water company can supply less than 100 thousand tons per day.

its classification, its limits, its quality testing and its monitoring. It is obvious here that this standard overlapped with the MH's national tap water standard in respect to tap water source regulation.

The publication of this standard once again highlights the institutional incoherency in power flow between government departments. Moreover, MC was trying to achieve new power through publishing water standard on potable water. On 28 September 1999, MC published an Industrial Compulsory Standard, the *Water Quality Standards for Fine Water*. This is the first standard for potable water and its associated water supply facilities. Note here that in 1999, only a few facilities in China were capable of supplying potable water. Hence, the aim of publishing this standard is not to deal with practical problems, but to pave the way for MC to achieve the power of administrating potable water in the future.

Noticing its power has been weakened by MC's publication of a series of industrial standards, the MH took its actions. In 2000, it tried to revise the 1985 national tap water standard through holding interdepartmental meetings (Luo, 2014). However, due to the disagreement between different departments, this revision version of standard failed to be published as a National Standard. As a result, on June 7 2001, MH published this revised standard as a departmental regulation with the name of the standard, which was only adopted by the subordinated departments of MH such as local health monitor centres. This standard includes 96 indices, 62 among which are organic pollutant indices. However, these 62 indices are irregular test indices, and many health monitor centres even did not equip with the equipment as advanced as the water company to test these indices. The publication of this standard signals the emergence of the institutional incoherency between water standard and water flow.

At the same time, the power of the MC also increased. On January 1 2002, it published another National Recommend Standard, the *Standard of Water Quantity for City's Residential Use*. It is the first National Standard regarding tap water affairs that published by the MC but not the MH.

Meanwhile, other government departments began to be involved in the standard competition between MC and MH. On April 28 2002, the National Environmental Protection Administration (NEPA), the predecessor of MEP, published its third revision of *Environmental Quality Standards for Surface Water*.

This is a powerful National Compulsory Standard that published in 1983. It was revised twice in 1988 and 1999 respectively. Differing from its previous versions, the third revision added the new standards on tap water source quality. This change signals that the NEPA was expanding its power from the regulation of aquatic condition for the fishery to the regulation of tap water source for people.

About the groundwater regulation, on October 1, 1994, the Ministry of Geology and Mineral Resources, the predecessor of Ministry of Land and Resources (MLR), published the first and the only National Recommended Standard of ground water quality, the *Quality Standard for Ground Water*. Today, even though the power in administrating groundwater has been transferred from MLR to MWR in the government administration reform in 1998, this standard is still valid now, demonstrating the institutional incoherency in power flow.

In 2005, MC published three legal documents on water affairs: a new tap water standard, a revised tap water standard, and an urban tap water supply planning. On June 1, 2005, MC published an Industrial Recommend Standard, the *Urban Tap Water Quality Standard*. The number of the index in this, 103, was more than the index number of 1985 standard and 2001 standard, both published by MH. Some indices limits of this standard were even more stricter than the water standards from developed countries such as Japan. This standard is applied to all water treatment plants in China. However, even though this standard has 103 indices, the water treatment plant did not test every index in its outlet water every day. They only tested nine regular indices on the daily base: turbidity, colour, smell and taste, visible matter, CODMn, residual chlorine, the total bacteria number, the coliform and the thermotolerant coliform (Wang, 2012). The qualified rate of these nine indices is 95% but not 100%. In a practical sense, given that many water treatment plants lack the relevant treatment technologies and equipment, the implementation of this standard is full of problems.

On May 16, 2005, the MC published the revised potable tap water standard. In October, it published the *2010 Urban Water Supply Sector Development Plan and Technological Progress Plan*. In this plan, it set a

series of new developmental targets of water quality for the water companies. From then on, this plan has been revised every five to ten years.

On December 29, 2006, the MH published the revised *Standards for Drinking Water Quality*. This National Compulsory Standard replaced its predecessor published in 1985 and became the most authoritative tap water standard in China. The number of indices in the standard was increased from 35 in the 1985 standard to 106. This increase is mainly due to the consideration of the transformation of pollutants in water bodies (Gong and Liu, 2012). In 1985, the water sources in China were not as polluted as they were in 2006. The main pollutant has been transformed from the microbial pollution in 1985 to the soluble organic pollutants and heavy metal ion pollutants in 2006. As a result, 59 out of 71 new indices are toxicity indices. The number of organic pollutant indices, such as CODMn, has been expanded from 5 to 53. 11 inorganic pollutant indices, such as antimony and thallium, have been added as well. Generally speaking, this standard is the strictest water quality standard in the history of China, which, given the description of the government official media, was as strict as water standard in the European Union (Xinhua Daily Telegraph, 2014).

The publication of the 2006 national tap water standard is an outcome of cooperative work. It was led by the MH, who cooperated with the China National Standardisation Management Committee, MC, MWR, MLR, and NEPA. This long overdue cooperation also reflects the difficulties of cooperation between these departments. It has been 21 years since the publication of the 1985 national tap water standard. Due to its strict standards, the central government did not ask the local government to adopt this new standard immediately. The local government can decide by themselves the time to adopt the new standard, but they must adopt it before 1 July 2012. However, since the new standard did not come with any penalty policies and regulations, it was not taken seriously by local governments and water companies (Gong and Liu, 2012). Similar to what has happened after the publication of MC's 2005 standard, the adoption of this 2006 standard is problematic. In 2008 and 2009, MHURD adopted a national survey among 4457 urban water treatment plants. They found that only 58.2% of all surveyed water treatment plants can produce

standardised tap water under the new tap water standard. This figure was so low that the government even worried that its disclosure might trigger social turmoil. Hence, this figure was only disclosed by the government official media, Xinhua News, in 2012 (Xinhuanet, 2012). The survey result demonstrates the institutional incoherency in water flow: on one hand, there are several water standards that strict enough to produce potable tap water; on the other, given the limited water treatment capacity for many water treatment plants in China, they still are only able to supply semi-potable tap water quality to their consumers.

It is important to note here that the low standardised rate is also due to the fact of serious pollution of the water source (introduced in detail in section 4.2), which is always beyond the treatment capacity of water treatment plants. Thus, this has formed another institutional incoherency between of water flow, namely the incoherency between the strict water quality standard and the serious pollution in water sources. As a result, the government's attention shifted to the protection of water sources. In 2007 and 2008, the MEP published two recommended technical guidelines about the protection of the tap water source. This evidenced the fact that without enough power, MEP's work is limited in pollution control. It cannot be integrated into the water source protection effectively. On January 1 2014, the MWR published its first and only plan about water source, Guidelines for Urban Water Supply Sources Plan. Since they both published legal documents regarding water source, the power boundary between MEP and MWR becomes ambiguous, which also reflects in the case study in Chapter 6.

## 4.6 Conclusion

With an introduction of the situation of China's freshwater resource, this chapter introduced the three existing institutional incoherencies in power, money and water flow respectively. Their circulation between the different agents in the 'source to consumer' urban semi-potable tap water provision system forms the foundation of Hybrid Institutional Architecture. In order to illustrate the institutional incoherency in power flow, this chapter highlighted the incoherencies in three relationships: the

relationship between government departments themselves, the relationship between government, water company and consumer, and the relationship between consumer, third party and Hybrid Institutional Architecture. In order to illustrate the institutional incoherency in money flow, this chapter analysed the composition of China's water rates and the ineffective marketization reform of urban public utility. Finally, the institutional incoherency in water flow was stressed in light of a analyses of the developmental trajectory of China's water standards published by different departments, which demonstrates the gap between strict water standard and semi-potable tap water.

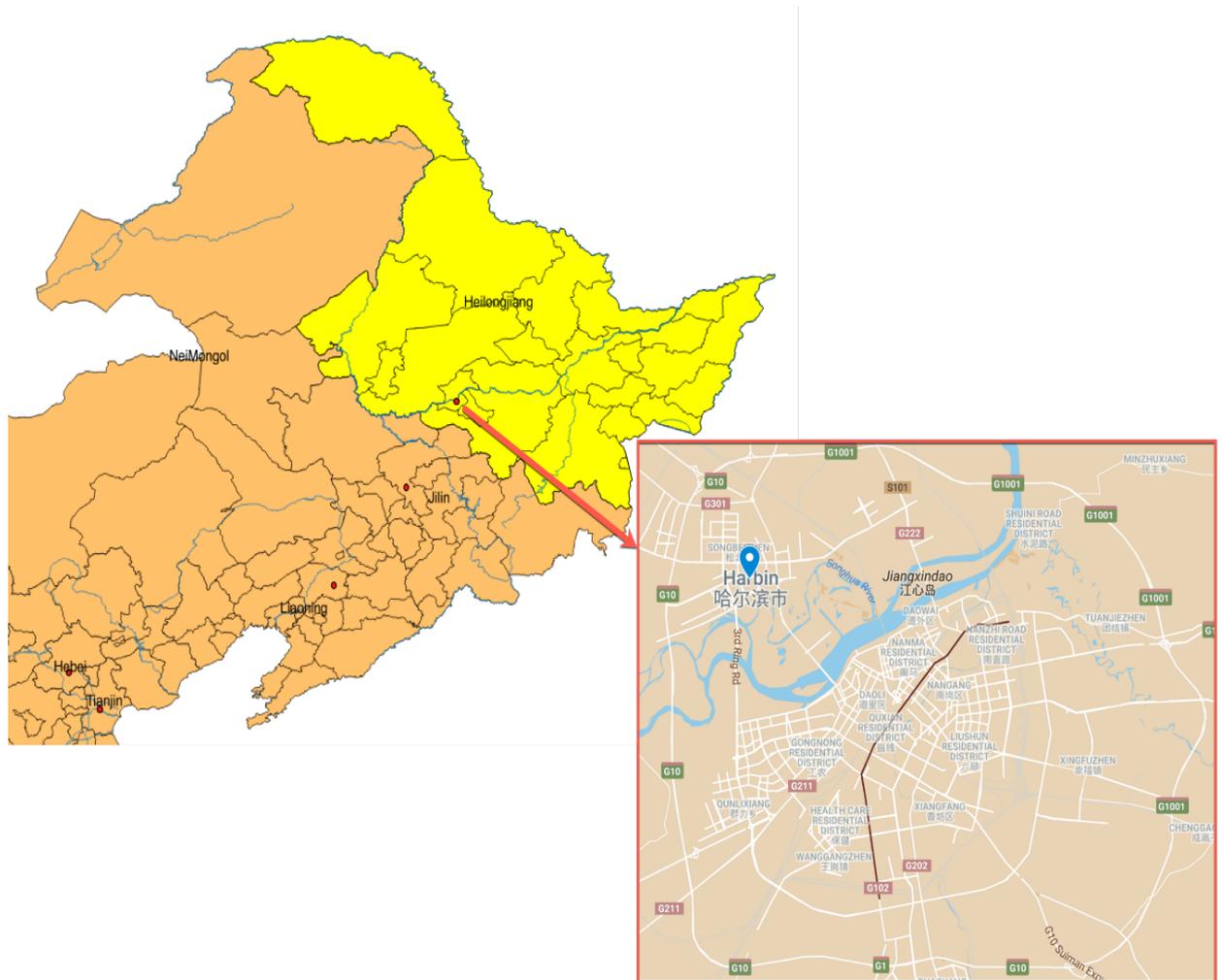
In the next chapter, a case study of Harbin will be presented to illustrate the sociogenic sustainability crises as the outcome of the unbalance between Hybrid Institutional Architecture, Consumer Coping Strategy Matrix, and water crises.

# Chapter 5 Harbin's Sociogenic Water Sustainability Crises

## 5.1 Introduction

As Figure 5.1 shows, Harbin is the capital city of Heilongjiang Province. In 2010 its population reached 10,635,971, making it one of the most populous cities in China. However, its water resources per capital is 1350 cubic meters, formulating a sharp contrast to the state's average level, 2173 cubic meter per capital(Xinhuanet, 2015).

All of the rivers near the urban areas of Harbin belong to the Songhua River system and the Mudan River system. There are two rivers that wind through the downtown area of Harbin, Songhua River, and Ashi stream. They are the primary water resources for the metropolis. Several small streams also flow through the periphery of the city, including Lalin stream and Feiketuo stream. The distribution of the city's water resources is uneven. The Eastern regions are enjoying relatively abundant water resource, whereas the central and western regions are hit by severe water scarcity. As a city with a river passing through, Harbin is on the list of 'Ten Most Water Shortage Cities in China' (Li, 2012). In 2013, Harbin possessed 11 public water treatment plants. Their total water supply capacity was 1.376 million cubic meters per day. The total length of the pipeline was 2114.3 kilometres. The year's total volume of water supply was 357.31 million cubic meters, including 150.7 million cubic meters of domestic water consumption. The total water-served population was 4.12 million.



**Figure 5.1: The location of Harbin**

This chapter aims to demonstrate the developmental trajectory of Harbin's tap water provision system, including three developmental phases of Harbin's urban tap water provision system and two sociogenic sustainability crises that have influenced the development of this system. With an analysis of archival data and interview materials, a contingent combination model of sociogenic water sustainability crisis is presented in the following sections to explain the emergences of two sociogenic water sustainability crises. All quotations cited in this chapter are translated by the current author from Chinese into English.

## 5.2 Three developmental phases of Harbin's urban tap water provision system

Before moving into the phase of modern tap water supply, Harbin's urban tap water provision system experienced three main developmental phases: the phase of well water supply (1960-1932), combined water supply (1932-1953), and primary modern tap water supply (1953-1980). This historical trajectory has had a significant impact on people's social memory about water, which paved the way for the constitution of the Hybrid Institutional Architecture of the urban tap water provision system that supplies semi-potable tap water to the consumer, and the emergence of Consumer Coping Strategy Matrix in dealing with the semi-potable tap water.

In the first two developmental phases of Harbin's tap water provision system, two special technological transitions can be observed. They are special due to four characteristics. First, they were both led by exogenous drivers, that is, the Russian and Japanese colonists. Second, the flow of power that was associated with these two technological transitions did not serve the majority, but rather the specific interests of colonists. This divergence of interests alienated the majority of consumers from the administration mechanism of the tap water provision system. Third, they developed so rapidly that they left little time for the public to become accustomed to the new changes. Fourth, at the same time, both demonstrated the systematic scaling up of the tap water provision system, which resulted in water quality improvement in Harbin. They also ushered in other big scale developmental processes led by the central government and local municipal government as endogenetic drivers. These two rapid technological transitions can be seen as part of the scaling up of the Hybrid Institutional Architecture of the tap water provision system.

In the third phase, another technological transition, driven mainly by the endogenetic power of municipal government, can be identified. However, this technological transition was also influenced by the flow of power from central government, who have a specific political goal of turning Harbin into a major industrial

zone of China. As a result of this technological transition, the priority was still not to address the citizens' tap water needs.

All three transitions happened during a relatively short-term, which left almost no time for the consumer to adapt to the concept of tap water provision. Moreover, all stages were led by political power instead of business power, which formed a social memory that it is always the government but any commercial entities that operate the tap water provision system. This can be seen as the origin of the Hybrid Institutional Architecture. Accordingly, major consumers' alienation from the system became a social memory and social reality. As a result, this contributed to consumer normalisation towards semi-potable tap water.

Given the limited historical record of Harbin's water provision system through these three phases, the data, if not marked as cited from another source, is cited from two main data sources: The Harbin Municipal Record Book: The Urban Planning; and The Harbin Municipal Chronicle: The Construction of Municipal Public Facilities.

### **5.2.1 The phase of well water supply (960-1932)**

In Harbin, for hundreds of years, well water was the sole water source for most citizens. The earliest records of well water supply were acquired from the ancient city ruins dated back to the early Song Dynasty (960-1276). In 1115, Harbin was chosen as the capital city of Jin Dynasty, a minority regime composed mainly of the Jurchen ethnic group (Harbin Municipal Government, 1999). Several well relics evidenced the usage of well water. Meanwhile, it is highly possible that a few people living near the Songhua River may have drunk and used the river water, although their number is too small to be statistically relevant to the water supply system at large.

During the reign of the Jiaqing Emperor and Daoguang Emperor (1795-1850), the water provision system was integrated into the general urban plan of Harbin. 13 Qitun (旗屯 urban administrative districts) had been planned. Within every Qitun, there were three avenues, six lanes, and twelve wells (Harbin Municipal

Government, 1998b). Such design was partially based on the convenience of fetching water. Since then, the usage of well water has become ingrained in peoples' minds, being culturally recognised as a tradition embedded within the social fabric and material infrastructure.

One reason for the long-lasting well water supply phase is the fact that urban population level always remained too low to enable the construction of facilities that utilised river water. Since Harbin is located in the far Northeast of China where the weather is always extremely cold, it was never a populous city until the end of the Qing dynasty. During the reign of the Qing Dynasty, the dominant race of the ruling class, the Manchu, was an ethnic minority group derived from the far Northeast areas of China. They believed that this area was their 'hometown' and 'the place of blessing,' as well as considering it to have remarkable strategic, cultural and military value. Therefore, the first emperor of the Qing Dynasty, Shunzhi Emperor, issued an apartheid decree, resulting in the building of a long guarded fence that separated the areas of Northeast China from Central China, where the majority of the Han population lived. From then on, Han people were prohibited from going into Northeast China unless they have permission issued by the authorities. Before the 19th century, Harbin was only a small city surrounded by large, empty lands.

During the 19th century, the population of Central China grew rapidly, causing the deficiency of both the housing and farming land. A series of floods and droughts further worsened this situation. At the end of the 19th century, the Guangxu Emperor, the eleventh emperor of the Qing dynasty, abolished the apartheid decree and facilitated a mass migration to the Northeast of China, historically called 'Chuang Guan Dong (Rush of Northeast China). Until the end of the 19th century, there were 30,000 people living in ten villages of Harbin (Harbin Municipal Government, 2007a). It can be seen as the first substantial population growth in the history of Harbin, which paved the way for the expansion of the city. However, given the abundant groundwater storage, owing much to the decree from the Qing dynasty, such abrupt population growth did not contribute to the development of river water provision system.

The first modern tap water provision system was introduced by Russian engineers, who were permitted to construct the China Eastern Railway in Northeast China, according to the Sino–Ruswellsian Secret Treaty

signed on 3 June 1896. They built several deep wells to supply water for the trains. In 1903, when this train line began to operate, some associated water facilities surrounded the train station, the pier and the new city districts, including the water tower, water extractor, pump house and pipelines (Harbin Statistic Bureau, 2014). Later in the Russo-Japanese War (1904-1905), the water supply facilities associated with the train line underwent a dramatic expansion (Tan, 2016, p.308). However, with the defeat of Russia, their reign over the China Eastern Railway came to an end gradually with the Japanese colonists taking over the city.

This development can be seen as the first rapid technological transition driven by an exogenous power, the Russian colonists. Even though their main purpose was railway construction, they realised that the added water facilities could also be a good source of income. However, this system only served a limited number of consumers, mainly consisting of Russians and other foreigners, who were charged by The Middle East Railway Group. The majority of citizens were completely alienated from this technological transition since hand-pressed wells were still the dominant method for Chinese people to fetch water in old urban districts. To them, this modern tap water provision system was something strange introduced by foreigners. Predictably, many had doubts about it. However, their doubts were either ignored or repressed by the Russian colonists, yet when it came to developing the tap water business, those oppositions had a significant impact. For example, in 1916, a businessman from Tianjin, the first city in China to be equipped with modern tap water facilities, came to Harbin with a goal of raising funds to initiate the local tap water provision business (Harbin Municipal Government, 1998a). This is the first record of the modern tap water business in Harbin. Unfortunately, he failed, as did all the other subsequent businessmen with similar attempts.

The main reason for these failures, as mentioned before, was that the local people were so accustomed to fetching water from their self-built water supply facilities, mainly the self-drilled wells, that they refused to accept and support any innovative idea of supplying tap water. Another reason was the lack of centralised political and economic power to support this business, due to ethnic diversity. On 15 May 1903,

the Middle East Railway launched the first census of Harbin. The figures showed that its population consisted of 28,228 Chinese, 15,579 Russians and 462 Japanese, and 200 representatives of other countries (Li, 2000). In 1917, the population of Harbin reached 100,000, only 11.5% of whom were born locally (Bakich, 2000). It was impossible for people from such different backgrounds to form a centralised flow of political and economic power to promote the development of a tap water provision system. Moreover, two conflicting flows of power were in operation, one was driven by the entrenched interests of Russian colonists and other foreigners as exogenous power and the other was driven by the established traditional believers of local people as endogenetic power. This resulted in a peculiar situation. On the one hand, from 1903 to 1926, the prototype of urban tap water provision system in Harbin was constructed and controlled by the Middle East Railway Group (Harbin Municipal Archives Bureau, 2014); on the other, the majority of citizens were still cut off from this new technology, which fuelled their existing strong resistance to it. In fact, the development of the modern tap water provision system was not relaunched until the Japanese colonial government took over the city.

### **5.2.2 The phase of the combined water supply (1932-1953)**

In February 1932, the Japanese military seized Harbin. In the same year, the military government published the 'Urban Plan of Harbin' and initiated the first long-term water management plan, which signals the second rapid technological transition driven by another exogenous power. For the first time in Harbin's history, it focused on the interconnections between hygiene, increasing water demands and pipeline. It was the first urban plan for Harbin to construct a formal urban tap water provision system. In this plan, the military government planned to channel river water from the Songhua River into the city to replace the well water, for the latter was always vulnerable to different types of pollution. It was the first time using river water as the main water source for the city's tap water provision system. Therefore, this second technological transition is also the beginning of the second phase of water supply in Harbin - the combination of well water supply and river water supply.

From 1936 to 1945, several tap water facilities had been constructed and launched by the Japanese colonial government. According to the records from the Municipal Record Book, in 1934, the Japanese colonial government established the Urban Construction Bureau, within which there was an agency responsible for administering urban tap water provision. The first urban tap water source project, Wenmiao Water Source Project, was completed in 1935. Similar to the water facilities built up by the Russians in the first phase, this project only served tap water to a certain group of people, the Japanese Army.

In 1936, the colonial government established two water treatment plants: Guxiang water treatment plants, whose supply capacity was 2,000 tons per day; and Nangang Deep Well water treatment plants, whose supply capacity was 3,000 tons per day. It also built the Harbin's earliest pipeline in the same year, which covered 13.8% of the total urban population. Identical to the Wenmiao Water Source Project, among the drinking consumers of this pipeline, 94.73% are foreigners (Dongbeinet, 2009). In 1939, 5,000 families had connected to the tap water supply (Harbin Municipal Government, 1998b), most of whom were either foreigners or businessmen from an elite class. In 1942, the Xinyang Water Treatment Plant was launched, the last water facility the colonial government built in Harbin.

After 1939, the expansion of Harbin's tap water provision system stopped due to the Pacific war between Japan and the US. Many construction plans of water facilities remained on paper. Later, some water facilities were destroyed during the Anti-Japanese War, which resulted in a sharp decline of urban tap water provision. In 1945, the urban water supply capacity was reduced to less than 10,000 tons per day (Harbin Municipal Government, 1998b).

The Japanese colonial government brought about an all-round technological transition to the development of Harbin's urban tap water provision system. On the basis of the Russian colonisers' heritage, it dramatically scaled up the system, introduced a series of new technologies and ideas regarding hygiene, pipeline and water treatment, particularly the technology of treated river water, which initiated the usage of river water of the Songhua River. However, this scaling up only benefited a small group of privileged

people. In general, people still neither had, knew about, nor had a chance to access the urban tap water provision system. In other words, the technology of modern tap water provision was not 'socially digested' by the majority, who still relied solely on well water.

The case of Taiwan, mentioned in Harvey's work, forms a stark contrast to Harbin (Harvey, 2015). Under the ruling of the Japanese colonial government for around fifty years, Taiwan's tap water provision system also experienced technological transition. Compared to Harbin citizens' oppositional attitude toward the development of tap water provision system, people in Taiwan accepted the new technology. This difference may partially be attributed to the relative long-term ruling of the Japanese colonial government, which was from the end of the 19th century until 1945. During this process, despite a brutal genocide implemented by the Japanese army to the aboriginal inhabitants aimed at seizing local water sources, many average people, especially children, were educated in school on the concept of modern tap water and showed their support for it. In Taiwan, there is a memorial and a statue for Yoichi Hatta, a Japanese engineer who contributed to the development of hydraulic engineering in Taiwan during the colonial period. However, in Harbin, the impacts of technological transitions are essential only regarding constructing water-associated infrastructures and facilities. The benefits of the modern tap water provision system were neither visible nor accessible to the majority.

On 28 April 1946, The CPC's Army retook Harbin. One of their prioritized tasks was to restore the urban water supply system. At the end of this year, The CPC's Harbin Municipal Government took over the severely damaged water treatment plants and the pipeline. Due to the shortage of funding, the colonial government left two water treatment plants unfinished: Sifangtai Water Source, later renamed by the municipal government as The First water treatment plants, Shamantun Water Purification Plant, renamed as The Third water treatment plants, and Xinyang Water Purification Plant, renamed as the Fourth Water Treatment Plant. These facilities eliminated much of the hardship in establishing the new urban tap water provision facilities, as well as reducing the time overhead that might normally be associated with that process. At the end of 1949, the urban water supply capacity had not only been fully restored, but also

increased from 5,000 cubic meters per day in the war period to 20,000 cubic meters per day (Harbin Municipal Government, 1998b).

### **5.2.3 The phase of primary modern tap water supply (1953-1980)**

After the founding of the People's Republic of China on 1 October, 1949, the Harbin's municipal government made a decision to increase the urban water supply capacity. In 1953, the Harbin's municipal government published the first Urban Long-term General Plan, including the first Urban Water Management Guidelines. From then on until 1965, they launched several water projects, including a construction project to build a new water treatment plant, The Second Water Treatment Plant, and a pipeline expansion project aiming to expand the pipeline from 150 kilometres to 407 kilometres. All of these projects exponentially increased the urban water supply capacity from 20,000 to 155,000 cubic meters per day (Harbin Municipal Government, 1998b). This is also the first rapid technological transition driven by endogenous power, which has no other interests but the public welfare. This was the first time the majority of Harbin citizens accessed tap water. However, similar to what has happened in the first two technological transitions, this technological transition developed too fast for Harbin citizens to be well informed and educated about the characteristics of tap water. As a result, there are no records of their habit shift in water consumption at that time, but two things can be confirmed: first, few people, including government officials, knew how to manage the modern tap water provision system; and second, given the rapid growth in industrial development, the substandard pipe, and the flawed administration, the quality of tap water deteriorated. Consequently, it could not be considered as 'potable water' at all by its consumers.

Accompanied by the scaling up of the tap water provision system, there is a significant increase in the water-served population (people who can access to the water supply) in this period. In 1952, the figure was 280,000, but only two years later, it reached 406,148. Obviously, such remarkable population increase imposed huge pressure on the urban tap water supply. Therefore, three plans were proposed, one was short-term, the other two long-term (Harbin Municipal Government, 1998b).

However, three exponential mistakes can be observed during this primary developmental period, which forms three disjunctions between Harbin's urban plan and social reality. It was those three disjunctions that made the urban tap water provision system, to a large extent, incompetent in proper functionality.

The first is a disjunction between the Urban Water Management Guidelines and the phenomenal growth of urban population. First, the predicted population growth in both the short-term plan and long-term plan was the same. In other words, the long-term plan did not take into account the population growth beyond the short-term plan. Meanwhile, the scale of population growth in the coming years surpassed the predicted figure dramatically. A year after the publication of Urban Long-term General Plan, Harbin's population reached its highest growth rate, 23.8%. In the next ten years, between 1950 to 1960, Harbin experienced a baby boom, during which its total population grew to 1.242 million with an annual growth rate of 9%. At the end of 1960, Harbin's population topped 2 million (Harbin Municipal Government, 1998b).

The second disjunction is between the urban water management guidelines and the ineffective administration of urban tap water provision system. It includes several aspects: first, in this period, the usage rate of equipment was low. Given the figure in 1952, only 26.10% of the water extraction equipment, 32.72% of the water treatment equipment was in use. These figures increased to 54.66% and 63.54% in 1954. However, similar to the prediction of the population, in the Urban Long-term General Plan, they were also predicted inaccurately. In the first short industrial planning, both figures would be increased to 95%, while in the second short plan they would be increased to 59%.

Another aspect is the high leakage rate of the water pipeline, which was mainly caused by illegal connections and water stealing. In 1952, the water leakage rate reached 31.20%. It reduced to 13.60% in 1954. In 1972, the total water leakage amount reached 7,820,000 cubic meters, occupying 13.3% of the total water sailed amount in that year. However, there is no prediction of leakage rate in the urban plan at all (Harbin Municipal Government, 1998a). This was possibly because the associated work on reducing this

rate would be so difficult that the municipal government was unable to set any goal or make any promises on it.

The third aspect was the disorder in setting rates of various water services. Because of the political impact of the Cultural Revolution, the water rates dropped dramatically. In 1955, the water rates for 672 public water supply booths was 0.007 Yuan per 40 kilograms. It was adjusted in the period of the Cultural Revolution to an extremely low rate, 0.05 Yuan per person per month. Predictably, the monthly water consumption amount doubled after the adjustment. Meanwhile, the service rates decreased from 8 Yuan for industrial facilities and 4 Yuan for domestic residents, to 0.5 Yuan for every applicant. All these adjustments further stimulated the water consumption to a higher degree.

The third disjunction is between urban water management guidelines and political turmoil. It distracted from and deprived the attention that should have been paid to the development of the urban tap water provision system. In order to prevent an air attack from the Soviet Union, on 16 June 1956, the National Construction Commission requested Harbin to 'take a long-term account for the hygiene and air defence and increase the groundwater supply to meet the increased water demand in the future'. That requirement impeded the development of surface water supply facilities in Harbin. It requested the water facilities to be designed underground or semi-underground and painted in colours that would camouflage with bushes.

Another case was that little attention may have been spent on domestic water supply plans, because it was overshadowed by the industrial water supply plan, the priority task for Harbin's municipal government at that time, given that Harbin was seen as one of the most essential industrial cities in north-eastern China. Generally speaking, in the periods of the Great Leap Forward and Cultural Revolution, the development of the urban tap water provision system nearly stagnated, which contrasted sharply with Harbin's unreasonable industrial plan aiming to build 'dozens of Chemical Factories'. From 1960 to 1962, Harbin did not initiate any new water provision projects. The water coverage rate also increased at a slow pace. In 1965, the coverage of urban water supply was 71%, with 1.17 million people consuming 2663 tons

of water for domestic usage per year. With seven years passing, it only slightly improved to 76% in 1972 (Harbin Municipal Government, 1998b).

As a result, all three disjunctions constituted a chaotic aggregation. In light of the low income from water rates and service rates, there was insufficient funding for the government to maintain the operation of water facilities, not to mention lack of funding to construct the new ones. As a result, in 1977, 233,000 residents who lived on a first floor had no water supply in the daytime, occupying 77.5% of all residents living in first floors in Harbin. 83,000 residents who lived on ground floors had no water supply in the daytime, occupying 3.2% of all residents living on ground floors in Harbin. These residents had to store tap water during the night for the next day's consumption. There were another 8000 residents, 3% of total water consumers, who had no water supply in both the daytime and at night. 510,000 residents had no tap water connection. These residents had to fetch water from the public water supply booths, where the queue was always long.

Owing to the increased political stabilization, during the period from 1973 to 1980, Harbin's urban tap water provision system expanded rapidly, which signals the coming of the contemporary tap water provision system (Harbin Municipal Government, 1998a). In 1973, the construction project of the Seventh Water Treatment Plant was initiated, and completed in December 1975 with the water supply capacity of 55,000 tons per day. However, due to its inferior quality, the water from this water treatment plant could only be used for industrial production. In 1977, the expansion project of Fourth Water Treatment Plant was completed, which increased the water supply capacity from 15,000 tons per day to 45,000 tons per day. In October 1978, National Construction Committee granted 13.72 million Yuan as dedicated funding for the expansion project of both the First Water Treatment Plant and the Third Water Treatment Plant. In 1980, Harbin developed eight groundwater sources and four surface water sources. The domestic water consumption reached 41,860,000 tons per day, consumed by 1.47 million people, 72% of urban's population. At the same time, two new problems emerged, the shortage of the groundwater, and the pollution of the surface water, which worsened gradually in the urban tap water provision system.

To conclude, the three developmental phases of Harbin's urban tap water development is full of political and economic turbulence (Sultana and Loftus, 2012; Harvey, 2015). Three short-term technological transitions have brought out the rapid development in the technology of urban tap water provision. However, all of them have their problems. The first two technological transitions were driven by two different exogenous powers with their certain political and economic interests. The third technological transition, which was to a large extent triggered on the basis of the heritages of the previous two technological transitions, was also driven by a political and economic goal rather than the welfare of the majority of citizens. Consumers, in this sense, were passive consumer rather than activate consumer of technology transitions. As a result, the consumers of tap water neither have the time nor the chance to become familiar with this modern 'innovation'. Their domestic traditions of disinfecting water by boiling it, were to a large extent retained.

Because of these short-term technological transitions, the government barely had any experience of administering the urban tap water provision system. As a result, three disjunctions can be observed: the first disjunction is between the urban plan and the phenomenal growth of urban population; the second disjunction is between the urban plan and the ineffective administration of urban tap water provision system. The third disjunction is between the urban plan and the political turmoil. As a result, a 'chaotic aggregation' in urban tap water development happened between the late 1960s and lasted until the 1980s.

During this period, it was impossible for the tap water provision system to cover the majority of Harbin citizens. For those who could get access to this service, the quality of tap water was questionable. As a result, as analysed in section 3.5, two types of consumer coping strategies can be widely observed. The self-built water supply facilities as Non-Tap-Water Coping Strategy, which aims to cope with the problem of fragmented water provision; and boiled water as Tap Water Coping Strategy, which aims to cope with the problem of semi-potable tap water. Therefore, the three short-term technological transitions failed to reconcile the citizen to the concept of modern tap water. At the same time, they paved the way for the

occurrences of three disjunctions, which further stimulated the development of two types of consumer coping strategies, transforming them into an ingrained social memory for every citizen in Harbin.

## **5.3 The first sociogenic sustainability crisis: water scarcity and overexploitation**

The signal of Harbin's contemporary tap water provision was the publication of *Harbin Urban Overall Plan* in 1980. It presented for the first time the general urban water supply situation in Harbin, along with the first official records of the Non-Tap-Water Coping Strategy for the fragmented tap water provision system, the self-built water supply facilities as Non-Tap-Water Coping Strategy, which not only includes the self-drilled water well, but also the large-scale water supply facilities built by companies, factories, hospitals, schools, factories, and other facilities where the current tap water provision system could not reach. In the context of five conditions and the dysfunction of hybrid whole tap water production, this coping strategy led to the over-exploitation of groundwater resource, the first sociogenic water sustainability crisis of Harbin.

### **5.3.1 Water scarcity and fragmented tap water distribution**

From the mid-1990s to the beginning of 2000s, Harbin faced prolonged water scarcity due to the dwindling water quality of Songhua River and the overexploitation of groundwater resources. Such a water shortage culminated in 2001, when Harbin was hit by its most severe drought since 1949. 1.086 million hectares of agriculture planting was affected, accounting for 77.9% of the total planting in Harbin. The water table of Songhua River, the main water source of Harbin at that time dropped to its lowest level in history. Different from the case of Athens (Kaika, 2003), where the water scarcity was socially constructed and used as the mean to achieve privatisation and other neoliberal agenda, in Harbin water scarcity has triggered a series of social and environmental sustainability crises.

This situation worsened by the fragmented tap water distribution. Given *Harbin's Urban Overall Plan*, tap water could not be supplied to the city's north and western areas due to two main reasons. First, given the low income of water company (introduced in section 5.2.3), the construction funding of pipeline is insufficient. As a result, the pipeline could not reach these areas. Moreover, this problem was worsened by the geographical conditions of Harbin's terrain. Harbin is located in a hilly area. The average height of its south and west terrains, 160 to 170 meters, was much higher than the average height of its north and eastern terrains, 117 meters. The city's uneven terrain dramatically increased the cost of pipeline construction. Second, water treatment plants and equipment was over-concentrated in only one water treatment plant, Shamantun Water Treatment Plant. It handled 80% of urban water supply and 74% of surface water treatment work with five pipelines connecting water source sites and six pipelines connecting the urban hub. One explanation of such over-concentration is that many other pipelines, such as the gas pipeline, heating, and sewage pipeline, were constructed in the same area where the tap water supply pipeline was located. Hence, it was difficult to make any change to the current water supply pipeline without interfering with the other pipelines.

### **5.3.2 The Non-Tap-Water Coping Strategy with fragmented tap water distribution**

Under the circumstance of fragmented tap water provision, consumers and facilities in the northern and western areas of the city had to develop their Non-Tap-Water Coping Strategies. Since bottled water and barrelled water were not available at that time, the only Non-Tap-Water Coping Strategy for the consumer to adopt was self-built water supply facilities. It is important to note here that this coping strategy was not a novelty. In the developmental phase of the tap water supply (1953-1980), which has been discussed in the previous section, a self-drilled well had already been widely adopted by numerous Harbin citizens who suffered from the chaotic aggregation as a result of three disjunctions in urban tap water provision system. In 1980, 216 facilities (such as school, hospital, factory, government department and so on) installed 620 groundwater wells. 531,000 citizens, up to 28% of the urban population, depended on their water supply

from these self-built water supply facilities, which supplied 42,000 tons of water for domestic consumption per day. Meanwhile, the urban tap water provision system supplied 118,000 tons of water for domestic consumption per day. If taking into account the industrial water consumption, the self-built water supply facilities extracted 580,000 tons of groundwater per day, whereas the urban tap water provision system only supplied 228,000 tons of water per day, 226,300 tons of which was surface water. This demonstrated that industrial facilities used more water from self-built water facilities than from the urban tap water provision system. The surface water source, the Songhua River, was also a source of the self-built water supply facilities, but mainly for industrial consumption. Four factories had consumed 65,000 tons of river water per day through their self-built water supply facilities (Harbin Municipal Government, 1998b).

In essence, these self-built water facilities are an illegal private appropriation of the public-owned water resource. However, their number was, to a large extent, grown with the tacit consent of the Harbin's municipal government. These attitudes also demonstrated in the developmental goals of the urban overall plan. In the plan, these self-built water supply facilities were allowed to exist in the industrial facilities for another 20 years until 2000. They were recognised by the municipal government and entitled with an official name, the urban emergency water source. As will be shown later, the municipal government published a regulation, clarifying the application procedures of drilling a new self-built water well. It was expected to function as a complementary water source to those who lived in the peripheral areas. These facts demonstrated that the government had been involved in the construction of a Non-Tap-Water Coping Strategy with fragmented tap water distribution.

The Harbin's municipal government had its difficulties in expanding the pipeline. As mentioned earlier, the geographical conditions of Harbin are complex. The south-western areas gradually inclined to north-eastern areas with a height gap of up to 43 meters. This area is full of the floodplain, river terrace, and uneven tableland. As a result, those buildings located in the five low-pressure water supply areas could not always have a consistent tap water supply.

However, no matter how difficult it was, the government failed to take responsibility for expanding the pipeline to reach the consumers and facilities. With tacit consent of the Non-Tap-Water Coping Strategy with fragmented tap water distribution, the government accepted the existence of these self-built water supply facilities. For example, in the record of Harbin Year Book 1986 (Harbin Yearbook Editing Committee, 1987, p.309), 'Harbin's water supply departments are composed of municipal water company (80%), enterprises, government departments, schools (all three of them occupied 19%), and residents (1%).' Here, residents have been considered as water suppliers parallel with the water company and other departments. When the government endorsed the Non-Tap-Water Coping Strategy, even temporarily, it was accompanied with an invisible cost: there would be invisible power and responsibility shifts between the government and the consumer. In this case, the Harbin's municipal government shifted its power of extracting the public-owned groundwater resource, as well as the associated responsibility of supplying tap water, to the consumer, expecting the latter to supply themselves the groundwater in terms of self-build water supply facilities. As a result of such power and responsibility shift, the process of extracting groundwater became uncontrolled.

Note here that, in Harvey's study of Delhi (Harvey, 2015), where over a million self-drilled wells functioned as a Non-Tap-Water Coping Strategy to fetch groundwater, such tacit consent can also be observed. However, these two tacit consents are different in many ways. Delhi's way of tacit consent is underpinned by the chaotic agglomeration without any plan. It was not integrated into the general administration of urban water resources at all. Therefore, the Delhi official's tacit consent cannot be considered as same as the Harbin government's tacit consent, which is a temporary compromise dedicated to alleviate the imminent pain caused by undeveloped water supply system. Furthermore, no matter how much the self-built water supply facility is out of control in general, the Harbin's municipal government still attempted to integrate them into its overall urban plan. Their effort was reflected in the fact that data of self-built water supply facility is available in different sources since the 1980s.

It can be concluded, therefore, that in this period, the Non-Tap-Water Coping Strategy with fragmented tap water distribution had developed rapidly with the tacit encouragement from the municipal government, which tried to integrate this coping strategy into its overall urban plan. Here, it is important to note three characteristics of this coping strategy: First, it was by nature an illegal private appropriation of the public water resource. Second, its construction involved the tap water consumer, the industrial facilities, and the municipal government. The other important agent, especially the market, did not have a significant involvement. This forms a sharp comparison with the Non-Tap-Water Coping Strategy that will be introduced in the next section, the bottled water and barrelled water. Third, in this period, the power and responsibility had been shifted from the municipal government to the consumers. However, such a shift did not happen in the other coping strategy. Also, from the anthropological stance, this coping strategy also reflects a whole process production/distribution process, which has been introduced in section 3.3.1.

### **5.3.3 The three disjunctions of Urban Overall Plan**

In Harbin's Urban Overall Plan, the problems of disjunction remained and became interwoven with the aforementioned Non-Tap-Water Coping Strategy with fragmented tap water distribution, and the authority's connivance and complicity with this strategy.

The first disjunction was between the urban plan prediction and the phenomenal growth of the urban population. Given the plan, in 2000, the total number of water consumers in urban areas would be 2.5 million, 300,000 of whom would still depend on the self-drilled wells for water supply. In fact, in 1980 the total population in Harbin was already 2,418,954, which reached 2,551,782 in 1982, just two years after the publication of this overall plan (Harbin Municipal Government, 1999). The data of the Fifth Population Census implemented in 2000 revealed that the urban population of Harbin at the time was 5.37 million (National Bureau of Statistics, P. R. China, 2011), more than twice the predicted number.

The second disjunction was between the urban plan and the ineffective administration of the urban tap water provision system. From 1949 to 1980, the industrial scale of Harbin expanded 40 times. In contrast, water supply capacity was increased only ten times and the efficiency for supplying surface water was low. In 1980, the real tap water supply capacities of the four surface water treatment plants were much less than their designed capacity. For example, The First Water Treatment Plant, with a designed water supply capacity of 100,000 tons per day, supplied only 41,300 tons. The Seventh Water Treatment Plant, with designed water supply capacity of 480,000 tons per day, supplied only 40,000 tons. This situation further intensified the consumption of groundwater through self-built water supply facilities.

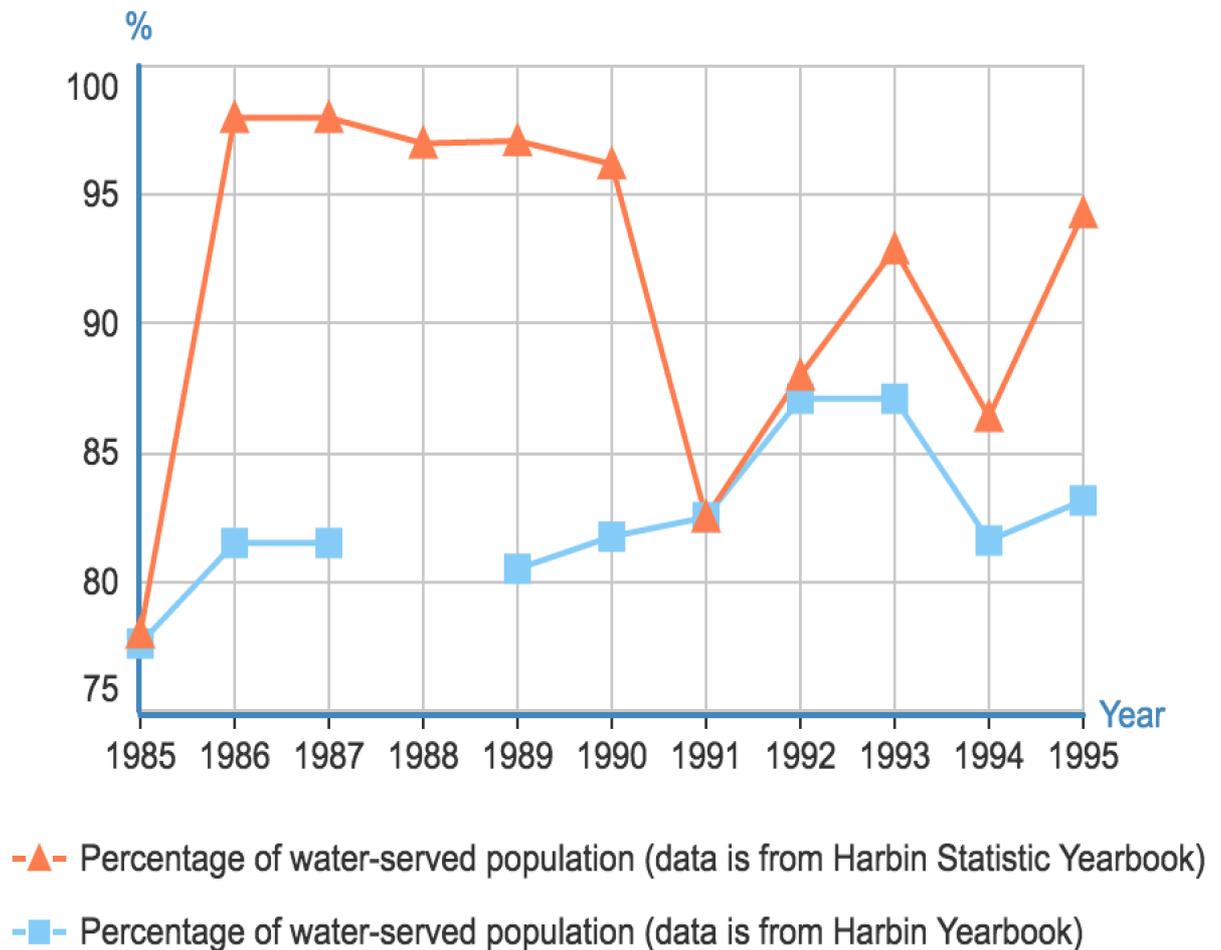
The third disjunction is between the urban plan and the water resources protection. The predicted figure of the annual amount of surface water these self-built water supply facilities would supply kept the same from 1980 to 2000. This means that such prediction did not take into account any essential factors including population growth, urban expansion, industrial development, environmental protection, water resources administration, and so on. The municipal government had no plans for either charging water rates on the basis of groundwater consumption volume from these facilities or claiming their administration. Neither did it propose to cap the number of self-built water supply facilities to control the overexploitation of groundwater resources. Several goals were established to 'control' the number of new self-drilled water wells. For example, one of them was to supply the same amount of water from the urban tap water provision system to the industrial facilities as from the self-built water supply facilities.

### **5.3.4 The controversial official data in water administration**

Facing the three disjunctions mentioned above, the municipal government published a series of controversial data in its two different types of yearbooks in an attempt to avoid talking direct responsibility.

For example, there are two sets of contradictory data showing the percentage of Harbin's water-served population, as demonstrated in Figure 5.2. One is from the Harbin Statistic Yearbook, the other is from the

Harbin Yearbook. However, in eight out of the ten years from 1985 to 1995, these two sets of data are in conflict with each other, especially in the four years from 1986 to 1990.



**Figure 5.2: Percentage of Harbin's water-served population from two data sources: from 1985 to 1995**

Given the data from the Harbin Statistic Yearbook, in 1985, the percentage of Harbin's water-served population was 78%. Just one year later, it suddenly reached 98%. However, in the Harbin Yearbook, the latter figure was only 81.5%. Moreover, since then until 1989, in the Harbin Statistic Yearbook the percentage of water served population was abnormally high: it is 97% in 1987, 97.1% in 1988, and 96.2% in 1989. Meanwhile, in the Harbin Yearbook, these figures were 81.5% in 1987, no data in 1988, and 80.5% in 1989.

Here, one obvious question emerges: which data source is more plausible? This answer can be arrived at by scrutinising other data. If the data of such rapid growth in the percentage of the water-served

population in the Harbin Statistic Yearbook is correct, then it must correspond to a rapid expansion in the urban water supply pipeline. According to *The Harbin Municipal Record Book: The Construction of Municipal Public Facilities*, in 1986 the municipal government put in place a new pipeline, 5,448 meters in length and 800 millimetres in calibre, connecting The Second water treatment plants to the Fourth Water Treatment Plant. Another pipeline construction record can be found in the Harbin Yearbook. It recorded that through the refurbishment of an old pipeline, 7909 families were connected to tap water supply, which increased the percentage of Harbin's water-served population by 3%. Neither of these records can explain the dramatic growth in the percentage of the water-served population from 78% to 98% reported in the Harbin Statistic Yearbook. The only plausible explanation of such growth is that the number is incorrect.

In fact, on December 20, 1986, before the publication of the data (as a routine it was published one year later in 1987), the State Council issued the Harbin's municipal government a document, *the Reply to the Harbin's General Urban Plan*. The State Council advised the municipal government that '[...] attention should be paid to increasing the domestic water coverage.' Hence it seems that the abnormally increased rate of Harbin's water-served population in 1986 was just a response to the State Council's criticism.

The aforementioned explanation raises another question: why has the data in the Harbin Yearbook not been affected? The answer is clear: in the Harbin Yearbook, this data set was not listed as clearly as it was in the Harbin Statistic Yearbook, but was 'hidden' in the content introducing the state of Harbin's water supply. Therefore, the editors of the Harbin Yearbook, deliberately or not, did not change the data regarding the percentage of Harbin's water-served population. However, since 2010, this data has stopped showing in the content of the Harbin Yearbook. Since 2012, given the sole record of the Harbin Statistic Yearbook, the percentage of Harbin's water-served population has reached and remained 100%.

This data implies something more serious than the controversy itself. It unveils the general attitude of the local government, at least in that specific period, was not to solve the existing problems, but to disguise them even in its most authoritative official data source, the Harbin Statistical Yearbook. Meanwhile, it also

reduces the trustworthiness of the other data in this data source. This municipal government's attitude, to some extent, can also be seen as another type of tacit encouragement for the implementation of the Non-Tap-Water Coping Strategy with fragmented tap water distribution.

### **5.3.5 The legal framework of Harbin's water management**

After the period of the Cultural Revolution, Harbin began to construct a top-down model of a legal system regarding the water resources management. The main focus was paid on water conservation. The central government always leads the local government to implement the new idea concerning water protection by publishing the relevant laws and regulations. However, the implementation of these ideas and concepts are always inefficient on a local level, which demonstrates that the political influence from central government to the local government, especially in issues of nature resource management, may not be as strong as many people have presumed.

Figure 5.3 shows the historical development of Harbin's regulation on water conservation and urban water supply. In general, Harbin's regulations on water conservation are republished or revised five times every 2 to 7 years since 1992. These republications and revisions were in line with the changing situation of the urban tap water provision system. Figure 5.4 shows the historical development of Harbin's regulation on water supply. This regulation has been republished and revised four times every six to fourteen years since its first publication in 1983.

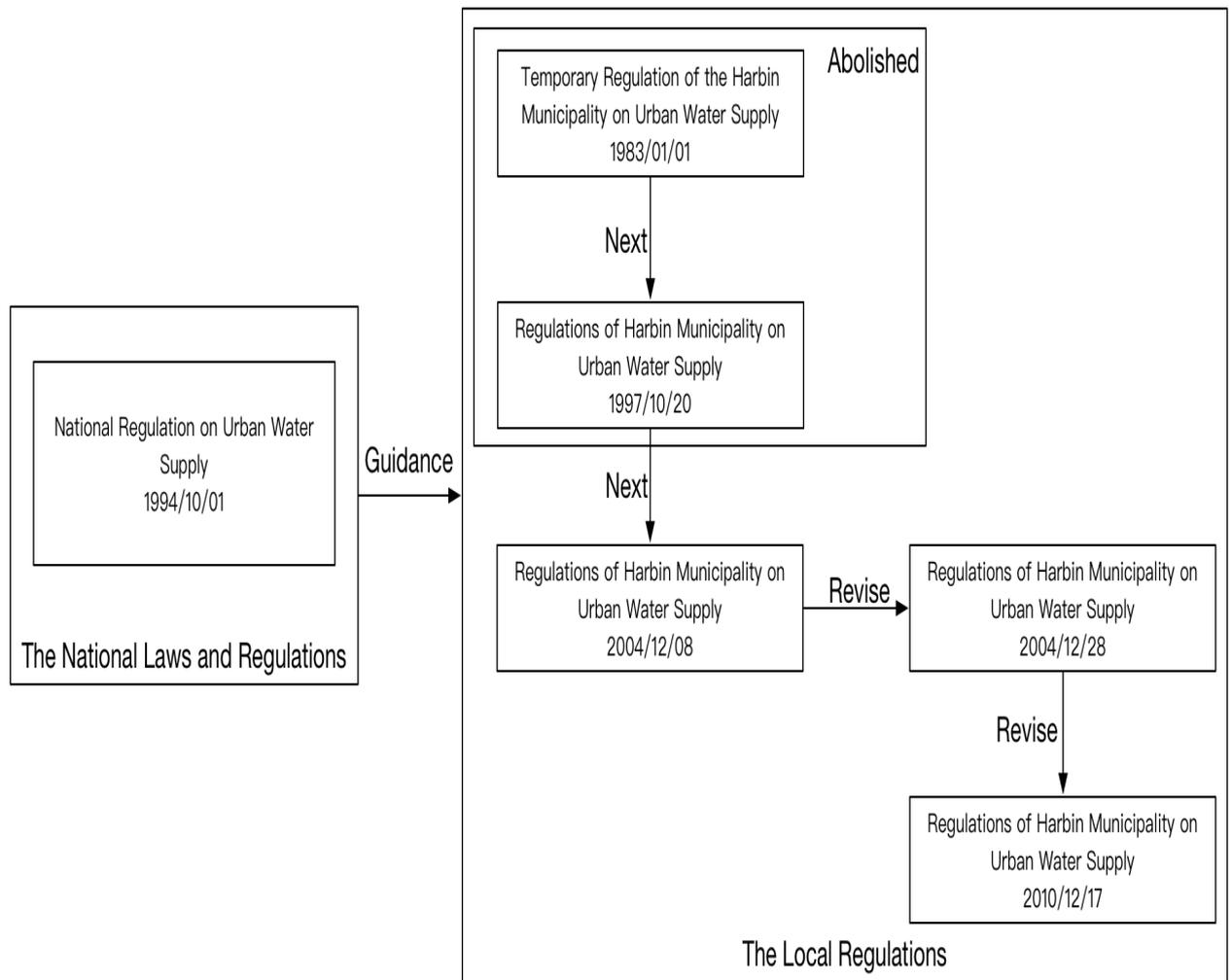
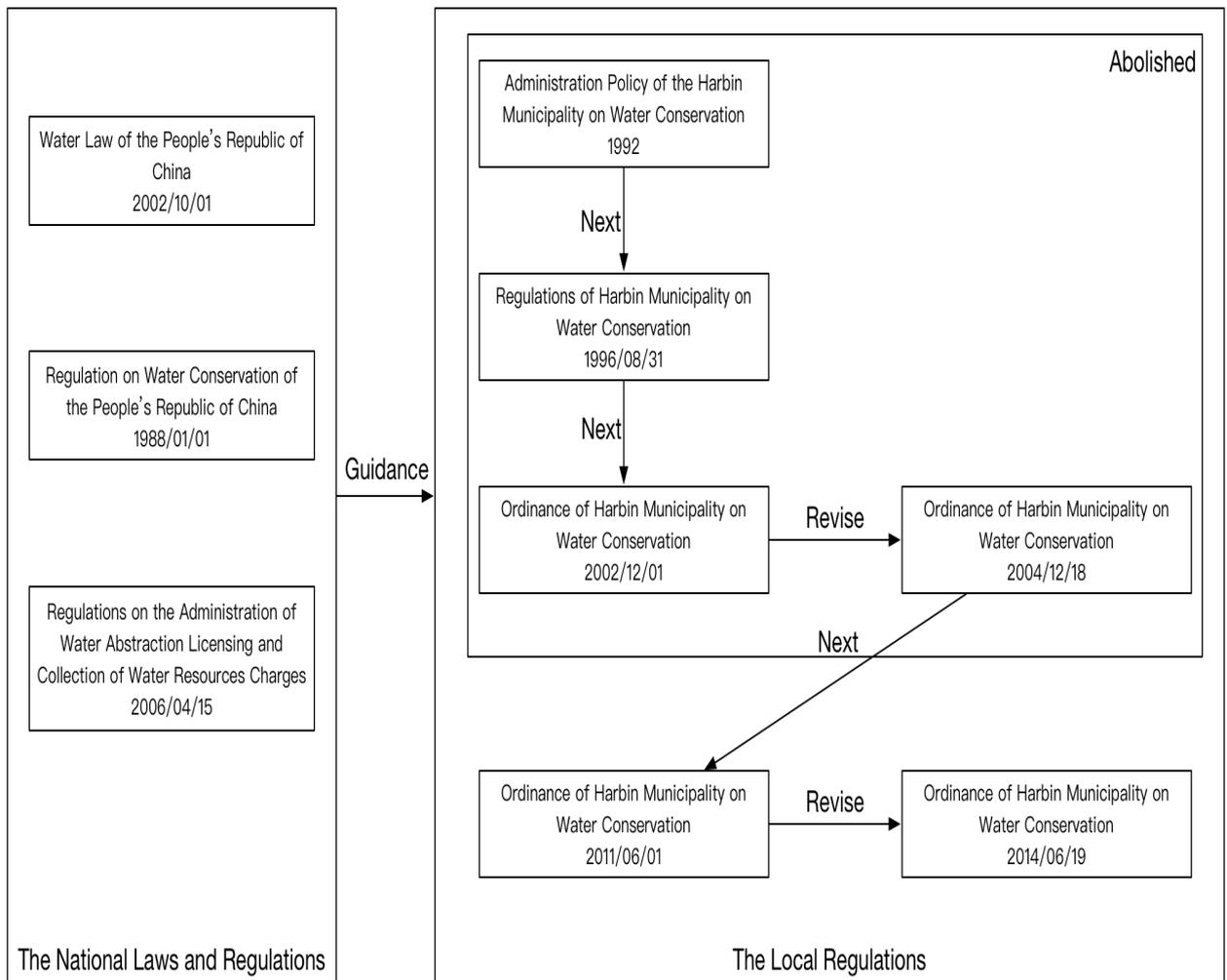


Figure 5.3: The historical development of Harbin's local regulation on water conservation



**Figure 5.4: The historical development of Harbin's local regulation on urban water supply**

Figure 5.3 and Figure 5.4 demonstrate several features of China's water resources management. First, there is a top-down model of water administration. This demonstrates that the central and local government constituted a flexible responsibility distribution system. The regulations published by the central government perform as both the principle and the guidance for the regulations published by the local government, whose responsibility is to elaborate these principles and guidance into details. Meanwhile, the local government can either adjust or abolish their regulations more often than the central government, which enables them to publish local regulations according to the changing environment. However, this also evidences that the central government has no 'direct' control over local water resources administration. Therefore, a second feature emerges.

The central government, in many senses, is not only performing the role of 'leader' but also the role of 'teacher' in terms of introducing new ideas in water administration to the local government. However, the local government, being both the 'student' and the implementer of such ideas, does not always manage to keep in pace with the central government. A stark example is the process of introducing the idea of water abstraction licensing. This caused the risk of disjunction in the policy implementation between the central and the local government.

Since the State Council published the *Regulation on the Administration of Water Abstraction Licensing* on September 1 1993, the idea of water property has been considered as an effective way of controlling the water resource. This regulation was later replaced by Regulations on the Administration of Water Abstraction Licensing and Collection of Water Resources Charges in 2006, as Figure 5.3 demonstrates. According to that regulation, 'each organisation or individual that abstracts water resources shall, except for the circumstances specified in Article 4 of this Regulation, apply for and obtain a water abstraction license and pay water resources charges.'

However, the Standing Committee of the People's Congress of the Harbin Municipality, published a local regulation on water resource, the *Regulation on Urban Water Conservation* on 31 August 1996, three years after the central government presented the idea of water abstraction licensing. However, it did not adopt the idea of 'water abstraction license' in its articles at all.

Quite ironically, in this urban water conservation regulation, the first article stated that 'these regulations are formulated in accordance with the Regulation on the Administration of Water Abstraction Licensing [...] by taking into account the particular circumstances of this Municipality, for the purpose of strengthening the administration of urban water conservation, protecting and properly developing the urban groundwater resource, promoting the economic and social development.' In article 27, it is stated that 'any unit and individual who needs to abstract groundwater should apply for the approval from the urban water resources office.' Clearly, the idea of 'water abstraction license' was not adopted by the Harbin's municipal government. It was not until 2002, nine years after the idea of the water abstraction

license was first proposed by the central government, that Harbin published a new version of *Regulation on Urban Water Conservation* that integrated this idea. In article 28, it is stated that 'any unit and individual who needs to abstract groundwater should apply for the approval from the water resources management authority in the county or municipal level. Only after getting the water abstraction license can the water be abstracted, except for the circumstances specified in other laws or regulations. The developments of spring water and geothermal water entail the other approval procedures for exploitation.'

Given the analysis above, a question arises: why did it take nine years for Harbin's municipal government to adopt the idea of 'water abstract license' proposed by central government? The answer is that at the time when this idea was proposed, the Harbin's municipal government was not fully prepared to take effective control of its groundwater consumption. The local government needs time to adjust the water supply system. Meanwhile, interests needed to be redistributed among different agents of tap water provision system. In conclusion, the practice of water abstraction license demonstrates the institutional incoherency in flow of power between the central and local government, as introduced in section 4.3.

### **5.3.6 The sociogenic water sustainability crisis: the overexploitation of groundwater**

Between the 1980s and 2000s, Harbin has undergone a sociogenic water sustainability crisis - the over-exploitation of groundwater. Since the 1980s, the groundwater resources has been the main source of Harbin's tap water supply. In 1980, groundwater made up 65% of the total urban water supply of the whole city. There was a heavy groundwater consumption from unmanaged self-built water supply facilities. Given Harbin's groundwater storage, the maximum annual groundwater extraction amount should be below 11 million tons to guarantee sustainability. However, the total annual extraction amount of groundwater in Harbin was 27.5 million tons, over two times that of the recommended extraction amount, which harmed the groundwater environment (Harbin Municipal Government, 1998b). The groundwater table of Harbin was plummeting one meter per year in average. In some places, it plummeted 1.5 meters per year. This is caused by the overexploitation of groundwater up to 330,000 cubic meters per day. Later, owing to stricter

administration, the extraction volume decreased to 120,000 cubic meters per day (Li, 2012). The long-term overexploitation also caused the catastrophic land subsidence, forming more than 500 square kilometres of a groundwater depression cone. In this region of the groundwater depression cone, some buildings had cracked (The People Net, 2000). The river water also flowed back into these regions and polluted the groundwater. This situation only took a turn for the better in recent years after a rectification campaign of self-built water supply facilities was launched by the municipal government (introduced in section 5.3.7). The water table of groundwater has increased continuously since 2004. However, when the Songhua River was polluted by a benzene spill, many self-built water supply facilities went back to work again.

Here, it is important to demonstrate how the different agents and conditions analysed above constitute a contingent combination model that triggered the sociogenic water sustainability crisis. As Figure 5.5 shows, there is a contingent combination model integrating the hybrid production of tap water with three agents, the local government, the consumer and the water company in the context formed by five conditions, the cultural condition, the historical condition, the geographical condition, the political condition and the environmental condition. The five conditions have certain interconnections with each other as shown in the five double-headed arrow lines. Given the definition of sociogenic sustainability crisis (introduced in section 3.9), a sociogenic sustainability crisis is a sustainability crisis that mainly triggered by motivations from both the natural environment and the social fabrics of certain society. In the case of Harbin, the geographical condition and the environment condition contributes to the form of motivations from natural environment, whereas the cultural condition, the historical condition, the political condition contributes to the form of motivations from social fabrics. All together, they lead to the outbreak of the sociogenic water sustainability crisis.

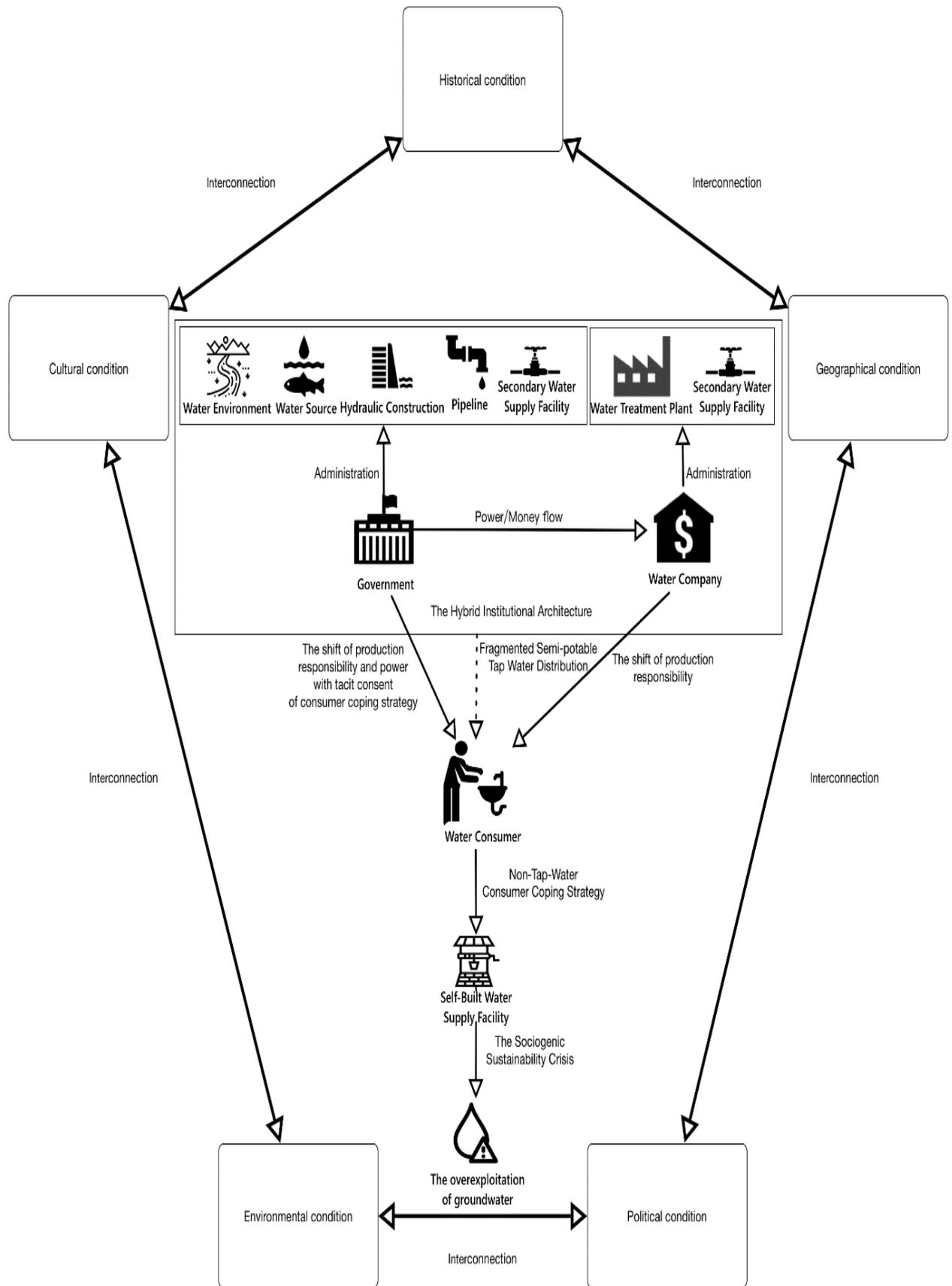


Figure 5.5: The contingent combination model of Harbin's first sociogenic water sustainability crisis

In respect to the pentacle composed by the five conditions, the cultural condition is the ingrained tradition of using well water. The history condition is the three rapid technology transitions and the heritage of water facilities left by the Japanese colonists. As mentioned in the previous section, the heritage significantly prompted the development of Harbin's urban tap water provision system. However, in winter seasons, these old facilities always malfunctioned, causing problems in tap water turbidity, residual chlorine and fluoride.

The geographical condition is the hilly and uneven terrain of urban areas, which dramatically increased the expenditure of pipeline. The political condition is the political turmoil of the Culture Revolution at that period. The environment condition has two facets: the urban environment and the natural environment. For the urban environment, there is an unexpected and unplanned rapid population growth, which has been analysed in the previous section.

Here, it is worthwhile elaborating on the natural environment condition in two points: First, being located in the north-east of China, Harbin has long-term winter seasons compared to other cities. During the winter, it has a low temperature, which increases the viscosity of river water. Thus, some solids do not precipitate as they normally would in general temperature, resulting in the increased turbidity of the water. Connecting the historical condition of the old facilities mentioned above, this causes Harbin's citizens to build self-built water supply facilities to extract groundwater as their Non-Tap-Water Coping Strategy in the period when bottled and barrelled water was not fully developed. Even today this problem still exists. On February 5, 2015, a Chinese magazine, *Oriental Outlook*, published a report, in which the quality of 29 cities' tap water was checked by the third party with no commercial and government background (China Water Safety Charity Fund, 2015). According to the national standard, the turbidity of Harbin's tap water was sub-standardised.

Second, there is also serious pollution in the surface water source of Harbin's, Songhua River. A significant case is the chronic Minamata Disease<sup>35</sup> which appeared in the Songhua river between 1958 to 1982, caused by poison effluents discharged by the Jilin Petrochemical Corporation (Wang, 2010). Meanwhile, the surface water still occupied 82% of Harbin's tap water provision. It was highly possible that many Harbin citizens had noticed the problem of tap water and thus turned to groundwater from self-built tap water supply facilities.

In respect to cultural conditions, Harbin citizens's tradition of drinking well water contributed to the establishment of self-built tap water supply facilities. This has been discussed in the previous section.

The local government and the water company are tied with each other by the flow of power, establishing a Hybrid Institutional Architecture. They both shifted certain power and responsibilities to the consumer.

As Figure 5.5 shows, if we ignore this Hybrid Institutional Architecture, it would seem that it is the tap water consumers who single-handedly triggered Harbin's first sociogenic water sustainability crisis by building self-built water supply facilities and overexploiting the groundwater resource. However, the root of this crisis is the dysfunction of Hybrid Institutional Architecture in producing semi-potable tap water, showing in Figure 5.5 by the dotted line between the hybrid institutional architecture and consumer.

In the context of the five conditions, both the water company and the government had their problems in tap water provision. The water company has two problems, the insufficient water supply and the insufficient pipeline coverage, as analysed previously. The local government has four problems: first, they had three disjunctions between urban plan and realities. Second, they had problematic and paradoxical data. Third, they kept a tacit encouragement attitude towards the implementation of Non-Tap-Water Coping Strategy in the context of fragmented tap water distribution, and later legalised these facilities without taking into account the amount of groundwater resource. The fourth problem is their

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<sup>35</sup> Minamata Disease, named after Minamata city in Japan as where this disease was firstly being identified, is a neurological syndrome caused by severe mercury poisoning. It leads to several symptoms, such as ataxia, numbness, insanity, paralysis, coma, and even death.

procrastination in adopting the policy from the central government. Both the water company and local government shifted certain power and responsibility to the consumer - the power of extract groundwater and responsibility to produce portable tap water. Holding that power and responsibility, consumers developed Non-Tap-Water Coping Strategy to deal with the fragmented tap water distribution, the self-built water supply facilities. With the government's tacit consent and the power and responsibility shift from government to consumer, the uncontrolled Non-Tap-Water Coping Strategy finally ended up as a sustainability crisis of groundwater over-exploitation.

Note here that this combination has four main characteristics. First, this combination is a contingent combination model. It means that few can predict the whole picture of both this combination and the sustainability crisis before it really happened. Such unpredictability, being one of the general characteristics of nearly every sociogenic water sustainability crisis, challenged the scientific methodologies as being recognised traditionally as the most effective way of predicting sustainability crises. Second, a series of casual connections can be built between every single condition and agent, another general feature for sociogenic sustainability crises. For example, the social condition of political turmoil may have contributed to the emergence of insufficient water supply and pipeline coverage. However, even though to tease out these casual connections would constitute promising research, the first step should be the demonstration of their combined action in fostering the catastrophic sustainability crisis. Third, in this contingent combination model, the bottled and barrelled water market did not play any pivotal role in this combination. This is possibly due to the underdeveloped tap water market at that time. However, in another combination of the consumer coping strategy and the Hybrid Institutional Architecture of tap water provision system, introduced in the next section, the market will play a significant role. Consequently, this second combination had caused more profound sociogenic influences on urban tap water provision system and peoples' daily lives, which will be analysed in detail later. Fourth, in this sociogenic water sustainability crisis, both power and responsibility had been shifted from the local government and the water company to the consumer. This does not happen in the second combination, since it only shifted the responsibility of water production but not the power.

### **5.3.7 The domino effect of Harbin's first sociogenic water sustainability crisis**

Moreover, this sociogenic water sustainability crisis has a domino effect: it triggered more social and public health accidents. For example, later when the pipeline reaches those areas where self-built water supply facilities were widely used, the municipal government found that it was difficult to move their consumers from relying on 'free groundwater' to paying for 'tap water'. First, their usages of groundwater had been legalised by the local regulation, as shown before. Second, many factories had invested a large amount of money in their self-built water supply facilities. Third, given the analysis above, it was possible that some of Harbin's citizens began to doubt the quality of tap water. The Harbin's municipal government had to enforce some consumers to install a water meter in their self-built water supply facilities so as to charge water rates. In this sense, it can be said that the Non-Tap-Water Coping Strategy had developed to a high degree that this coping strategy was not only a social, but also an official recognised way of accessing water, paralleling with the urban tap water provision system. Therefore, Harbin's municipal government had to publish several strict regulations to control the usage of these facilities.

The implementation of this control was in accordance with the expansion of the pipeline. When the pipeline reached new areas, numerous self-drilled wells would be abandoned. Moreover, the groundwater scarcity crisis also caused the decrease of the water table, which exhausted numerous self-drilled wells. Most of these wells were abandoned without proper treatment such as sealing or refilling, which, predictably, caused a series of accidents. In 1980, 56% of Harbin's self-drilled wells were abandoned. In the Nangang District, one of Harbin's most populous districts, 72% of self-drilled wells were abandoned. Many of these wells were not refilled or sealed properly. Since they were located in populous areas, even until recent years, there were still many accidents concerning people, especially children, falling into these abandoned wells (Heilongjiang News Net, 2006). Moreover, in 2005, when the Songhua River was severely contaminated by the spill of a poison pollutant, the municipal government relaunched these facilities and drilled 109 new groundwater wells. From then on, the government's attitude towards the self-built water

supply facilities shifted again. Today, Harbin still kept 7167 water wells, which supplies 90.2305 million cubic meters' groundwater for urban domestic consumption and 71.228 million cubic meters' groundwater for industrial production (Kong, Gu and Jia, 2011, p.3).

Another example is the public health accidents. According to the data in 1967, in those industrial districts where tap water provision system had not yet reached, nearly all self-drilled wells were polluted by sewage water. Workers and staff in these areas did not dare to drink the water supplied from their working places and had to take the water they took and treated from homes to work. Later even these industrial factories stopped using the local groundwater and transferred water from other areas by trucks. In one case, the Harbin Chemical Corporation owned dozens of trucks just for carrying tap water (Harbin Municipal Government, 1998b).

Confronting the sociogenic water sustainability crisis, Harbin's municipal government proposed three principals in water usage: water quota, water recycling and water conservation. The water quota was a method to control the industrial water usage. Factories consuming more than one thousand tons of water per day were assigned a water quota on a monthly basis. They would be fined if they use more water above the quota. Meanwhile, Harbin's municipal government set a goal to increase water recycling rates from 30% to 59%. Note here that this goal was mainly targeting industrial zone rather than household with a promotion of increasing industrial technological efficiency of water usage and developing water reuse technology and apparatus. In respect of water conservation, the water rates became a major means of controlling the domestic water consumption. This was in line with the policy of installing domestic water meters.

Another possible positive aspect of this crisis is that it may have prevented a more catastrophic environmental disaster from happening. If the tap water consumer in Harbin relied too much on the tap water, sourcing from the polluted Songhua River, it is possible that the chronic Minamata Disease could have had a much more destructive effect in general. Between 1957 to 1982, the PetroChina Jilin Petrochemical Company had discharged its sewage poisoned by methyl mercury for 25 years to the

Songhua River (Wang, 2010). By depending on groundwater, many Harbin citizens escaped from the risk of being infected with this disease.

The last domino effect of the first sociogenic water sustainability crisis is that given the severe scarcity of groundwater storage, the Songhua River became the major water source of the city. In 2001, 80% of the city's tap water was from river water. This paved the way for the emergence of its second sociogenic water sustainability crisis.

To conclude, a certain connection can be observed from these historical records: three short-term technology transitions introduced the modern tap water provision technology in Harbin. However, they not only failed in cultivating the local citizen with the concept of this technology but also alienated them from being integrated into its development.

The tradition of using and treating water was retained. For the period of CPC's administration of tap water provision system, the social and political turmoil and the inexperienced administration led to three types of disjunction between the urban plan and social realities. Because of the problematic tap water provision regarding its quality and quantity, the traditions of using and treating water were integrated into Consumer Coping Strategy Matrix to deal with fragmented tap water distribution and semi-potable tap water. When self-built water supply facility was combined with the inefficient water administration, together they caused a 'sociogenic water sustainability crisis', namely the overexploitation of Harbin's groundwater resource. This crisis also had a domino effect that triggered a series of other social and public health accidents. Moreover, since this scandal lasted for around 20 years (from 1980s to 2000s), it has been normalised by the consumer in their life, being memorised as a social memory and a coping strategy of fragmented water distribution rather than a scandal that needed to be solved immediately. Such attitudes formulate a sharp contrast to what had happened in the Songhua River Toxic Spill Crisis.

## 5.4 The second sociogenic sustainability crisis: Songhua River Toxic Spill Crisis

In the previous section, the contingent combination model triggered the over-exploitation of groundwater resource, the first sociogenic water sustainability crisis in Harbin. This section aims to analyse the second sociogenic water sustainability crisis, the Songhua River Toxic Spill Crisis.

Over the past hundreds of years, the Songhua River, with its moderate hardness and low turbidity of water, was the main tap water source of tap water for Harbin residents. However, after the foundation of PRC, due to the pollution from both the domestic and industrial sewage, the water quality of the Songhua River plummeted severely. The chronic Minamata Disease appeared in the Songhua River between 1958 to 1982, as mentioned in the previous section, was a remarkable case (Wang, 2010). However, for many years, little sociological research had been conducted on this accident. Not until 2010 did Wang Leina present a conference paper discussing that long-term environmental disaster. This neglect might partially explain why 23 years after this accident, on 13 November 2005, the same company triggered another notorious sociogenic water sustainability crisis - the Songhua River Toxic Spill Crisis

In fact, besides this pollution incident, the Songhua River had already been polluted for a long time. It took 4.6 million tons of effluent from upstream with 264 varieties of organic compounds being identified in the water, 11 out of which carcinogenic(Kong, Gu and Jia, 2011). Since the Songhua River crossed several administrative regions, the pollution from upstream areas could not be controlled by a single city, say, Harbin (Dongbeinet, 2009). Meanwhile, Harbin by itself discharges around 770,000 tons of wastewater to the Songhua River every day, including 9,400 tons of wastewater from hospitals, which was either raw sewage or untreated with the national sewage treatment standard (Deng, 2002; Kong, Gu and Jia, 2011). In light of these ineffectual supervisions on sewage discharge, the outbreak of the Songhua River Toxic Spill Crisis is inevitable.

### 5.4.1 The timeline of Songhua River Toxic Spill Crisis

It is important to first note that although 11 years have passed since this incident, there has still not been an official investigation report available for public access. The data in different news reports sometimes even conflict with each other. Thus, to secure the validity of the data and information, this thesis compared data and information between different reports and various sources. Contrary to the lack of concrete information and data from official channels, some online documents and reports have detailed information regarding this pollution accident. The author will mark the sources of these details.

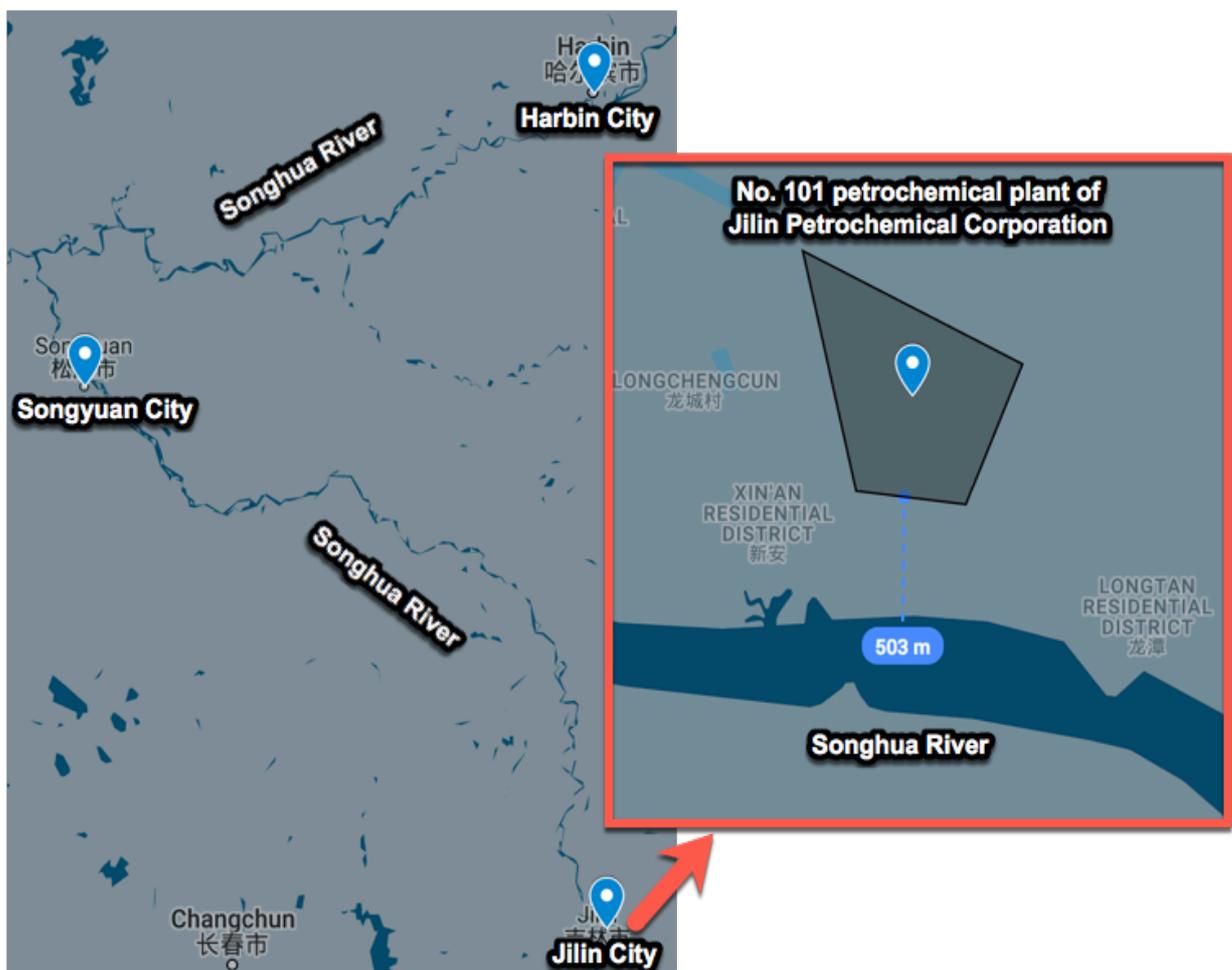


Figure 5.6: The key locations of the Songhua Songhua River Toxic Spill Crisis



**Figure 5.7: The explosion scenario of No. 101 petrochemical plant of Jilin Petrochemical Corporation<sup>36</sup>**

It is important to first note that although 11 years have passed since this incident, there has still not been an official investigation report available for public access. The data in different news reports sometimes even conflict with each other. Thus, to secure the validity of the data and information, this thesis compared data and information between different reports and various sources. Contrary to the lack of concrete information and data from official channels, some online documents and reports have detailed information regarding this pollution accident. The author will mark the sources of these details.

As shown in Figure 5.6 and 5.7, the incident occurred between 13:30 to 13:45, 13 November 2005. Two fuel towers in the second aniline workshop the No. 101 petrochemical plant of Jilin Petrochemical

<sup>36</sup> Source: <http://news.sina.com.cn/c/2005-12-07/09408513566.shtml> Accessed: 18 May 2016

Corporation, located in Jilin of Jilin Province and 380 kilometres away from Harbin, exploded. Eight people were killed, 59 people were injured, and ten thousand evacuated (The UNEP mission team, 2005; Su, Xu, Wu and Wu, 2005; China Youth Daily., 2005; Liang and Yang, 2006; Kirschner and Grandy, 2006). Given an online document<sup>37</sup>, the blast site was a new workshop that launched in September 2004. In fact, No. 101 petrochemical plant had experienced another explosion accident on 30 December 2004, one year before this incident.

There was a spill of approximately 100 tons of toxic chemical compounds of benzene, aniline and nitrogen into No.2 Songhua River (in Jilin Province, the river is called No.2 Songhua River; in Heilongjiang Province, where Harbin located, the river is called Songhua River), whose flow was just hundreds of meters away from the exploded plant, as shown in Figure 5.6 (China Youth Daily., 2005).



**Figure 5.8: Dead fish on the bank of the Songhua River in Jilin<sup>38</sup>**

<sup>37</sup> Source: [http://www.chinadmd.com/file/optxvcrie3tuaercwsai6ues\\_2.html](http://www.chinadmd.com/file/optxvcrie3tuaercwsai6ues_2.html) Accessed: 17 May 2016

<sup>38</sup> Source: [http://www.chinadaily.com.cn/english/doc/2005-11/24/content\\_497399.htm](http://www.chinadaily.com.cn/english/doc/2005-11/24/content_497399.htm) Accessed: 18 May 2016

All three main pollutants in this explosion, benzene, the nitrobenzene, and the aniline, are not likely to bio-accumulate in aquatic organisms, but both benzene and nitrobenzene are likely to remain in groundwater if rainfall brings them to underground aquifer (The UNEP mission team, 2005). However, as Figure 5.8 shows, on 22 November, there were still numerous dead fish lying on the bank of the Songhua river in Jilin (China Youth Daily., 2005).

Just 15 days before this explosion, the Jilin Petrochemical Corporation was awarded the honorary title of 'National Environmental Friendly Facility' by the director general of NEPA, Xie Zhenhua, who resigned on 30 November because of this incident (Su et al., 2005).

Figure 5.6 demonstrates the close distance between the river and chemical plant, plus the locations of two cities. Jilin is situated upstream of the river, whereas Harbin is located downstream. Thus, the plume of pollutants would flow from Jilin to Harbin along the Songhua River after the explosion. However, on the day of the explosion, both the leaders of the petrochemical plant and Jilin officials disguised this crucial information by only admitting to the pollution in the air (Su et al., 2005; Liang and Yang, 2006). A news report published on 27 December disclosed that an environmental protection engineer of Jilin told the journalist that they noticed the water pollution of the Songhua River on the day of the explosion, but Jilin did not disclose this situation to the media and public (Su et al., 2005). Another news report quoted the words from an interviewee and argued that in fact the environmental protection bureau of Jilin was excluded from the on-site investigation task force on the day of explosion (Liang and Yang, 2006). On 14 November, in the press conference of Jilin, a vice mayor announced that the explosion would not generate a large scale pollution. The air quality matched the standard. No poison gas was observed and there were no changes in the water body (China Youth Daily., 2005). In news reports published on 15 November, a local environmental protection official claimed that the pollution in the air could be cleared within one or two days (Liang and Yang, 2006).

On 21 November, the Harbin's municipal government issued its first announcement claiming to suspend the tap water provision for four days between 22 to 24 November with the excuse of pipeline maintenance

(The UNEP mission team, 2005; Liang and Yang, 2006; Kirschner and Grandy, 2006). However, numerous Harbin's citizens began to rush to purchase bottled water with panic because of the 'rumour' of water pollution. Later, another rumour about an earthquake was widely spread and people either tried to escape from the city by jamming in the train stops, airport and main roads, or to panic buy flour, food oil and salt. On the midnight of 21 November, the Harbin's municipal government issued the second announcement. It was also an urgent announcement, which revealed the reality of the explosion and its resulting pollution of the Songhua River (Liang and Yang, 2006).

Even on 22 November, a leader of the petrochemical plant of Jilin Petrochemical Corporation still claimed that 'the explosion only generated water and carbon dioxide. It would never pollute water. We had our own sewage treatment plant and we would not discharge substandard sewage into the Songhua River' (China Youth Daily., 2005). However, this argument, is only valid under the condition that the pollutants were all combusted sufficiently in the explosion. But in fact, around 100 tons of pollutant did not burn at all and was spilled into the pipeline that conveyed the rainwater and clean water.

On 23 November, ten days after the explosion, through its website, NEPA issued its first announcement regarding this pollution scandal, the *News Announcement No.84*. It acknowledged the existence of water pollution of the Songhua River and briefed the emergency response: 'Experts have been assigned to cooperate with the local government in preventing the pollution from spreading. The water quality is monitored on an hourly basis.' (Liang and Yang, 2006, p.35). It is not until that moment that this pollution incident is formally disclosed to the public.



**Figure 5.9: The pollution plume in Songhua River<sup>39</sup>**

As shown in Figure 5.9, with the average speed of 3 kilometres per hour, an 80km long plume reached Harbin on 25 November 2005. Its peak concentration of nitrobenzene was 33.15 times above the permissible level of China's standard of tap water source, 0.017mg/L. There were few reports about the environmental impacts on the other dozens of cities and counties this plume had passed by before approaching Harbin, since NEPA claimed that Harbin (with a population of 4 million) and Dalianhe town (a town of Yilan county with a population of 20,000) were the only two places using Songhua River as their tap water source. However, Songyuan, located in the middle of the Songhua River between Jilin and Harbin as shown in Figure 5.6, suspended its tap water provision from 14 November to 21 November with the

<sup>39</sup> Source: <http://news.sina.com.cn/c/2005-12-07/09408513566.shtml> Accessed: 18 May 2016

same excuse as the first announcement of the Harbin's municipal government, pipeline maintenance (Wang, Duan and Wang, 2005). Compared to the media reports about Harbin's tap water provision suspension, which evoked enormous pressure on the local government to reveal the reality of the pollution incident, few media have reported the tap water provision suspension in Songyuan. This may explain why it was not until the pollution incident was revealed by the central government did most of the Songyuan citizens know the genuine reason for the tap water suspension.

On 26 November the Prime Minister at that time, Wen Jiabao arrived in Harbin to inspect the pollution situation of the Songhua River.

On 1 December, in the National Video and Telephone Conference of Environmental Pollution Accident Emergency Processing, the deputy director general of NEPA, Wang Yuqing, denounced the Jilin municipal government that NEPA did not receive any information regarding this pollution incident from the local environmental protection agency of Jilin during November 14 to 17, the most precious three days after the explosion that could have been used to prevent the pollution from spreading. Many officials of NEPA endorsed this claim (Liang and Yang, 2006). However, the official record of the environmental protection department of Jilin province showed that after five hours of the explosion the information had been delivered to the duty office of NEPA, although the relevant data of the pollution was not included given the time limitation. This department also argued that on 14 November they reported the pollution situation to NEPA again and the latter only assigned an expert task force to the blast site. 'All the reports have been recorded and we have committed to our responsibility' said by an official of environmental protection bureau of Jilin province' (Su et al., 2005).

On 5 December, a UNEP (United Nations Environment Programme) mission team was invited by NEPA for an on-site visit, but their investigation was restricted since they could only get access to the second-hand information offered by the NEPA (The UNEP mission team, 2005).

On 6 December, the investigation team of the State Council was established, led by the director-general of the State Administration of Work Safety and including eight senior officials from different departments

(Xinhuanet, 2006). However, their investigation report was submitted to the State Council and not open to public access until today.

The pollution incident had been escalated into an international dispute between China and Russia after this plume of pollutant converged with the Heilong River, the border river between China and Russia, and may have affected the water quality of Khabarovsk, located close to the border part of the Heilong river (the Russian name is Amur River). On 16 December, China and Russia had constructed a dam with the help of 3000 Chinese and the equipment supported by the central government of China (Kirschner and Grandy, 2006). It prevented the plume of pollutant from transgressing the border.

On 26 December, in the last announcement of the Songhua River Pollution Incident, the NEPA announced that the concentration level of pollutant detected in monitor sites of the Songhua River was below the national standard.

### 5.4.2 The sociogenic water sustainability crisis: Songhua River Toxic Spill Crisis

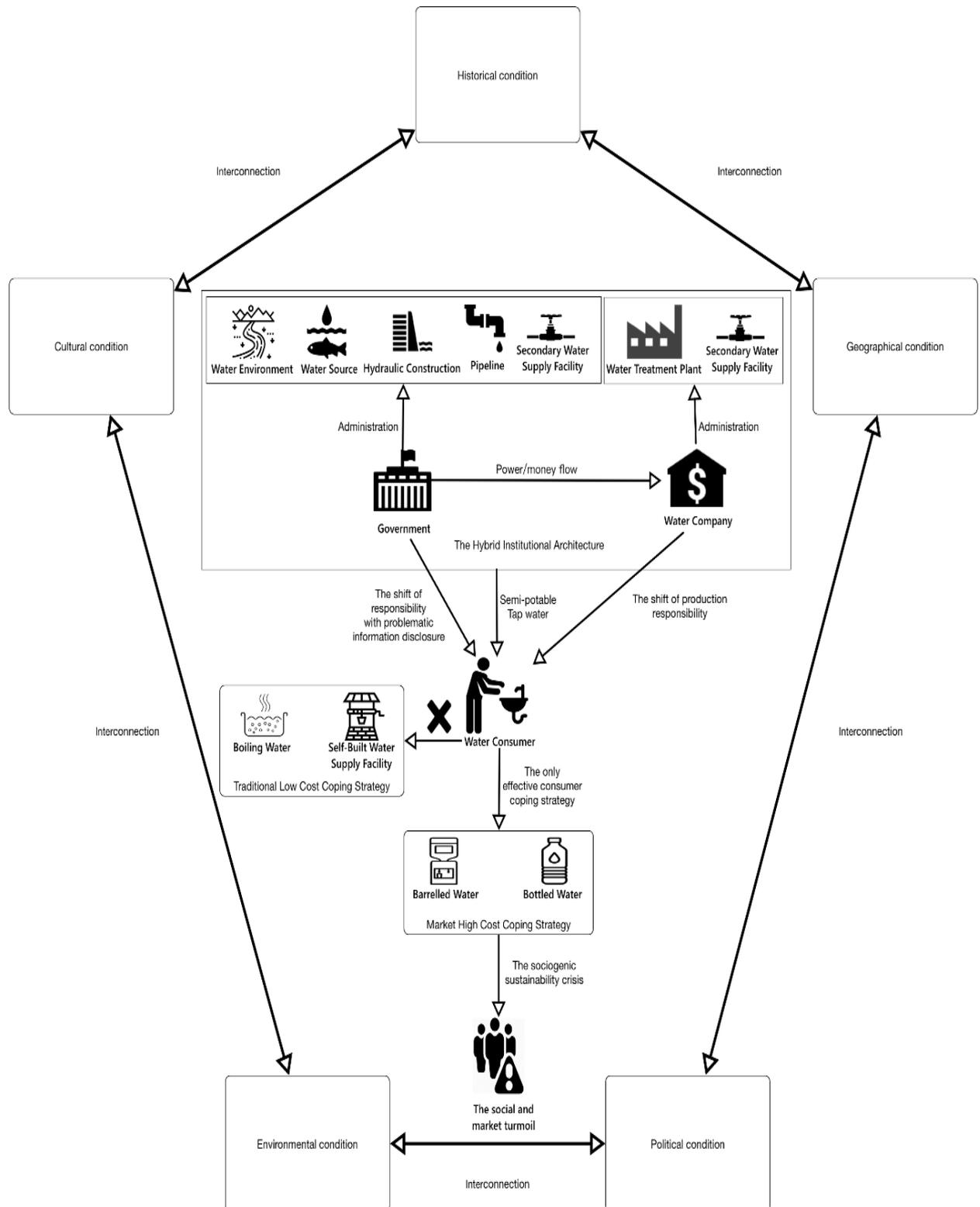


Figure 5.10: The contingent combination model of Harbin's second sociogenic water sustainability crisis

As demonstrated in Figure 5.10, the contingent combination model of Harbin's second sociogenic water sustainability crisis is composed of two parts: the general context, which consists of five interconnected conditions, and the dysfunctional hybrid production process of tap water.

In respect to the historical condition, there are three historical conditions worth mentioning. First, the water pollution of the Songhua River has long been one of the most controversial issues between the Harbin's municipal government and Jilin Petrochemical Corporation. Given the catastrophic outcome of the first sociogenic water sustainability crisis, Harbin's municipal government attempted to use surface water instead of groundwater as the main water source of the city. Therefore, in the 1980s they built up the Seventh Water Treatment Plant. However, in light of the fact that this water treatment plant was located downstream of Jilin Petrochemical Corporation, the Songhua River was polluted by the industrial sewage it discharged. As a result, the water treatment plant was never launched. Presumably, Harbin's municipal government must have complained about this situation to its senior departments, Heilongjiang province and Jilin province, but these two provincial governments could not cooperate with each other effectively to treat this problem. An investigation report of Heilongjiang scientific consultative committee even described the Jilin petrochemical corporation as a 'time bomb' for the Heilongjiang province (Heilongjiang Scientific Consultative Committee, 2011).

Second, as discussed in UNEP's report, the environmental agency always lacked the necessary authority to implement effective evacuations, rescue, crowd control or other emergency services in environmental disasters (The UNEP mission team, 2005). Before this incident, few of China's municipal governments had established an effective partnership framework that coordinate various relevant departments into the work of response to environmental emergencies. In this crisis, it can be observed that the Jilin environmental agency did not involve itself as much as it should have from the beginning. This incident is the most serious environmental pollution incident since the foundation of the People's Republic of China, which may explain why neither the municipal government nor other departments had any experience in how to deal with it properly.

Third there was not any community-level emergency response framework for both cities. In fact, during the period of water suspension, the Harbin's municipal government had to organise 300 small groups to visit every citizen community. They informed the local people of the crisis and prompted them to store tap water.

Fourth, the earthquake that happened in Daqing acted as a catalyst for the spread of rumour and anxiety among Harbin citizens. On 25 July 2005, the Lindian county of Daqing, an industrial city located just 150 kilometres away from Harbin, experienced a five magnitude earthquake. Harbin citizens experienced the tremor. Therefore, when the Harbin's municipal government issued their first announcement to suspend all tap water supply in the city with the excuse of pipeline maintenance, many people associated it with the earthquake that had happened just four months ago.

In respect to the geographical condition, the most obvious one was the upstream location of the pollution site and the downstream location of Harbin. Another geographical condition was the close distance between the petrochemical plant and the river, as shown in Figure 5.10, which had been argued by some environmentalists as the 'most direct reason' of the toxic spill crisis (Su et al., 2005). Finally, the Songhua River is a special river since it connects two powerful countries: Russia and China. It is because of this geographical condition that the level of crisis rose from a national level to international level. In other words, the special geographical condition of the Songhua River performs as a fundamental condition that imposes remarkable extra pressure on both the central and local governments to resolve it in a proper manner.

In reference to the political condition, the most obvious one is the political concern from Russia. Russia asked China to support monitoring equipment, collectively monitor the water quality, and construct a dam in Fuyuan county, a county near the Heilong River. Russia closed 151 primary schools, 136 kindergartens, and 536 food processing factories in three cities. A compensation was likely to have been paid to the Russian government, but its details were never revealed. Meanwhile, there were few open reports about the possible destination of the pollutant plume after it was blocked by the dam.

The second political condition is the limited third party involvement. As the UNEP mission team argued in its report, no independent third party laboratory had been invited in the investigation of this pollution incident. Meanwhile, the mission team could not get access to either the water sample or the first-hand information.

The environmental condition can be drawn into two categories: first, the environment of the Songhua River. Second, the environment of petrochemical plant.

In general, the environment of the Songhua River was unfavourable for pollution control. The toxic spill crisis occurred in early winter during the dry season, therefore the Songhua River's flow was relatively slower and thinner than in other seasons. Moreover, some surface of the Songhua River was frozen. Given the fact that benzene and nitrobenzene decompose in water, some of these pollutants had been captured by the ice. Given the test result, the concentration of nitrobenzene is one fourth of that in water (The UNEP mission team, 2005, p.7). Those trapped pollutants would be released into the water body again when the ice melted in the spring season, causing a secondary pollution of the river.

Another significant environmental change in the Songhua River was triggered artificially. The Jilin municipal government, through a negotiation with the State Grid Corporation of China, managed to persuade them into releasing the water stored in Fengman and Xiao Fengman reservoirs to dilute the pollutant and speed up its movement in the river.

Few reports covered exactly how the pollutant was spilled into the river. The environment of petrochemical plant may offer a deeper understanding of this question. According to online document<sup>40</sup>, there were two types of pipelines connecting the plant with the Songhua River. One is the sewage pipeline, which channelled the pollutant to the sewage treatment plant. This pipeline had been described by both the officials and leaders of the corporation as the pipeline that should convey the pollutant to a sewage treatment plant instead of the river. However, another pipeline, which conveyed the rainwater and clean

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40 Source: [http://www.chinadmd.com/file/tz3viaotvacvo3ueoscs06az\\_1.html](http://www.chinadmd.com/file/tz3viaotvacvo3ueoscs06az_1.html) Accessed: 20 May 2016

water directly into the Songhua River, was the pipeline that spilled the pollutant leaked from the explosion and the polluted fire-fighting water into the river. Figure 5.11 shows A simulation of explosion scene. Another news report further pointed out that the fire accident like this case should have readied a fence to baffle the polluted fire-fighting water from spreading (Wang, Duan and Wang, 2005). Ironically, this pipeline was the same pipeline that spilled the methyl mercury and caused the epidemic of chronic Minamata Disease 25 years ago. This demonstrated that from the beginning of the plant construction, which was June 2002, the Jilin Petrochemical Corporation had paid no attention to preventing the possible pollution crisis associated with any explosion risk.



Figure 5.11: A simulation figure of explosion scene<sup>41</sup>

41 Source: <http://www.creg.net.cn> Accessed: 20 May 2016

As cultural condition, cultural adaptive patterns can be observed in the municipal government and among Harbin citizen respectively. The first cultural pattern was demonstrated in the seven-day tap water suspension implemented by the Songyuan municipal government. To a large extent, this news was ignored by journalists and academia. Songyuan forms a sharp comparison to Harbin. They both tried to conceal the toxic spill crisis in their first announcement with the same pipeline maintenance excuse, but the Songyuan municipal government succeeded, whereas Harbin's municipal government lost both its credit and face to the public. However, it is due to this comparison that we realise the attempt of disguise is not just a single mistake made by Harbin's municipal government, but a culturally adaptive way commonly adopted by various municipal governments for disguising their mistakes. In other words, the Harbin's municipal government's false first announcement was just a common culture adaptive pattern of dodging potential political risks, which were adopted by other municipal governments as well.

Note here that this cultural adaptive pattern was not a 'collective decision' by all officials in the municipal government. There are always opposite voices, though they were ignored by senior officials.

In an interview with a senior official of a Harbin's water company, some vivid details about the how he/she tried to suggest his/her leaders to disclose the information can be seen.

'After being informed of the water pollution crisis, we knew that we must make the decision of suspending the urban water provision immediately. However, the question was whether to inform the public honestly about the reason for the tap water suspension. In the beginning, we reported to the public that the water supply system was under maintenance, so it needed to be suspended for three to four days. I was the one who represented the company to participate in the meeting held by Harbin's municipal government. Our general manager was on his business trip; our deputy general manager called him and he returned immediately. When discussing the problem of how to report to the public, I suggested to our leaders that we should not disguise the reality by using the excuse of pipeline maintenance to suspend tap water. I told them that if we used that excuse, it might cause the real accident. Some people went to the Songhua River directly to fetch water. Some livestock needed to drink water directly from the river. Farmers were using

water from the Songhua River to irrigate their crops. These people and livestock were all taking a risk if we hid the fact of toxic spill crisis. Moreover, some food companies were using the river water to process their food production. However, my leaders told me that “we understand your concern, but it depends on the higher leaders to make the decision.” The leaders of the municipal government finally issued the announcement using the excuse of pipeline maintenance. But at around 10 pm on that night, the Prime Minister Wen Jiabao, who represent the stance of central government, informed us that we must disclose the fact to the public. Thus, we changed our announcement on the second day of the tap water suspension.’

His/her statements partially explained why on 26 November the former Prime Minister Wen Jiabao had to set foot on Harbin by himself as the representation of central government: central government did not trust the local municipal government when the latter was solely in charge of the administration of urban tap water provision system. This has been pointed out in section 4.3.

‘They could not see the key point,’ He/she commented on the leaders of Harbin’s municipal government. ‘Sometimes they had no idea about how to deal with the problems they encountered for the first time.’

In sum, given the analyses above, it was obvious that the five conditions were interconnected with each other in a much closer degree than in the first sociogenic water sustainability crisis. This is partially due to the fact that this crisis lasted only 14 days, far shorter than the first sustainability crisis which lasted for years. Thus, the chain reactions between these five conditions are more obvious. Though detailed analyses of the exact contents of these reactions would be useful, they are not the priority task of this dissertation.

In the context of these five conditions, the hybrid production process was dysfunctional again. The inconsistent flow of power between the central government and local municipal government was evidenced in the NEPA’s open criticism towards the Jilin municipal government. Another inconsistent flow of power was inter-departmental, demonstrated through the possible marginalised position of Jilin’s MEPB in the investigation of this crisis. The Harbin’s municipal government underestimated the possible public reaction to this crisis at first and tried to disguise the reality as the Songyuan and Jilin municipal

governments had done before. However, they did not take into account three crucial facts. First, eight days had passed since the explosion and the existence of toxic spill crisis had already been proved. Second, as the capital city of Heilongjiang province, there were numerous citizens who either worked in the provincial and municipal government or had their 'information channel' to know the reality. Third, compared to Songyuan, Harbin have more citizens with high education level. Many did not believe the government's first announcement of pipeline maintenance for they knew that maintaining work of that scale must be implemented area by area. At midnight, the Harbin's municipal government finally disclosed the reality in its second announcement and published another announcement calling for storing water the next day. It is the first time in Harbin's history that the municipal government had to issue three announcements within two days.

Harbin was one of only two cities in the Heilongjiang province that had the capacity for monitoring nitrobenzene. Without any experience in dealing with this pollution, the Harbin's municipal government spent 3 million Yuan, plus another 10 million Yuan from the provincial government, to purchase equipment. 100 environmental experts had been assigned to Harbin as different task forces(Heilongjiang Scientific Consultative Committee, 2011). From 24 November, a series of official news conferences were held by the municipal government to provide the latest important information. Experts began to broadcast TV programs to explain the situation. The price of bottled water was strictly monitored and controlled, whereas 1300 tons of bottled water were delivered from a nearby city, Shenyang, to Harbin; All 918 auxiliary groundwater wells in Harbin were re-launched and 81 new groundwater wells were drilled (Xinhuanet, 2005). It can be said that the whole country's power had been mobilised into rescuing the city of Harbin from the water crisis. There was no single water poisoning case reported during the period of water suspension (Xinhuanet, 2005).

For the water company, the main problem was the lack of technology for treating the polluted river water. Neither Harbin nor any other cities of China had equipment for treating nitrobenzene (Heilongjiang Scientific Consultative Committee, 2011). On 24 November, a headquarters had been established, which

included all relevant leaders and experts in different departments, with the leaders from the Ministry of Housing and Urban-Rural Development in charge. They took over the administration right of Harbin's tap water provision system from the Harbin water supply and drainage company. Given an internal report from the leading expert from headquarters, an initial plan was two-faceted: on one hand, Harbin water company added an extra activated carbon filter layer directly into their current water filter pool (Zhang, 2005). On the other, they mixed the activated carbon with the coagulant in the source water. This plan demanded 1400 tons of activated carbon, which were delivered to Harbin from other cities on emergency trains (Harbin Railway Yearbook Edition Committee, 2006). Experts from Beijing modified the equipment in water treatment plants for inputting activated carbon. Extra chlorine was added into the source water as well. However, the effect was not satisfactory. The main problem was the inadequate reaction time between activated carbon and the pollutant. Special attention had been spent on the intake point of the tap water provision system. The result of this emergency experiment showed that in one to two hours of the source water flowing in the 5.3 kilometres pipeline, 40 mg/L activated carbon could reduce the concentration of nitrobenzene from 0.061mg/L to 0.0034 mg/L (Zhang, 2006). As a result, a distinctive way of absorbing pollution was developed by scientists from China Academy of Environmental Sciences (CAES). An underwater cage with brooms made of activated carbon, straw and maize stocks inside could absorb up to 40% of the nitrobenzene from the water flow that passed through it (The UNEP mission team, 2005). However, this method was implemented only on a limited scale in the tap water intake point, since the surface of the Songhua River was almost all frozen. With all these efforts, on 27 November when the tap water provision was restored, the tap water quality went back to normal.

Given the analysis above, it can be said that during the crisis period, the government and water company were so closely linked that they had been integrated with each other. As Figure 5.10 shows, the government and the water company constituted a Hybrid Institutional Architecture with much more power than they had had respectively before. As has been argued in section 3.8, the institutionalised distrust was between the consumer and that Hybrid Institutional Architecture. In other words, in the context of the five conditions, the trilateral relations of consumer, government and water company had

been transformed into bilateral relations between consumer and Hybrid Institutional Architecture. With the huge power gap between the two, the information disclosure became problematic. To the consumer, the aforementioned activities of this Hybrid Institutional Architecture were inaccessible. Neither could they be imparted with the vivid details of these activities. However, they had the basic capacity of discerning the 'suspicious information' from the government announcement. In this context, powerless consumers began to adopt their only valid Non-Tap-Water Coping Strategy collectively, namely, purchasing bottled water and barrelled water.



Figure 5.12: The empty shelf of bottled water in Harbin's shopping mall<sup>42</sup>

<sup>42</sup> Source: <http://news.sohu.com/20051122/n227564985.shtml> Accessed: 22 May 2016

Some studies blamed the NEPA and Harbin's municipal government for their inadequate communication with consumers and believed that the public panic derived from ineffective communication (The UNEP mission team, 2005; Rui-bo, 2007; Wu, 2015). Indeed, the social memory of water insecurity (mentioned in section 5.3.7) was fuelled by the ineffective public communication of the government. However, with one-side focused on the effectiveness of communication, they failed to answer another crucial question: why was the bottled and barrelled water market so important to reduce the panic? Why did consumers not panic in the first sociogenic water sustainability crisis when they were served with semi-potable tap water and even could not access public tap water? As Figure 5.12 shows, panic buying happened in many shops, and as a consequence, the price of bottled water rocketed at the beginning, which in turn escalated the panic buying. The deputy vice mayor of Harbin admitted that the people could only be soothed by seeing a sufficient bottled water supply (Xinhuanet, 2005). Obviously, there is a connection between the bottled water supply, the tap water supply, and consumers' panic buying which demands an explanation.

Once tap water supply was suspended, water supply would be completely cut off from water treatment plants, there would be no water at all in every area of the house, including household sanitation services. Thus, Harbin's 'source to consumer' semi-potable tap water provision system was paralysed as Figure 5.10 demonstrated. In the first sociogenic water sustainability crisis, pipelines were not developed enough to cover most of the citizens, along with the problematic quality of tap water. Compared to this, the dysfunction happened in the second sociogenic water sustainability crisis was much more devastating in two senses. First, the Tap Water Coping Strategy was dysfunctional; Second, the Hybrid Institutional Architecture restrained the power of constructing self-built water supply facility. As a result, lacking effective Consumer Coping Strategy, consumer's coping capacity reduced dramatically, which underlines their extremely powerlessness (also see section 3.8 for analysis of powerlessness). Such powerlessness also intensified by temporality, which makes citizens unable to have any time to self-build in response to crisis. In other words, they could neither boil tap water nor build their self-built water supply facilities to cope with the water crisis. In essence, such powerlessness in the confrontation with semi-potable tap water supply was the root of their panic. As Figure 5.10 shows, with the dysfunction of Tap Water Coping

Strategy, the only valid consumer coping strategy was Non-Tap-Water Coping Strategy, which includes bottled water, barrelled water, and self-built water supply facilities. However, given the temporality and consumer's powerlessness in building self-built water supply facilities, the bottled water and barrelled water became consumer's only coping strategy.

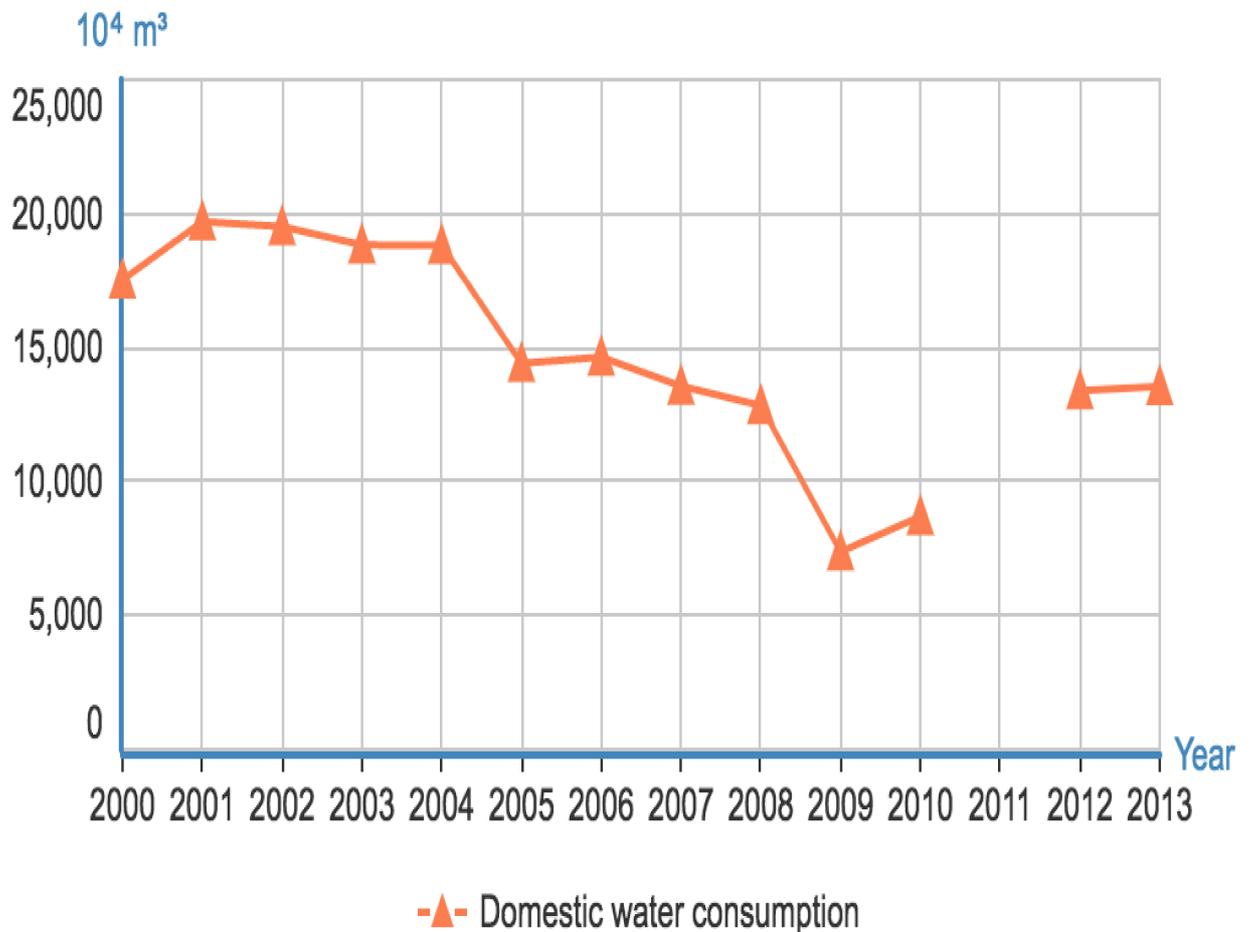
Since bottled water and barrelled water are also High Cost Commercial Coping Strategies, they were only adopted by those consumers who could afford their cost. In other words, tap water's manageability (See Chapter 3 for its definition) is varied by consumer when they confront with water crisis together, reflecting the fact that the existed social injustice was further intensified in this sociogenic water sustainability crisis. Moreover, when the demands of this two coping strategies were significant, it would lead to competition among consumers, resulting in more serious panic buying campaigns and associated social turmoil. The two conflicting government announcements in one day were definitely a problematic public communication between Hybrid Institutional Architecture and consumer, which further promote the social turmoil. Under this condition, the most vulnerable victims were those powerless citizens who neither could afford the bottled and barrelled water as coping strategies nor had access to genuine information.

Actually, Harbin's municipal government tried to aid those vulnerable citizens who were incapable of affording the High Cost Commercial Coping Strategies. Millions of Yuan were assigned as the specific funding to purchase bottled water for 310,000 low income families, disabled people, and retired old veterans with a standard of three bottles of water (around 600 millilitre for each bottle) on the first day of water suspension, four bottles on the second and five bottles on the third day (Xinhuanet, 2005). However, whether this policy covered all of the vulnerable citizens was still a question. Moreover, if the Harbin's municipal government kept disguising the reality like Songyuan's municipal government managed to do during the crisis, the health damage those people might suffer would be dramatic. The official claimed in the interview that 'it is the first time for China's government to disclose the information of a significant water pollution crisis honestly'.

In fact, some damage had already occurred. A fisherman living in Songyuan admitted that he fished in the Songhua River as usual during the pollution period and had eaten and sold the fish he caught (Wang, Duan and Wang, 2005). No one had told him that these fish were inedible.

### **5.4.3 The domino effect of the second sociogenic water sustainability crisis**

The most significant domino effect of Harbin's second sociogenic water sustainability crisis is the enhancement of consumers' institutional distrust in Harbin's semi-potable tap water. Given the analysis above, it can be perceived that their social memory of water insecurity had been dramatically renewed in this notorious water crisis. With the dysfunction of Non-Tap-Water Coping Strategy in this crisis, many consumers stopped consuming tap water and turned to the High Cost Commercial Coping Strategies, resulting in the sheer drop of the tap water consumption amount. As Figure 5.13 demonstrates, the drop of domestic tap water consumption between 2004 to 2005 is stark, from 188.18 million cubic meters to 144.12 million cubic meters. In the next four years until 2009, the domestic water consumption continued to decrease and reached its bottom at 73.79 million cubic meters in 2009. Such a consecutive drop evidenced Harbin citizens' boosting institutional distrust in semi-potable tap water.



**Figure 5.13: Harbin's domestic water consumption between 2000 to 2013**

To turn the tide of such strong consumer institutional distrust in semi-potable tap water, the Harbin's municipal government began to prompt its secondary water source construction project, the Mopanshan Reservoir, a 5.312 billion Yuan invested water reservoir that conducted water 175.5 kilometres away from Harbin. The water quality of Mopanshan is much better than both the groundwater and the river water. Its first-stage project began to conduct water in 2006. However, it was not until 2010 that Harbin's domestic water consumption amount began to bounce back. Even so, its amount was still much less than its peak amount before the Songhua River Toxic Spill Crisis. The analysis of Mopanshan Reservoir will be presented in detail in next chapter.

## 5.5 Conclusion

In the first sociogenic water sustainability crisis, the scarcity and overexploitation of the groundwater resources were, to a large extent, stimulated by the consumer coping strategy for fragmented tap water distribution. In the second sociogenic water sustainability crisis, the problematic water quality stimulated consumers to purchase bottled water and barrelled water as the only available Non-Tap-Water Coping Strategy. In both cases, in the context of five conditions, the balance between the Hybrid Institutional Architecture, the Consumer Coping Strategy Matrix and water crises was thrown off, which triggered two types of sociogenic water sustainability crisis in their respective contingent combination model.

For the Harbin's municipal government, the pivotal point of these two sociogenic water sustainability crises is different. In the first crisis, the pivotal point is the water problem. As a result, municipal government needs to recover groundwater resources and stop shift power of water production to consumer. This demands long-term and discreet plan. In contrast, in the second sociogenic water sustainability crisis, the pivotal point is consumer coping strategy. The municipal government must have a short-term emergency plan to tackle the social turmoil triggered by tap water suspension and panic buying of bottled and barrelled water. Both long-term discreet plan and short-term emergency plan demands the development of Harbin's current 'source to consumer' semi-potable tap water provision system. However, given the Hybrid Institutional Architecture and its two inevitable outcomes, semi-potable tap water and Consumer Coping Strategy Matrix, there is no internal and external stimulation for the 'source to consumer' semi-potable tap water provision system to make any progress. This will be analysed in detail in the next chapter.

# Chapter 6 Harbin's Tap Water Provision System: The Hybrid Institutional Architecture

## 6.1 Introduction

The previous chapter introduced Harbin's three developmental phases of urban tap water supply and its two sociogenic sustainability crises. Together, they constituted household consumer's specific social memory of tap water, and have imposed profound influence on the development of the current tap water provision system.

This chapter presents a general picture of the Hybrid Institutional Architecture of Harbin's current urban tap water provision system on the basis of interview materials and archival data. With detailed analysis of this Hybrid Institutional Architecture, this chapter aims to demonstrate that the semi-potable tap water and the Consumer Coping Strategy Matrix are, to a large extent, inevitable outcomes of the limited conditions and problems of main agents in the Hybrid Institutional Architecture of 'source to consumer' urban tap water provision system.

To achieve these two goals, in-depth and semi-structured interview materials from four senior officials will be analysed. They were from four key departments of Harbin's urban tap water provision system, all holding senior responsibility positions. For confidentiality, they are anonymous and are referred to and quoted as he/she. All four departments are mentioned under aliases: water company A, water treatment

plant B that subordinated to A, municipal tap water administration department C and municipal health supervision department D. All interview quotations in this chapter are translated by the author from Chinese into English.

## **6.2 The Hybrid Institutional Architecture of Harbin's tap water provision system**

Figure 6.1 demonstrates the Hybrid Institutional Architecture of Harbin's tap water provision system. Three agents, Mopanshan Reservoir, Water Company A and its subordinated Water Treatment Plant B, and Municipal Government Departments (C and D) are numbered as 1, 2 and 3 respectively in the diagram.

According to the interview materials and archival data, each agent has limited conditions which caused problems. These problems then led to inevitable outcomes. These three subjects were demonstrated in Figure 6.1 by three dotted-line frames in the figure. When exploring three agents together, intricate interlacements between these limited conditions and problems can be observed. As shown in the diagram, the Municipal Government Department was the centre of all three agents. It assigned power/money flow to the water company and water treatment plants and directly administrates Mopanshan Reservoir. Eight limited conditions of three agents caused nine problems, which included six black-framed hybrid problems that were triggered not by one agent but two. This will be explained in detail in the following sections. Intensification and reinforcement of problems make semi-potable tap water and Consumer Coping Strategy Matrix the inevitable outcomes of Harbin's Hybrid Institutional Architecture of urban tap water provision system.

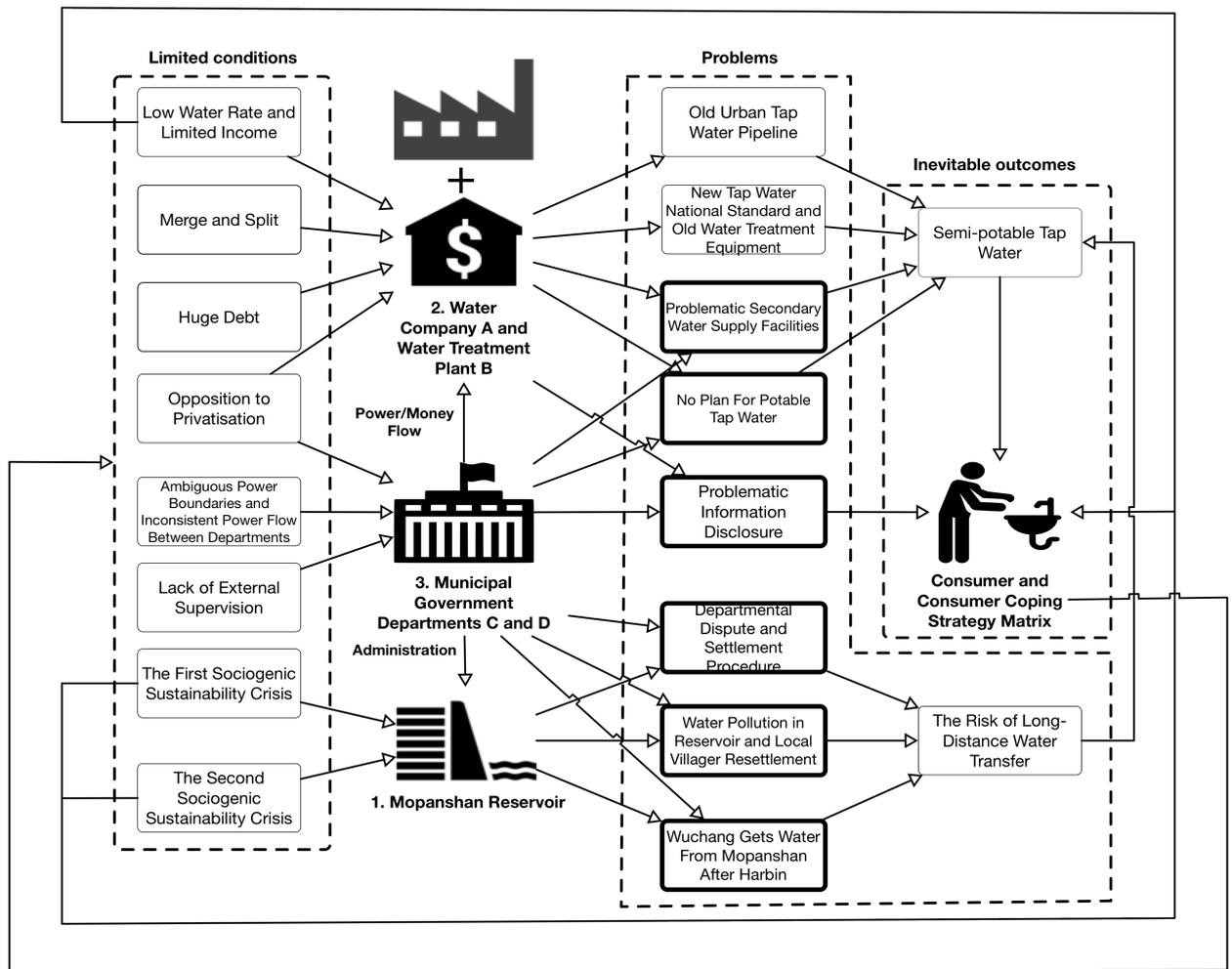


Figure 6.1: The Hybrid Institutional Architecture of Harbin's urban tap water provision system

In order to have a comprehensive understanding of this Hybrid Institutional Architecture, this chapter will adopt two optic angles of analysis. A 'zoom in' optic angle would be helpful to examine each limited condition and problem of three agents respectively. A 'zoom out' optic angle will then be employed to probe how these problems lead to the outcomes of semi-potable tap water and Consumer Coping Strategy Matrix. Both of these optic angles will be fully elaborated in the following sections.

## 6.3 Mopanshan reservoir

Harbin has three small local reservoirs with the total designed water storage capacity of 5.51 million tons and total actual water storage capacity of 4.2 million tons (Kong, Gu and Jia, 2011, p.3). However, their capacity is too low to satisfy the city's increasing water demand. Besides, as shown in Figure 6.2, with the

over-exploitation of the local groundwater resources in Harbin's first sociogenic water sustainability crisis and the deteriorated quality of the Songhua River in Harbin's second sociogenic water sustainability crisis. There was an unprecedented urgent need for municipal government to construct a new water source for the city. Thus, Mopanshan Reservoir became Harbin's first and only water transfer project.

As shown in Figure 6.2, the construction of Mopanshan Reservoir triggered four problems. Three of them, Departmental Dispute and Settlement Procedure, Water Pollution in Reservoir and Local Villager Resettlement, and Wuchang Gets Water From Mopanshan After Harbin, are hybrid problems. This means that they are triggered by two departments, the Mopanshan Reservoir and Harbin Municipal Department. Together, these three problems led to the fourth problem of Mopanshan Reservoir, the risk of long-distance water transfer.

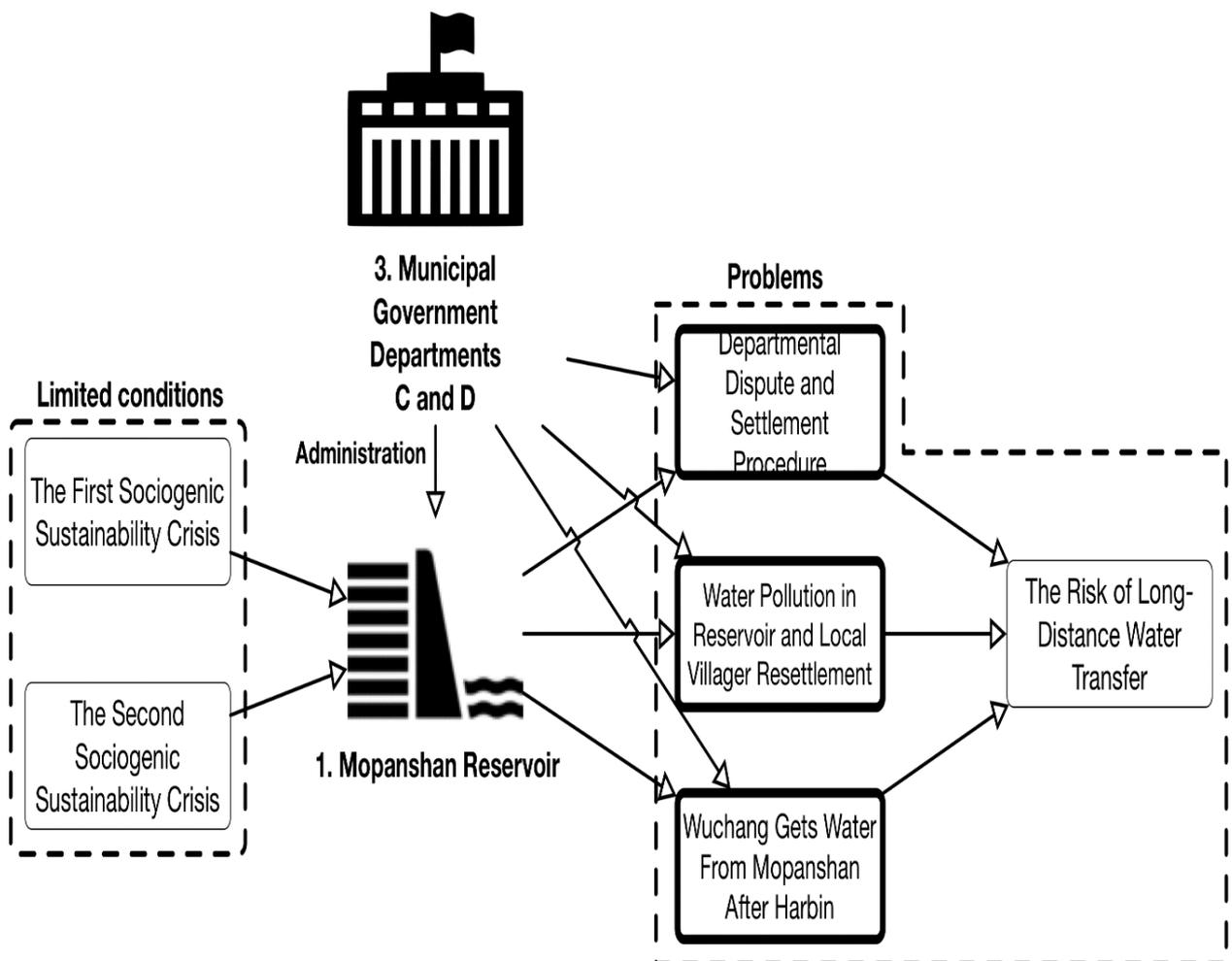


Figure 6.2: The conditions and problems of Mopanshan Reservoir

Locations and distance of key targets mentioned in this section, Harbin, Wuchang, Mopanshan Reservoir and Fenghuang Wetland, are shown in Figure 6.3. Note here that since the distance was calculated by the ruler tool of Google Earth, it is a little bit different from official data.

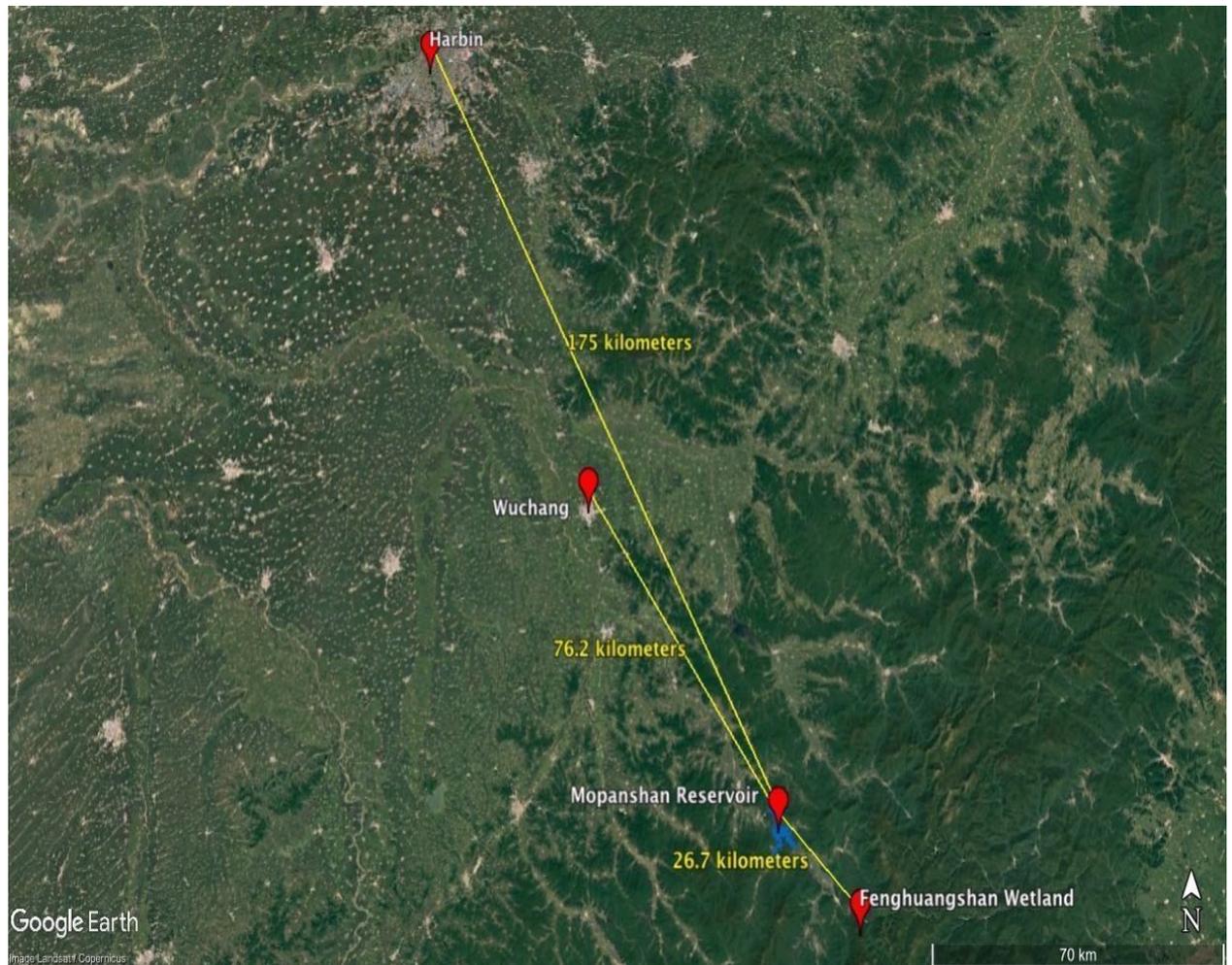


Figure 6.3: Locations of Harbin, Wuchang, Mopanshan Reservoir and Fenghuang Wetland

### 6.3.1 The construction of Mopanshan Reservoir

As shown in Figure 6.3, Mopanshan Reservoir is situated in Shahezi county of Wuchang City. Wuchang is a county-level city under the jurisdiction of the latter. The main water sources of the reservoir are Lalin River and Fenghuangshan Wetland. Their flows shape a river valley plain near the reservoir. Not only does the reservoir possess abundant groundwater storage, but its water quality also reaches the first class of the national tap water standard, which means that its water is potable water.

The general water transfer project can be divided into three subordinate projects: the water storage project, the water distribution project and the water treatment project. The water storage project was to build a reservoir in Mopanshan water source with the total reservoir capacity of  $5.23 \times 10^8$  cubic meters and the designed reservoir capacity of  $4.43 \times 10^8$  cubic meters (Lin and Han, 2007). The water distribution project was to build two water supply pipes, each of which is 175.5 kilometres long with a diameter of 2.2 meters. The water treatment project was to build Mopanshan Water Treatment Plant, and a corresponding 194.5 kilometres' urban tap water supply pipeline. With 900,000 cubic meters of treatment capacity per day, its primary function is to treat the water channelling through the two pipes. The total investment of Mopanshan Reservoir is 5.312 billion Yuan, including 100 million dollars' loan from the Asian Development Bank, 2.4 billion Yuan long-term loans from the Heilongjiang branch of Industrial and Commercial Bank of China, and the self-raised funds and national subsidy funds for up to 300 million Yuan.

The construction proposal of Mopanshan Reservoir was firstly submitted by two members of Harbin Municipal PCC (People's Political Consultative Conference) members in 1997 (Hu, 2001). On July 28, 1998, the members of Municipal PCC standing committee investigated the connection between the urban tap water quality and tap water sources. In June 1999, the construction proposal including three alternative locations to construct Harbin's secondary water source was submitted to the National Planning Commission. Mopanshan Reservoir was selected as the secondary water source of Harbin besides the main major source of the Songhua River. Compared to the other two options, the Xiquanyan Reservoir and Taoshan Reservoir, both of which suffered from the water pollution derived from the rapid development of the tourism industry, Mopanshan reservoir enjoyed a relatively well-preserved nature environment. Its perennial vegetation coverage rate reaches 95% with an average annual precipitation of 800 millimetres (Ji, 2011). Another advantage of Mopanshan Reservoir was that it did not have as many surrounded villages as the other two reservoirs. However, as will be revealed later, the problems of reservoir migration and the tourism industry were to a large extent underestimated. This selection did not mean the confirmation of the project; given the massive scale and the vast investment of this project, there were other political procedures ahead.

At the municipal level, this proposal did not proceed until 2001. The municipal government kept a cautious attitude towards the project, reflecting on the limited number of the relevant news reports. However, the outbreak of water scarcity crisis enforced the municipal government to launch the proposal of Mopanshan Reservoir.

To deal with water scarcity, on 2001 annual PCC conference, two municipal PCC members submitted two proposals focusing on the water source projects of Harbin (Hu, 2001). The first and prioritised proposal was not about Mopanshan Reservoir but another Reservoir, which had been granted by the central government in the 1990s. In contrast, the construction proposal of Mopanshan Reservoir was still full of uncertainties. The major focus of Mopanshan Reservoir project, therefore, was an environmental evaluation. A special team was established and assigned by municipal PCC to explore the upstream environment of Mopanshan Reservoir and collect the water data. This work paved the way for the legislation for protecting Mopanshan's water resource.

The first stage of Mopanshan Reservoir was granted by the National Development Planning Commission in November 2002. The construction project launched on April 20 2003 and completed at the end of 2005. It finished the construction of Mopanshan Reservoir, one 175.5 kilometres long distance water supply pipe, the first stage of Mopanshan Water Treatment Plant with the water treatment capacity of 450,000 cubic meters per day and 111 kilometres urban water pipeline. It was operated on 23 December 2006, occupying 64% of Harbin's total domestic water consumption (Cheng, 2006).

Owing to the outbreak of Songhua River Toxic Spill Crisis, the second stage of the project was granted promptly by the central government and launched in 2006. After the crisis, Harbin's municipal government immediately decided to initiate the second stage project of Mopanshan Reservoir right after the completion of its first stage project, which was granted nearly immediately by the central government. If the second sociogenic water sustainability crisis did not occur, it would have been impossible for Harbin's municipal government to get permission from the central government for second stage project so easily and quickly, as it had borne a significant financial burden from the first stage construction of the project.

Given that, the central government's subsidy rate of the second stage project increased from 10% to 35% (The People Net, 2006). The second stage of the project included the construction work of another 175.5 kilometres long distance water supply pipe, the second stage of Mopanshan Water Treatment Plant with the water treatment capacity of 450,000 cubic meters per day, 83.54 kilometres urban tap water pipeline. The whole project was completed in November 2009.

In sum, the construction of Mopanshan Reservoir is not specifically aiming to deal with consumer's plummeting trust in Harbin's tap water after the Songhua River Toxic Spill Crisis, but the latter definitely prompted the development of the former. From this sense, Mopanshan Reservoir can be deemed as a significant domino effect of the second sociogenic water sustainability crisis. It was the government's effort to rebuild the consumer's trust in the manageability of tap water by shifting the water source from an untrustworthy one (Songhua River) to a trustworthy one (Mopanshan Reservoir). In 2010, all citizens in Harbin were supplied with tap water from Mopanshan Reservoir. After four years of the consecutive drop, Harbin's domestic water consumption for began to recover for the first time.

### **6.3.2 Departmental dispute and settlement procedure**

During the construction process of the reservoir, several departmental disputes emerged, which became one of the most troublesome hybrid problems between Harbin government departments and Mopanshan Reservoir. The first and most severe dispute was between two government departments from two different institutions: the Shanhetun State-Owned Logging Enterprise (SSLE), who possessed 1151 square kilometre forestation areas around Mopanshan Reservoir, and Harbin's municipal government.

SSLE is a logging enterprise subordinate to Heilongjiang Forestry Bureau. Contrary to the administrative relationship it has with Wuchang's municipal government, Harbin's municipal government has no direct administrative relationship with SSLE, which meant they had to negotiate with the latter. Mopanshan reservoir was just located inside the deforestation areas of SSLE, so was suffering from the resultant water reduction and soil erosion. Since 2000, the water storage volume of Mopanshan Reservoir decreased

gradually due to the deforestation. An obvious solution to this problem was to stop deforestation, which became the centre of the dispute between the two government departments.

The dilemma was about the interests of SSLE. If deforestation stopped, it would face a sharp shortfall in its revenue. According to the policy of Natural Forest Protection Project, the annual allowable deforestation volume for SSLE was 105,000 cubic meters. This was a huge amount of revenue. It was also impossible for Harbin's municipal government to take over all the nine State-Owned Logging Enterprises that surrounding Mopanshan Reservoir, for it could not afford the cost of this option - there were thousands of staff and workers in these State-Owned Logging Enterprises.

SSLE had a clear understanding of their plight. The water-connected forestation areas occupied half of the entire forestation areas of State-Owned Logging Enterprise. In 2005, their average gross annual personal income was only 4,560 Yuan<sup>43</sup> (656 dollars). Besides, in order to protect the water quality, the forest farm had transferred the plants in the upstream of Mopanshan Reservoir to cash crops and herbs so as to control the usage of pesticides and fertiliser. All these arrangements demanded significant initial investment. Since Mopanshan Reservoir might not be a revenue source anymore, their interest moved to a high mountain wetland function as the water source and 'natural water treatment plant' for Mopanshan Reservoir, the Fenghuangshan Wetland, located at the top of an upstream mountain 26.7 kilometres away from Mopanshan Reservoir, as demonstrated in Figure 6.3.

In June 2000, a so-called international group, China Holiday Paradise International Group, claimed a will to invest 850 million dollars on Fenghuangshan Wetland in constructing the largest ski holiday resort in Asia continent (Lin and Han, 2007; Harbin Daily, 2008). However, there is no information about this group on the Web. Moreover, this investment was problematic. There were no construction records for any ski resorts in areas around Mopanshan Reservoir. With such a high rainfall rate every year, the ski resort would not be able to operate for enough days to make the profit. Besides, the timing of this investment was

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43 Source: <http://baike.baidu.com/item/%E5%B1%B1%E6%B2%B3%E5%B1%AF%E6%9E%97%E4%B8%9A%E5%B1%80> Accessed: 10 April 2016

suspicious. It came after the Mopanshan Reservoir was selected as the secondary water source for Harbin. However, SSLE supported the investment project at that time, whereas Harbin Municipal Government, clubbing together with several other departments, opposed it. The latter initiated a strict Environmental Impact Scrutiny and Environmental Impact Assessment on this investment project. In 2003, the Harbin government finally decided to reject this investment project.

However, in November 2002, the Fenghuangshan Wetland was still developed as a resort. The central government approved the establishment of 'Fenghuangshan National Park', paving the way for SSLE to plan two tour routes in it, along which were dozens of public toilets draining the excretion directly into the reservoir without treatment (Harbin Daily, 2008). However, it insisted that the exploration of the Fenghuangshan Wetland was only a win-win developmental cooperation with Mopanshan Reservoir.

In 2011, the dispute between Harbin's municipal government and SSLE finally settled down with the publishing of a legal document, The Agreement of Stopping Deforestation in Upstream Areas of Mopanshan Reservoir. Harbin's municipal government needed to compensate Heilongjiang Forest Agency the loss caused by stopping deforestation for 39 million Yuan every year from 2011 to 2016 (Ji, 2011). Noted here that the compensation was not paid directly to SSLE, but its senior agency. However, the issue of compensation distribution is still unclear. From this sense, SSLE's concern for their revenue becomes understandable. Without the revenues from logging, the SSLE would have to rely on the compensation redistributed from its senior agency, who did not have a redistribution scheme open for scrutiny. Thus, SSLE was unwilling to give up any gains they made through the developing tourism industry, resulting in a new concern of the booming tourism development of Fenghuangshan Wetland evidenced in a news report in 2015 (Yan, 2015). However, the development of tourism industry will probably last for many years in the future.

From this dispute, a conflict-settlement procedure between different government departments can be perceived. This system operated when there were no clear power boundaries between different agents, and when a legal solution of the departmental dispute was extremely time-consuming. In this case, the

Harbin's municipal government claimed the property rights of water resources in Mopanshan, but it cannot prevent the SSLE from logging the timbers around the water body and causing environmental pollution. Neither can it prevent the development of tourism industry near the water source of Mopanshan Reservoir. With no law or regulation to draw a clear line between the interests of agents with equivalent administration levels, a negotiation was arranged between them by their senior department, Heilongjiang provincial government. While rejecting all of the external interventions, this negotiation integrated the conflict into an internal administrative framework. At the same time, it can be observed that the senior agencies kept its authority in the final resolution. Without such a conflict-settlement negotiation, the conflict could be developed to an alarming level. After all, it was, in essence, a conflict with four million people's water demand on one side, and ten thousand people's incomes on the other. To conclude, even though the detail of such kind of negotiation is not open to the public, its effectiveness has been proved, at least in conflicts referring to government departments.

Note that this procedure has many defects. The most obvious one is the lack of transparency between the enterprise and Forestry Bureau, and between SSLE and its subordinated enterprises. In 2014, several employees in SSLE, including its former main director, were punished for embezzling public funds by National Audit Office<sup>44</sup>. In general, this procedure has been widely adopted by many governments in dealing with their disputes with other government departments. As a result, the flow of power and the flow of money running through this procedure are, to a large extent, behind the veil. Since there is no effective public supervision on the operation of this procedure, a series of similar crimes regarding huge amounts of compensation funding can occur.

### **6.3.3 Water pollution in reservoir and local villager resettlement**

Since local villagers were the main pollution source for Mopanshan Reservoir, and since their resettlement demanded the involvement of government department, there was an intricate correlation between

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<sup>44</sup> Source: [http://news.ifeng.com/a/20141224/42788494\\_0.shtml](http://news.ifeng.com/a/20141224/42788494_0.shtml) Accessed: 18 April 2017

government department, Mopanshan Reservoir, water pollution, and local villager resettlement, generating another complicated hybrid problem.

In a 2007 news report, four main pollution sources of Mopanshan Reservoir were identified (Dongbeinet, 2007). Three of them were either caused by or associated with the local villagers: the non-point sources agricultural pollution, the rural kitchen waste pollution, and the potential environmental risk of petrol stations nearby villages. The fourth pollution source was the pesticide sprayed by Shanghetun State-Owned Logging Enterprises, which was eliminated after the negotiation between Heilongjiang Forest Agency and Harbin's municipal government.

The pollution problems are intertwined with the problem of reservoir resettlement. Many local villagers did not want to be moved from their homes to other places. However, given the isolated locations of their villages, they had no other way than cultivating the land around the reservoir to feed themselves. The farm lands around Mopanshan Reservoir are fertile with reputation for its yield. Wuchang Rice has become a popular rice brand in the national market. Thus, many villagers chose to grow rice in their lands, which demanded four to five times more fertiliser input than growing upland rice. What is more, rice is vulnerable to pests, which entails the usage of a large amount of pesticides. As a result, large quantities of fertiliser and pesticides diluted themselves into the nearby water bodies and groundwater, turning into the main compositions of the non-point water pollutant. In the total 1151 square kilometres upstream area of Mopanshan Reservoir there were seven small logging enterprises, 11 villages, 14,100 people, and 80,000 livestock. Each year, 2179.6 tons of fertiliser and 15.86 tons of pesticides were sprayed in farming, and 10,000 tons of untreated household sewage and 100,000 tons of untreated wastewater were discharged to the environment (Dongbeinet, 2011). In each summer, the swollen surface flows will bring these pollutants to Mopanshan Reservoir. The result of water quality monitoring indicated that the organic pollutants did not exceed the standard limit, but they might cause possible environmental damage. In recent years, with the booming economy in Fenghuangshan Wetland, villagers may have more reasons to stay.

What is more worrying are the attitudes of local villagers, which can be seen as a typical reflection of the tragedy of the commons. In several news reports (see Dongbeinet, 2006; 2007; 2012), the local villagers exclaimed that the water they drank was from self-drilled wells, so the water quality of Mopanshan Reservoir was not their business. Similarly, they had no awareness of environmental protection. Many villagers dumped their garbage beside the river. Some even put the pesticide bottle into the river to dilute the pesticide and then threw the bottle into the river. There was a government propaganda for 'green food technology zone'. In this zone, no pesticides and fertilisers that included chemical compositions would be permitted in cultivation. However, this zone was never established on a significant scale. Those relatively environmental-friendly pesticides and fertilisers came with a high cost, and local villagers did not have any government subsidisation for using them. Besides, using toxic fertilisers and pesticides would increase the crop yields more than using the relatively environmental-friendly pesticides and fertilisers (Wang, 2008). With the natural environment being 'controlled' by the local villagers, and with no effective compensation mechanism for using environmental-friendly pesticides and fertilisers, it was no surprise to witness such a sharp conflict between rural and urban people: the former refused to take into consideration the latter's benefit.

Given the situation above, a villager resettlement was arranged. In 2004, 4400 villagers were resettled from the flood areas of Mopanshan Reservoir. In 2005, in order to protect the environment of the water source, another 2000 people were resettled (Zhang, 2012). Besides, in order to guarantee the construction of the urban pipeline network, the Harbin's municipal government had enacted two announcements about land acquisition in 2003 and 2007, corresponding respectively to the construction period of the first and second stage of the project of Mopanshan Reservoir (Harbin Municipal Government, 2003; 2007b). In both two announcements, there were articles of compensation: 'in requisitioning land, compensation should be made to those who own legal housing related deeds according to the 'Harbin's interim measures on urban housing demolition and management.' They asked that 'all of the units, individual businesses, and residents positing within the scope of land acquisition should prioritise the overall interests against their personal interests to support the construction project'.

Residents within 200 meters' radius of Mopanshan Reservoir were all resettled before 2012, when the *Harbin Mopanshan Reservoir Water Source Conservation Regulation* took effect. To prevent people from intruding on this area, a 70 kilometres long, 2.2 meters high fence around Mopanshan Reservoir was established by Harbin Environmental Protection Bureau, and regulated by Mopanshan Water resources Protection and Management Office (Cui, 2008). However, with only five employees in this office, effective management was a huge challenge.

### **6.3.4 Wuchang gets water from Mopanshan after Harbin**

As shown in Figure 6.3, Wuchang is the nearest city of Mopanshan Reservoir. It also held the direct administration power of Mopanshan Reservoir. As mentioned earlier, Wuchang is administrated by Harbin's municipal government, so even though it was 76.2 kilometres away from Mopanshan Reservoir, it had water supplied from Mopanshan Reservoir later than Harbin.

In the massive media coverage about Mopanshan Reservoir, Wuchang received little attention, even though Mopanshan Reservoir is located in its administrative realm. Since 2006, it administrated a reservoir that supplied water not to its citizen but citizens of another city, whereas its tap water was mainly sourced from groundwater. In 2013, a nondescript news published with a title '200,000 Wuchang Residents get Water Supplied from Mopanshan Reservoir' (Wen, 2013), confirmed that Wuchang citizens finally got tap water supplied from the nearby water reservoir, seven years after Harbin citizens.

In this case, Wuchang residents' proximity to the water resources did not justify their priority of accessing it. Similarly, Harbin residents' distance to water resources did not nullify their priority of enjoying water from this source. This is due to the fact that Harbin is the capital city of Heilongjiang Province. Its political power priority and privilege has been so huge that it even expanded to the very basic infrastructure projects such as tap water supply, surpassing the legitimacy of accessing water based on proximity. This demonstrates one aspect of how political power shaped the general water supply structure in China: the capital city's demands of water resources always surpass the non-capital cities, even the latter is closer to

the water resource. A similar case can be observed in China's South-to-North Water Diversion project (Barnett et al, 2005).

In this situation, what non-capital cities do is to try to make some profits from the capital city's massive hydraulic projects, but when their interests conflict with the interests of the capital city, the latter would always prevail over the former. For example, in 2004, the mayor of Wuchang claimed that 'we should seize the opportunity of the Mopanshan Reservoir Water Supply project to encourage our citizens to participate in the work of construction, developing industries of transportation, food service, pipeline production, tourism, and aquaculture' (Liu, 2004). Here it is obvious that Wuchang tried to focus on the positive aspects of reservoir construction. In July 2005, an official from Wuchang's agriculture department announced that Wuchang had designated the arable land around the water catchment area into the 'Organic Food Base'. Given his statement, since 2006, all of the farming within the base would strictly follow the standard of organic food. In three years, pesticides and fertilisers that included chemical compositions would be banned in cultivation. The goal was that in 2008, the surrounding arable land of Mopanshan Reservoir would become an organic food base. However, in April 2006, only one hectare of arable land was cultivating 'organic rice' without using fertiliser and pesticides (Dongbeinet, 2007). In 2008, the fertilisers and pesticides were still being widely used in farming (Cui, 2008). In 2012, with the validation of *Mopanshan Reservoir Water Source Conservation Regulation*, it was impossible to build an organic food base (or any other buildings) near Mopanshan Reservoir. In conclusion, when Wuchang's plan of making a profit from Mopanshan Reservoir conflicted with Harbin's major interest of water protection, the former was repressed and all its efforts lost.

### **6.3.5 Risk of long-distance water transfer**

From Mopanshan Reservoir to Harbin, the 175 kilometres' long-distance water supply inevitably triggers some concerns. First, as a close pipeline, it passed two mountains, five railways, three rivers ten highways and six towns (Xinhuanet, 2011). It has to be protected by a certain patrol party day and night. Secondly, given its long length, the changing temperature, and the complexity of its surrounding environment, once

the tap water supply is suspended by any accident, it will take a long time to detect the problem and to restore water the supply (Xie, 2011). Thirdly, a long-distance pipeline is vulnerable to various potential damage, either natural disasters or human construction projects. Fourthly, a long-distance water supply means that the residual chlorine is more likely to evaporate in the pipe, and bacteria would have more time to grow up. Besides the risks listed above, once the long-distance pipeline connects with the old urban pipeline, the tap water quality would still be reduced from a potable level to a semi-potable level.

Given that, after the investigation of water quality, in November 2011, Harbin's municipal government launched the Songhua River Water Source Project, which aims to refurbish the three old water treatment plants and build two new water treatment plants that supply the river water (Tao and Ma, 2014; Wang, 2015). At the end of 2017, the tap water supplies to southern areas of Harbin will come from two water sources, Mopanshan Reservoir and Songhua River.

## **6.4 Water company A and water treatment plant B**

Water company A is a state-owned enterprise offering municipal public service. It has several subordinated water treatment plants, including the water treatment plant B.

As shown in Figure 6.4, A and B are in dire straits now. A series of water companies merge and split impaired A's administration. Both its direct and extra incomes were limited. Due to the construction project of Mopanshan Reservoir, it was running with a huge debt. Since they were strongly opposed to privatisation, the limited conditions made it incapable of either updating the old urban tap water pipeline or changing old water treatment equipment, not to mention taking over the administration of second water supply facilities.

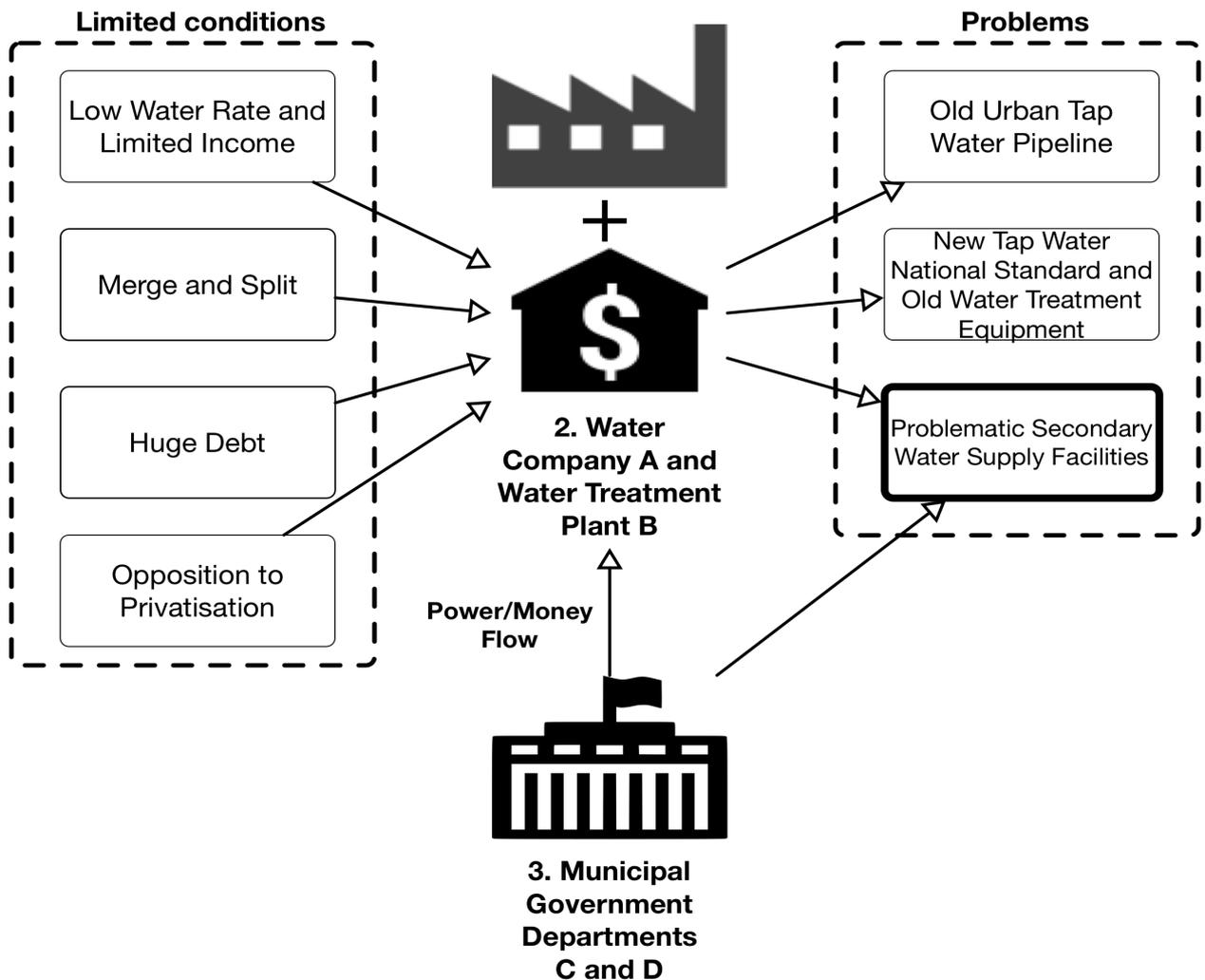


Figure 6.4: The condition and problem of water company and water treatment plant

### 6.4.1 Low water rates and limited income

On 8 December 2009, Harbin's municipal government held a hearing to discuss the price of tap water from Mopanshan (Harbin Municipal Government, 2009). In this hearing, the municipal government set the cost price of tap water at 3.75 Yuan per cubic meter, including source water cost for 1.93 Yuan and operation cost for 1.82 Yuan. With the government subsidy, the domestic water rates for Harbin citizens was 2.4 Yuan, which increased from previous 1.8 Yuan. This price ranked sixth in 27 capital cities, whereas the Harbin's disposable income per capita in 2008 ranked 17th among them (Heilongjiang News Net, 2009). Besides, a news report blamed the hearing's operation as 'full of doubt'. It claimed that some consumer

representatives attended the hearing with fake identities (Wang, 2009). Harbin's municipal government denied this claim in its press conference.

In the interviews, regarding the problem of water rate, interviewees from different departments responded with different attitudes. The interviewee from the water treatment plant B commented on the water rates as 'not high' given its cost. 'For citizens, they must have thought this water rates was high, since they might compare it with the water rates of tap water from Songhua River. However, now it was from Mopanshan, 180 kilometres away from us, and we need to supply the treated water to the city. With all of these, plus the cost of treatment and the cost of operation, I think the water rates was not high. There is also a sewage treatment fee in the water rates, not only the fee generated from water production.' Obviously, his/her perception of the current water rates is based on the cost of water transfer and water treatment.

The interviewee from water company A, however, emphasised the necessity of increasing water rates. 'Our group barely has any profits. It is because of the low water rate. [...] I think it needs to be increased, for the costs of raw materials and labour are increasing now. Because of the increasing cost, it is more and more difficult for our group to undertake the urban reformation and reconstruction projects.' But at the same time, he/she also admitted that water rates were so fundamental that they had to be kept at a low level. 'For example, when the price of oil fluctuates, the price of electricity fluctuates, and then the cost of labour rose. However, the price of water is fixed no matter how much the price of the other raw materials changed. It is because the water price is the fundamental basis of everything in the market. If the water price increases, then the price of everything will increase as a response. It is due to the consistent use of water that leads the water's price to be kept at a relatively low level.' His/her perception of current water rates is based on the operation situation of his/her group, which is running in huge debt, as will be revealed later.

Besides the major income from the water rate, the interviewee from A also has some extra income from its subordinated construction company. However, he/she admitted that given the economic recession and

weather condition, it could not earn as much money as before. 'In south areas, the construction companies can work for up to 12 months, but in north areas, because of the cold weather, our workers cannot afford to work for 12 months a year,' He/she said.

### **6.4.2 Merge and split**

After being informed of the approval of Mopanshan Reservoir from central government, Harbin's municipal government launched a series of complicated capital operations. Given the explanation of the interviewee from A, there were two requirements for municipal government to apply for a loan from the central government: first, it must have a fixed asset; and second, it must have an entity that is financially strong enough, for example a company, to sustain the project. In 2003, only the Water Supply Office, a subordinate department of Harbin's municipal government, was qualified for applying for a loan. However, it was not counted as an entity with any fixed asset. In order to meet these two requirements, in 2003, the Harbin's municipal government combined three water companies, the Municipal Tap Water Group, the Municipal Water Drainage Company and the water engineering company responsible for the tap water supply from Mopanshan Reservoir, to establish a company with enough capital. 'You have to have enough fixed assets to apply for the funding at that time. The best solution was to merge the small companies to establish a strong entity with fixed asset,' he/she said.

As a result, a new group was established, the Harbin Water Supply and Drainage Group (HWSDG). Its overt function was to operate the tap water supply and sewage for the whole city. However, as an SOE, it also functioned as a financing vehicle. Up to July 2011, its total assets were 8.18 billion Yuan, but its total liabilities were as high as 5.83 billion Yuan. In July 2013, three years after the completion of the Mopanshan Reservoir project, the HWSDG was separated into two groups: the Harbin Water Supply Group (HWSG) and the Harbin Water Drainage Group (HWDG). It seems like everything was restored to what they had been before. The interviewee from A thought such re-separation was positive. 'Compared to the past, they are more focused. One group was focusing on the water supply, whereas the other was focusing on the drainage,' he/she said. However, how the liabilities of HWSDG were separate between the two

groups is unclear. What can be confirmed is that this separation marked the completion of the mission of the HWSGD.

This internal and dynamic change in HWSGD demonstrated the close link between the water company, the government, and the water reservoir in the Hybrid Institutional Architecture. The central government planned the development direction and water companies in local cities would follow it no matter what had happened before. Frequent changes in such scale would definitely lead to turbulences in the administration system of the two companies, and it would be expanded to their subordinate companies, costing a long time to make proper adjustments.

### **6.4.3 Huge debt and expenditure**

Due to the loan HWSG borrowed from the central government for constructing Mopanshan Reservoir, it is currently in huge debt. Given Municipal Year Book (Harbin Yearbook Edition Committee, 2014), in 2013 its total assets was 9.65 billion Yuan, its total debt was 6.71 billion Yuan, accounting 69.5% of its total assets. Both interviewees from A and B acknowledged that this debt was a huge burden. The interviewee from B thought that the government should share some financial burdens, because the project of Mopanshan Reservoir is a municipal public project. The interviewee from health supervision department C, on the other hand, was aware of the huge debt of A, but he/she was cautious in delivering any comments.

Besides the debt, the interviewee from A admitted that as an old SOE, HWSG also has to afford the pension for its retired employees. The interviewee from B also acknowledged that 'in an old SOE for so many years, some employees may have sluggishness and dependence'.

What can be observed here is that all of three interviewees recognised the financial troubles confronted by HWSG as SOE. However, at the same time they all clearly opposed the idea of privatising the water company, although it may release HWSG from its troubles.

#### 6.4.4 Opposition to privatisation

Facing such harsh realities of their financial situation, both interviewees from A and B claimed that they opposed any attempts of privatising the urban tap water supply facilities. The interviewee from A argued that 'the fundamental problem was that private capitals were not as professional as us in operating a tap water supply system. Thus, they could not ensure the quality of tap water. Their pursuit of interests would confine their service quality.' The interviewee from B was worried about the private capital's control over tap water treatment plants 'if tap water treatment plants were controlled in one person's hands, [...] it would make this person take advantage of us.'

Obviously, both interviewees strongly opposed the attempt of privatisation. Their worries were about security and operation of those privatised facilities, which formed a remarkable comparison to their attitudes towards their financial problems. This may evidence the fact that even though holding a heavy burden of debt, as in the case of SOE, they were not worried too much about bankruptcy. In other words, those financial problems were not as fatal for them as they might be for Non-SOE. They could still operate water supply facilities without making any changes, even with such huge a debt and high interests. How and when would they repay the debt is still unknown.

#### 6.4.5 Old urban tap water pipeline

Given the limited income, huge debt and expenditure, it is extremely hard for HWSG to update the Harbin's old urban tap water pipeline. 'The old pipeline could not be modified without the financial support from the central government. This was the only funding that we could use to modify the pipeline. We were not allowed to use the other funding.' He/she also admitted that most of Harbin's water pipelines were made by cement, glass-reinforced plastic and foundry iron, which have different leaking rates. He/she also acknowledged that many pipes' service life had expired. 'HWSG does not have funding to modify these pipes. Thus, it has no other choice but to suffer a high water leakage rate,' he/she said.

The interviewee from B also admitted that 'I can guarantee you that the outlet tap water from our plant is potable, but given Harbin's old urban tap water pipeline, I cannot guarantee you the quality of domestic tap water.' The interviewee from tap water administration department D emphasised that pipeline management needed the cooperation of multiple government departments, he/she also claimed that it was the construction department who managed the pipeline. However, the interviewee from A pointed out that it was HWSG in Harbin who managed and maintained the pipeline.

The mistake of the interviewee from D implicates a problem of urban tap water administration in the Hybrid Institutional Architecture: it demands effective cooperation between multiple parallel departments, but they are sometimes unfamiliar with each other's working areas.

#### **6.4.6 New tap water national standard and old water treatment equipment**

The interviewees from C and D both thought the new national domestic tap water standard, including 106 indicators, was applicable. It only needed better administration. However, the interviewee from A admitted that since publishing in 2007, this standard was not adopted widely because of the old water treatment plant. 'It is not an inapplicable standard at all. The problem of its limited adoption was also the lack of fund. It was a common challenge for nearly all water companies in China. We have no money to upgrade our water treatment equipment. Even capital cities were in this plight, not to mention those secondary and third tier cities,' he/she said. Moreover, he/she indicated in addition that 'from what I know, no city in North China possesses the equipment of advanced water treatment. Such equipment is not only lacking in Harbin, but also in Shenyang, Liaoning and Jilin provinces. [...] Currently, Harbin also has the demand for such equipment, but it depends on whether we can receive enough funds to purchase them.'

Without an advanced water treatment plant, the interviewee from B admitted that without advanced water treatment equipment, they only test 15 essential indicators out of 106 indicators in daily water quality test. However, he/she had confidence in the water quality from Mopanshan Reservoir. Similarly,

the interviewee from C claimed that the reason why B did not equip with advanced water treatment equipment was 'because water from Mopanshan Reservoir was in good quality'.

### **6.4.7 Problematic secondary water supply facilities**

As has been argued in Chapter 3, the administration of secondary water supply facilities was a 'gray area' for general urban tap water provision systems. Its variable and complicated status made all relative agents in the system hesitate to take over its administration. As a result, it was considered the most vulnerable link in the system by many experts and another troublesome hybrid problem.

The interviewee from A admitted that Harbin's secondary water supply facilities were regulated by MCHURD and property management company for every resident community. Without any national regulation, its regulation differed from city to city. He/she thought it was a potential loophole for urban tap water regulation. 'It was necessary for the water company to take over the administration of this system,' he/she said, 'the water tank and the pipeline of the secondary water supply are not being properly maintained in a responsible manner. In that situation, it is impossible to expect tap water in potable quality. Many resident communities are suffering from sub-standardised tap water service from their old pipeline and old secondary water supply equipment.'

However, when it comes to the question of whether A would take over the administration of secondary water supply facilities, he/she reiterated the problem of the insufficient fund. 'It will be our group's burden to modify these pipelines and equipment. They were unaffordable, especially given the current low water price.' He/she also indicated that the property management company was in the same shoes. 'These property management companies also lack funds to modify these systems, which leads to a questionable quality of tap water. According to the regulation, the water tank of every resident community must be cleaned every half year, but without sufficient funds, many communities just washed their water tanks once a year, even once every two years.' In the end, he/she admitted that 'it was very difficult to modify the secondary water supply, and it was not our developmental goal'.

The interviewee from B claimed that he/she had no idea which department was in charge of secondary water supply facilities. This can be seen as further evidence revealing the fact that sometimes different departments of the urban tap water provision system were unfamiliar with each other's work in the Hybrid Institutional Architecture. But at the same time, he/she admitted that a poor management of secondary water supply facilities would damage the tap water quality. He/she once again emphasised the high cost for A to take over and maintain these facilities.

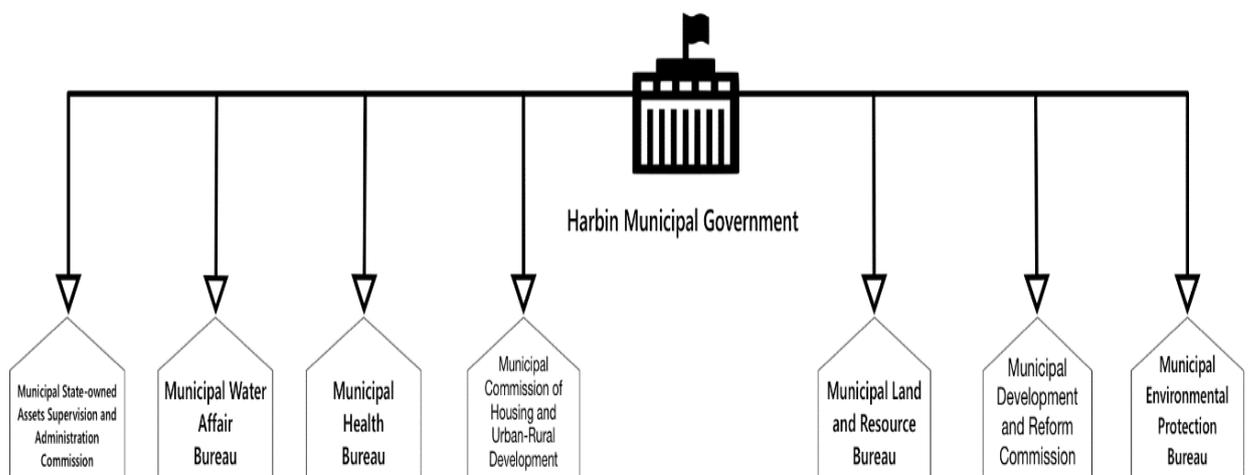
D is responsible for supervising the secondary water supply facilities in Harbin. The interviewee from D had an entirely different attitude on the administration of secondary water supply facilities. He/she argued that there was a prejudiced view on secondary water supply. 'It was an economic problem. It related to benefits of all agents.' He/she claimed that 'every health department, in fact, would pose more attention to the management of water than their management of the canteen'. Strongly denying the criticism about the poor management of secondary water supply facilities, he/she insisted that their supervision work had 'reached the very fundamental level of secondary water supply'.

It was necessary to connect D's interviewee's viewpoint with his/her position. In fact, the core of the secondary water supply facility's problem was not its supervision but its administration. As the interviewee from A had pointed out, an effective administration entails a professional and responsible manner, which are on the basis of sufficient funds. Without any radical change in money flow, the current problem is likely to persist in the future.

## **6.5 Harbin municipal government departments C and D**

Given the outcome of the Super-Ministry Reform, all issues regarding tap water provision are administrated by the Harbin Municipal Government. However, if one takes a closer look, even in municipal level, the administration of tap water still involves at least seven different government departments,

including the Municipal State-owned Assets Supervision and Administration Commission, Municipal Water Affair Bureau (MWAB), Municipal Health Bureau (MHB), Municipal Commission of Housing and Urban-Rural Development (MCHURD), Municipal Land and Resource Bureau, Municipal Development and Reform Commission and Municipal Environmental Protection Bureau (MEPB). They are shown in Figure 6.5. Among them, two departments are especially important: the MWAB, which is responsible for the administration of Harbin's water companies; and MHB, which is performing the role of supervisor for tap water quality.



**Figure 6.5: The Harbin's municipal government departments that involve in tap water administration**

As shown in Figure 6.6, the municipal government departments mainly have three limited conditions: first, there are no clear boundaries between these departments, which reduces the efficiency of administration; second, there is no effective external supervision for the work of these departments; third, similar to water company A and water treatment plant B, government departments C and D also more or less oppose to privatisation. With three limited conditions, information disclosure became a hybrid problem of between A, B, C and D.

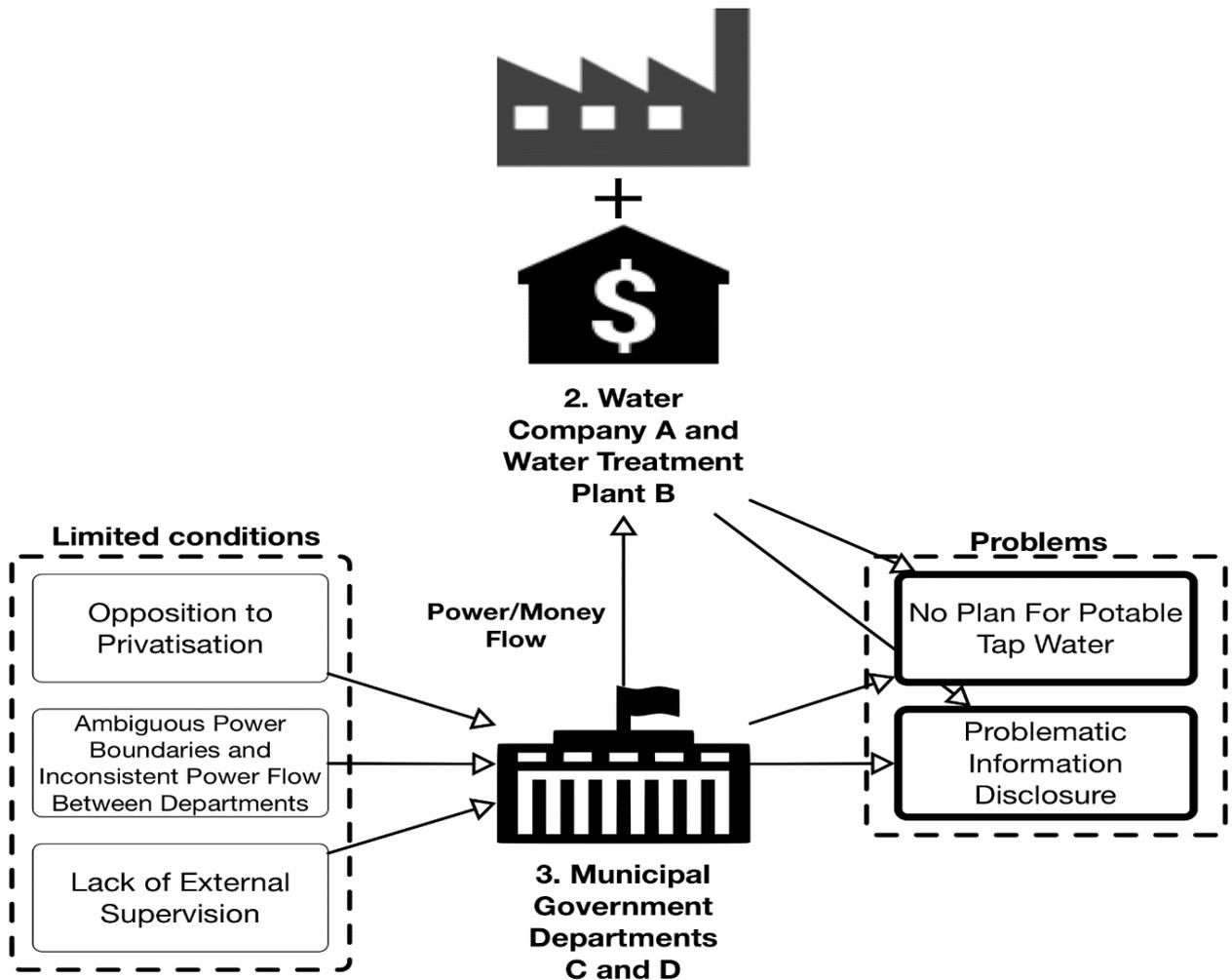


Figure 6.6: The limited conditions and problems of Harbin Municipal Government Department C and D

### 6.5.1 Opposition to privatisation

Both interviewees from C and D expressed their opposition to privatisation, although in a much more discreet manner compared to water company A and water treatment plant B.

The interviewee from C was very cautious about the question of privatisation. 'I did not know privatisation management. But many cities, including Shenzhen, Shenyang, and Qiqihar all sold their water companies at a low price and then bought them back at a high price. [...] This was because the water supply was related to peoples' livelihood. Those private capitals and enterprises would not comply fully with the baton of government, but we had to guarantee citizens' livelihood. (If not) citizens may petition for their benefits and government would have no idea about it.' Following this viewpoint, he/she then emphasised the role

of water company as SOE. 'SOE was like the central bank of the government, it would guarantee citizens' livelihoods no matter how much money it had lost. But (private capital) would treat water supply as market behaviour. Why did they supply you tap water if their needs were not satisfied?' In the end, he/she emphasised again that 'I have no idea about privatisation, I just introduce you to the situations of the other cities objectively.'

Among four interviewees, the interviewee from D was the only one who thought importing private capital could be an option. But he/she insisted that 'even though private capital could occupy a small amount of the shares of the water company, the large shares must be controlled by the government'. He/she also promoted the importance of water security to a political security level. 'Water security also related to national security. If you want to overthrow a country, you can just destroy its water source. That would be a fatal damage.' He/she reiterated that this capital must be supervised strictly by the government. 'We should never loosen our grip on it.'

As introduced in the previous section, interviewees from A and B opposed privatisation because they questioned the professionalism and security of private capitals. But the interviewee from C was concerned about the potential interest conflict between the government and private capital. The government's priority task is to guarantee the citizens' livelihood, whereas the private capital's priority task is to secure profits.

Two presumptions were implicated from the statement of C's interviewee: first, the water company was deemed to lose money; second, consumers treat water company as a government department. Thus they would complain to the government rather than water company about the problems of tap water. Both presumptions demonstrated the fact that in the Hybrid Institutional Architecture, the relationship between government and the water company was so close that even government official treat water company as a government department. From the government perspective, citizens' livelihood and social stability were the priority tasks for water company as SOE. Thus, the deficit and debt of the water company were not considered as severe enough a problem by government officials, since they had forecast the

scenario that SOE was running in loss. However, all these analyses also reflected a fact: by focusing on keeping the current stable and self-balanced status, improving the quality of tap water from semi-potable to potable is not the priority task for government departments.

### **6.5.2 Ambiguous power boundaries and inconsistent power flow between departments**

Given the complicity of water administration, the power division among government departments was sometimes unclear, making the power flow inconsistent. From the horizontal dimension of the general urban tap water provision system, the problematic power division embodies in municipal administration level as the ambiguous power boundaries between municipal government departments. As has been discussed in Chapters 3 and 4, this is the reflection and outcome of the institutional incoherency in power flow.

One example of the ambiguous power boundaries and inconsistent power flow was the process of approving *Mopanshan Reservoir Water Source Conservation Regulation*. Submitted at the end of 2009, it took both the local and provincial government more than three years to approve it. From Zhang Chunlin's viewpoint, the main drafter of this regulation, this was due to the fact that those officials who possessed the power did not have adequate experience in environmental protection to realise the importance of this regulation (Ji, 2011). In this case, the power of these officials did not reach to the central problem that deserved it.

Even after the regulation was approved, the power relationships between government agencies were ambiguous in terms of water environment management. Some news report claimed that the location of Mopanshan Reservoir was chosen by the MWAB. The water quality of natural environment was monitored by MEPB, when the water came into the pipeline, it was the water company and MHB's responsibility to monitor it (Xie, 2011). However, in the interview with C, the interviewee claimed that 'the water protection was under the charge of C, but when you want to evaluate the water quality of Mopanshan Reservoir, C

and A's data were not valid, the only valid data was from the MEPB'. In the interview with D, the interviewee also admitted that 'speaking of water environment, it was complicated, because it was associated with the environmental protection bureau, housing department, water resources department and health department, the boundaries between them were not very clear'. In other words, the power boundary between MEPB and MWAB in water environment protection was ambiguous.

Another example in horizontal dimension was MWAB's administration on A. In fact, few knew that MWAB only administrated A's business, whereas another government department, Municipal State-owned Assets Supervision and Administration Commission, was in charge of A's other important issues such money and staff. In the interview, the interviewee from C argued that 'MWAB is only responsible for the business of water companies, they do not take care of other issues'. In other words, the power flow and money flow of A were derived from two different government departments. It is still unclear whether there is a cooperation between the two departments. But it was clear that the administration of A was much more complex and decentralised than people have previously presumed. The dispersed power and the ambiguous power boundaries between government departments reinforced one another.

The inconsistent power flow between departments was evidenced in the interview with the interviewee from A, who claimed that 'some water companies were administrated by the MWAB, some are administrated by the MCHURD. [...] This was because of the problematic administrative structure. In the past, we were not administrated by the MWAB but the MCHURD. Later, central government initiated the reform (Integrated Water Administration Reform, analysed in section 4.3.4). However, this reform was problematic, but at that time it was too late to rectify. As a result, those water companies which changed their administrative departments were kept in that status, but those who did not change also kept their status. Some areas even changed at first and then changed back again. This was because of the problematic power transformation at the central government level, especially the power of administrating tap water was transformed from the MHURD to the MWR, the senior department of the MWAB. Now the administrative order and documents from the MHURD could not reach the MWAB, and administrative

order and documents from the MWAB could not reach water company, which was administrated by the MHURD.' He/she later clarified that water companies in Harbin were in charge by MWAB, which was administrated by the municipal government. However, it still received operational guidance from MCHURD. His/her statements about the problematic administration structure supported the argument about institutional incoherency in power flow between central, provincial and local government departments, which has been analysed in section 4.3.3. However, it is interesting to notice that as a senior official from the water company, he/she did not know that the Super-Ministry Reform has deprived all administration power of urban water affairs from the MHURD and handed over it to municipal government. He/she argued that water companies were still under the administration of the MHURD.

The interviewee from C presented another more obvious example about the influence of MHURD. In reply to the question about water monitoring, he/she claimed that 'we inspect the quality of outlet tap water twice a year as required by MHURD'. Obviously, his/her words implicated C still has connections with MUURD.

Both examples evidence the argument this thesis has made in section 3.3: the power conflicts between state council and ministries and between ministries themselves are transmitted to the municipal level. Without a series of effective reforms and modifications in the associated standards, regulation, laws, and industrial associations, the power boundaries between these government departments will still keep in ambiguous and intricate statues. Even after nearly 20 years, government administration reform, the MHURD and its subordinate departments are still griping a certain amount of power regarding urban tap water provision.

Regarding the ambiguous power boundary between MWR and MEP, the interviewee from C presented an example. He/she argued that 'MWAB only monitors the quality of water for production purpose. Water source protection is the responsibility of MEPB'. He/she also pointed out that it is MWAB was responsible for water source protection, but it has no power to evaluate and declare water quality of different water bodies, such as river, lake and groundwater. Thus, MWAB has no power to make comments on water

quality of Mopanshan Reservoir. As has been argued in section 4.3.3, the overlapping administration of water affairs between MWR and MEP is demonstrated in the ambiguities between the administration responsibilities of 'water resources protection', 'water pollution control' and 'water environment quality'.

### **6.5.3 Lack of external supervision**

The interviewee from water company A admitted that there were at least three departments involved in water supervision. 'The first department was the water quality monitor centre from the water treatment plant; the second was the water quality monitor centre from the water company; the third was the Harbin Health Supervision Bureau. In most capital cities, there were at least three water supervision departments.'

However, there was a paradox regarding external supervision for both the water company and government department. Being treated like a government department in many ways by itself, the water company thought the supervision from another government department was an effective third-party supervision, because it represented the government. The interviewee from water company A considered the supervision of D was a third-party supervision. 'D's reputation should be solid enough to make a valid conclusion because it represents the government.'

The core of paradox was the instinctive contradiction of SOE. As a semi-government and semi-enterprise organisation, SOE's self-identification was always ambiguous. This was why when talking about external supervision, water company A identified itself as an enterprise, which made the supervision from D an external supervision. But for those who could not differentiate the SOE's identity between government department and enterprise, namely most of the tap water consumers, such supervision would not be considered as 'external' supervision.

The interviewee from D admitted that they tested the sample of outlet tap water twice a year, and the sample of water source once a year. The other health department, Harbin Disease Control Centre, would also be involved in water supervision. He/she believed that the establishment of third party supervision needed to in line with China's specific situation. He/she thought funding was the essential problem. 'In

fact, our country already established a water quality management system, including testing and supervision. If you want to invest a certain amount of attention and money, especially money, on establishing the third party, you need to know that the cost of testing water quality is high, you need to ask whether it was worthwhile for the whole country.'

The interviewee from C asked a question. 'Who was the third party?' He/she expressed his/her confusion. 'I do not understand these peoples' idea. They did not trust the government, but the government was the exact department that administrated water quality. We just uploaded water quality data honestly.' However, he/she then made a cautious statement. 'I did not have any thought about the problem of third party supervision.'

#### **6.5.4 No plan for potable tap water**

All four interviewees took dim views of the development of potable tap water, making it another hybrid problem. The interviewee from water treatment plant B claimed that there were two main problems: pipeline arrangement and funding. 'Everybody thought potable tap water was good. [...] But we really could not achieve it now. The first problem was the pipeline, you must use an independent new pipeline rather than the old ones. [...] And it is very difficult for you to find a location for new pipeline underneath the street, where sewage, electronic, and heating pipeline are buried. They could not be exposed on the street recklessly. The older your city was, the harder it would be. [...] Another problem was money. It was not a small investment.' However, in the end, he/she thought the potable water was a development goal in the long run.

The interviewee from water company A thought potable tap water was a 'very long-term goal' for them. He/she argued that 'even after 50 years China might still not be able to achieve this goal. I do not think it is necessary for us to achieve potable tap water. Firstly, China is too big to employ the same administration mode as those small western countries. We could not change our administration mode as smoothly as those countries. Secondly, in China we seem to have numerous problems about pipeline quality. Without

pipelines of solid quality, it would be absurd to discuss the possibility of potable tap water.' He/she then pointed out the development gap between different areas in China. 'From a long-run, say 50 to 100 years, some capital cities and some second-class cities might be able to achieve the goal of potable tap water, but it was impossible for those under-developed areas to achieve it. For these areas, they would not have a systematic plan for their development; they would develop step by step.'

The interviewee from D thought potable tap water was a 'beautiful but far-fetched dream'. 'It could only be achieved in a limited scope in certain areas. [...] How could you supply potable water for the whole city? That's not a small amount of investment.' His/her concern was also about the feasibility of this goal. 'This goal was not feasible. [...] Currently, the most important goal for China was to supply safe tap water, this was a feasible and practical goal. I thought it was a future issue to improve the water quality from safe to potable.' Meanwhile, she thought this future was 'not a short-term goal.' 'Whether it was a long-term goal,' he/she said, 'is depending on China's environmental condition, its economic development situation and peoples' needs.' In his/her understanding, safe water is referring to tap water that meet the national tap water quality standard. However, as has been highlighted in section 3.2, that kind of safe water is not 'safe' in many circumstances given to the loopholes of tap water definition in previous studies.

The interviewee from C reiterated the problem of the pipeline. He/she presented an example about potable water supply in Daqing, a city located in north China. 'We went to a resident community in Daqing where they supplied potable tap water. The tap water was supplied from water treatment plant to community at first and then was treated in the facility established in resident community.' He/she emphasised that the pipe for potable water in that community was too thin to be used to supply tap water to all citizens, which made this mode unpractical to be adopted and promoted widely.

### **6.5.5 Problematic information disclosure**

As one of the most significant hybrid problems, the problematic information disclosure has been highlighted in the second sociogenic water sustainability crisis, introduced in section 5.4. However, further

incoherency in tap water quality information disclosure between the water company and government department can be observed in the interviews.

The interviewee from water treatment plant B claimed that their main work was tap water production, and given the risk of pollution, the plant should not be open to the public. 'It is the government who should promote the tap water safety,' he/she said. However, he/she also admitted that he/she did not know where to find open communication channel about tap water quality in Harbin.

The interviewee of water company A also argued that it was the government's responsibility to disclose the tap water quality information. 'It was not the water company's responsibility to release the information. We submitted all information to the government, and they needed to build an open communication channel to disclose it. It was possible that our city did not have such an open communication channel.' Later he/she added: 'I had not heard of any government department in our city asking us for this information before.'

The interviewee from D also admitted that he/she did not know how much information had been disclosed. 'From what I know, regarding the information about tap water quality, there was not much that had been disclosed.'

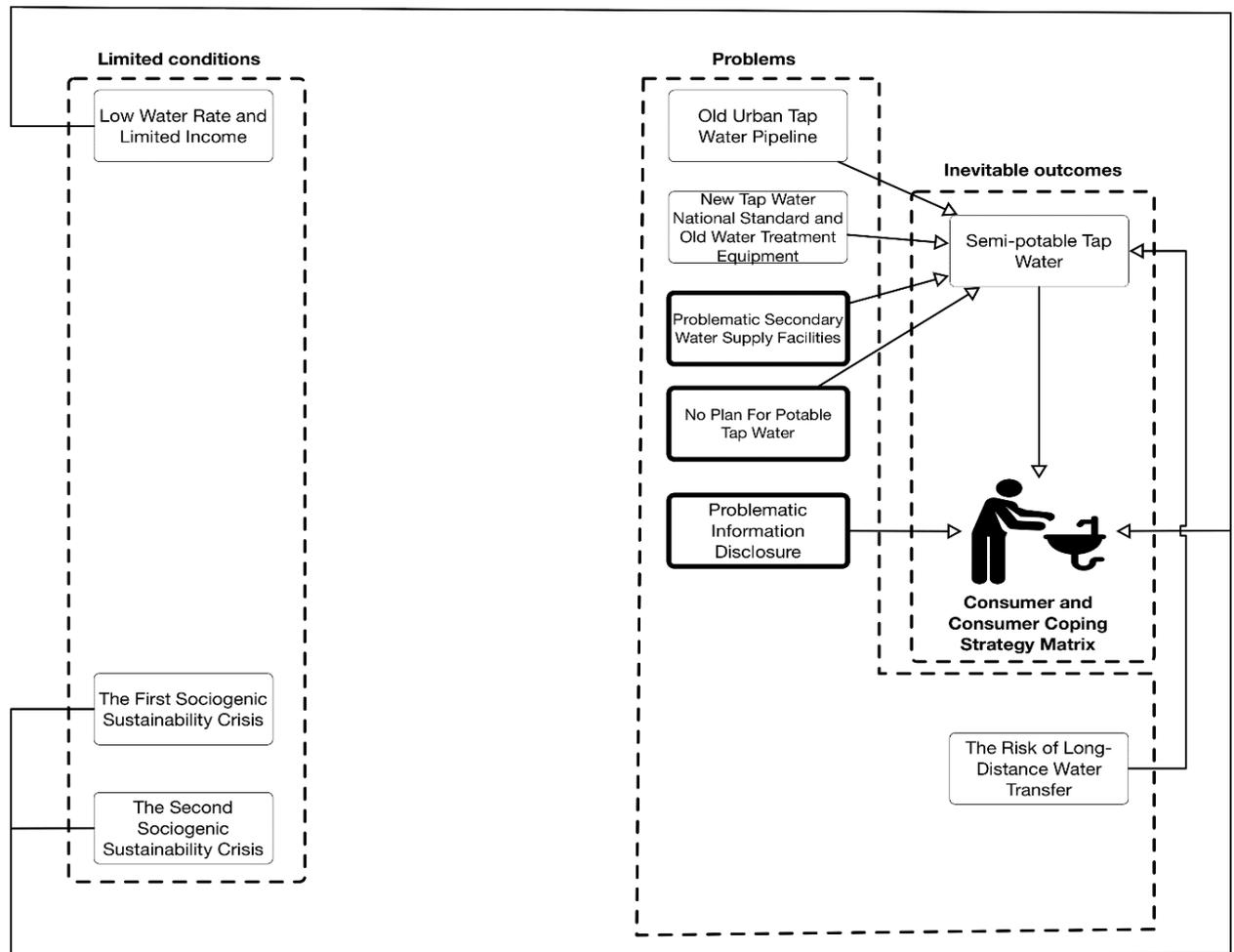
However, compared to other interviewees, the interviewee from C had a totally different opinion. 'MWAB kept promoting the water quality information, including the promotion from the water company. [...] The water company already spent a great amount of effort to promote information disclosure. The government department also put the water quality test result on their website for everyone to check.' He/she thought the government website was the most authoritative open communication channel for information disclose: 'the other information channel would ask for money. [...] They did not have any budget, and I thought their website could keep this information permanently. [...] People just did not visit the government website. If you tried to find it, you could find it.' Later he/she showed that the information of tap water quality was listed in the 'public announcement' section of MWAB's website, mixed with a series of other government announcements.

Here, the problem of communication has been turned into a problem of authorisation. Both of the water treatment plant and water company expressed their willingness to disclose the information, but they emphasised that they were not empowered to do so. Therefore, the government became the only agent that held the power of disclosing tap water quality information. Meanwhile, it seems like government departments had no idea of its importance and position in information disclosure, and presumed that the water company had promoted the tap water quality. The final result of such incoherency was that even three interviewees did not know where the information was published, not to mention whether it is available to the tap water consumer. Regarding information disclosure, MWAB did nothing more than post the information in its website. This situation was worsened by the dysfunction of the third party, as analysed in section 4.3.5.

## **6.6 Semi-potable tap water and Consumer Coping**

### **Strategy Matrix: two inevitable outcomes**

The previous three sections analysed the limited conditions and the problems of the three agents in Harbin's urban tap water provision system. They formed a Hybrid Institutional Architecture that was only able to supply semi-potable tap water to consumer, who had to treat the semi-potable tap water again in terms of Consumer Coping Strategy Matrix. As shown in Figure 6.7, in this process, there were three limited conditions and six problems that directly promoted the generation of semi-potable tap water and the Consumer Coping Strategy Matrix. As shown in Figure 6.7, they have become the two inevitable outcomes of the Hybrid Institutional Architecture of Harbin's urban tap water provision system.



**Figure 6.7: The inevitable outcomes of the Hybrid Institutional Architecture: semi-potable tap water and the Consumer Coping Strategy Matrix**

### 6.6.1 Semi-potable tap water

The definition of Semi-potable tap water has been presented in section 3.2. The interviewee from water company A admitted that during winter the tap water quality might not meet the New Tap Water National Standard. 'It depended on the season,' he/she said, 'we did not have the advanced water treatment equipment. The problem of low temperature and low turbidity was too tough to be fully solved. [...] It was a tough problem for many cities' tap water provision systems. No effective solution had been offered yet.' Besides this problem, he/she also reiterated the issue of the old pipeline. Similarly, the interviewee from water treatment B claimed that their outlet water was potable tap water, but also implied that there was pollution in the pipeline which could affect the quality of the end water. The interviewee from D also

expressed a similar opinion. '[...]Harbin had a good water source, but when it transferred through the old pipeline and secondary water supply facilities, its quality may have dropped.'

There was no doubt that Harbin's tap water was semi-potable. However, previous research on urban tap water did not outline the intricate interconnections and mutual influences between these three main agents and between their limited conditions and problems. As shown in Figure 6.7, five problems, old urban tap water pipeline, old water treatment equipment, problematic secondary tap water facilities, no plan for potable tap water and the risk of long-distance water transfer all contribute to the form of semi-potable tap water. As analysed before, these five problems by themselves were caused by other limited conditions and problems existing in Harbin's current tap water provision system. Therefore, it could be concluded that Harbin's semi-potable tap water was an inevitable outcome of the function of Hybrid Institutional Architecture of Harbin's urban tap water provision system.

## 6.6.2 Consumer and Consumer Coping Strategy Matrix

The definition of Consumer Coping Strategy Matrix has been introduced in section 3.5. As demonstrated in Figure 6.7, there were three limited conditions and two problems that stimulated the development of the Consumer Coping Strategy Matrix.

In the first sociogenic water sustainability crisis, fragmented water distribution and low quality tap water dramatically promoted the Low Cost Traditional Coping Strategy. The traditions of boiled water and self-drilled water well still played a pivotal role. Meanwhile, in this process, the government kept a tacit consent in its uncontrolled development, causing the overexploitation of Harbin's groundwater.

In the second sociogenic water sustainability crisis, a severe pollution in water source and a problematic information disclosure intensified consumer's powerlessness. Tap water was not manageable anymore for those consumers who relied on Tap Water Coping Strategy. Thus, Non-Tap-Water Coping Strategy boomed quickly. Consequently, in the following four years, consumer's institutional distrust in semi-potable tap

water was nourished by their social memory of water crisis, which significantly reduced the sale of tap water.

During these periods, the water rates was always kept to a relatively low degree, which partially justified the supply of semi-potable tap water. Whereas media continued its reports about the water pollution issues and low quality tap water, a problematic information disclosure between government departments and consumer further blocked consumer from accessing the information and knowledge of water quality. It was just in this context that the market had offered a series of products such as bottled water, barrelled water, and domestic water filtration equipment as alternatives and auxiliaries for tap water.

Given that, the interviewee from A claimed that 'the people have been misled by many rumours'. He/she insisted that 'I only drank tap water. I believed that it was the best water among other options'. He/she also believed that the standard of bottled water and barrelled water was not as professional as tap water, and the companies of bottled water and barrelled water were also not as regulated as SOE. 'They do not have a regulated market, a regulated production process, a regulated monitoring system and regulated business administration. All of these deficient regulations might have contributed to the low quality of their production.' Given that, he/she believed that tap water was the safest water for consumers. 'Compared to western countries where the regulation was much more effective, in China the consumer had no idea what was inside their beverage. So the safest way of drinking water was to drink tap water.'

The interviewee from A also criticised the domestic tap water filtration equipment. 'The service life of domestic water filtration equipment was limited, and they could not have the same function as the filtration equipment we used in tap water treatment plants. They might not be replaced for years. Thus, it might intensify the pollution. In the water treatment plant, there was a strict rule to change the filter every two months and to change the supplements every three months. There was also a rule to wash the equipment every five months. No matter what kind of domestic water filtration consumers were using, they could not maintain the equipment as frequently as we did, and they did not have the equipment to change and modify the filtration equipment as we did.'

However, besides his/her opposition to High Cost Commercial Coping Strategy, he implicated his support to Low Cost Traditional Coping Strategy, arguing in particular that drinking boiled tap water instead of other beverages was good for children's health.

The interviewee from D expressed a similar opinion, emphasising that there were risks of secondary pollution in bottled water and barrelled water. He/she claimed that he/she only drank tap water and thought it was the safest choice. He/she also implicated his/her normalisation to Low Cost Traditional Coping Strategy through arguing that 'it was not necessary to have a large amount of residual chlorine if we boiled water'. This means that he/she had considered boiling water as an individualised domestic disinfect method that could contribute to water treatment processes of 'source to consumer' urban semi-potable tap water provision system.

These two interviewees' attitudes evidenced a fact that even for those water experts, boiled water was normalised as a 'natural' composition of the general urban tap water provision system, not to mention what general consumer thought about it. Thus, an important question was raised: what influence did the Consumer Coping Strategy Matrix impose on the 'source to consumer' urban semi-potable tap water provision system?

To some extent, this question could be answered by the following quotations said by the interviewee from A: 'Some rich cities in China had abundant funds, but they did not consider water supply to be an important issue. They thought that since there was no problem for people to drink tap water for dozens of years, why should we invest our funding in it? The people had no idea about the tap water quality, and thus even if it improved through government funding, people would not appreciate it. Therefore, the leaders of counties and cities placed little attention on water supply. They only wanted to guarantee the basic quality of tap water to the degree that it would not cause any health problems and social crises. There were many other fields where they could invest their funds.'

The above statement had clarified the influence of the Consumer Coping Strategy Matrix on the Hybrid Institutional Architecture: to guarantee the basic semi-potable quality of tap water. As shown in Figure 6.8,

with that quality being guaranteed, there were no other stimulations for the government to improve tap water quality at all. In other words, all limited conditions of the Hybrid Institutional Architecture would keep without any amendments, which would then continue to make semi-potable tap water and the Consumer Coping Strategy Matrix inevitable outcomes of the urban tap water provision system. As has been argued in Chapter 3, since the Consumer Coping Strategy Matrix becomes the ultimate solution of all systematic problems demonstrated before, it contributes to the stability and the self-balance of the Hybrid Institutional Architecture, making it resist to any external stimulations for progressing.

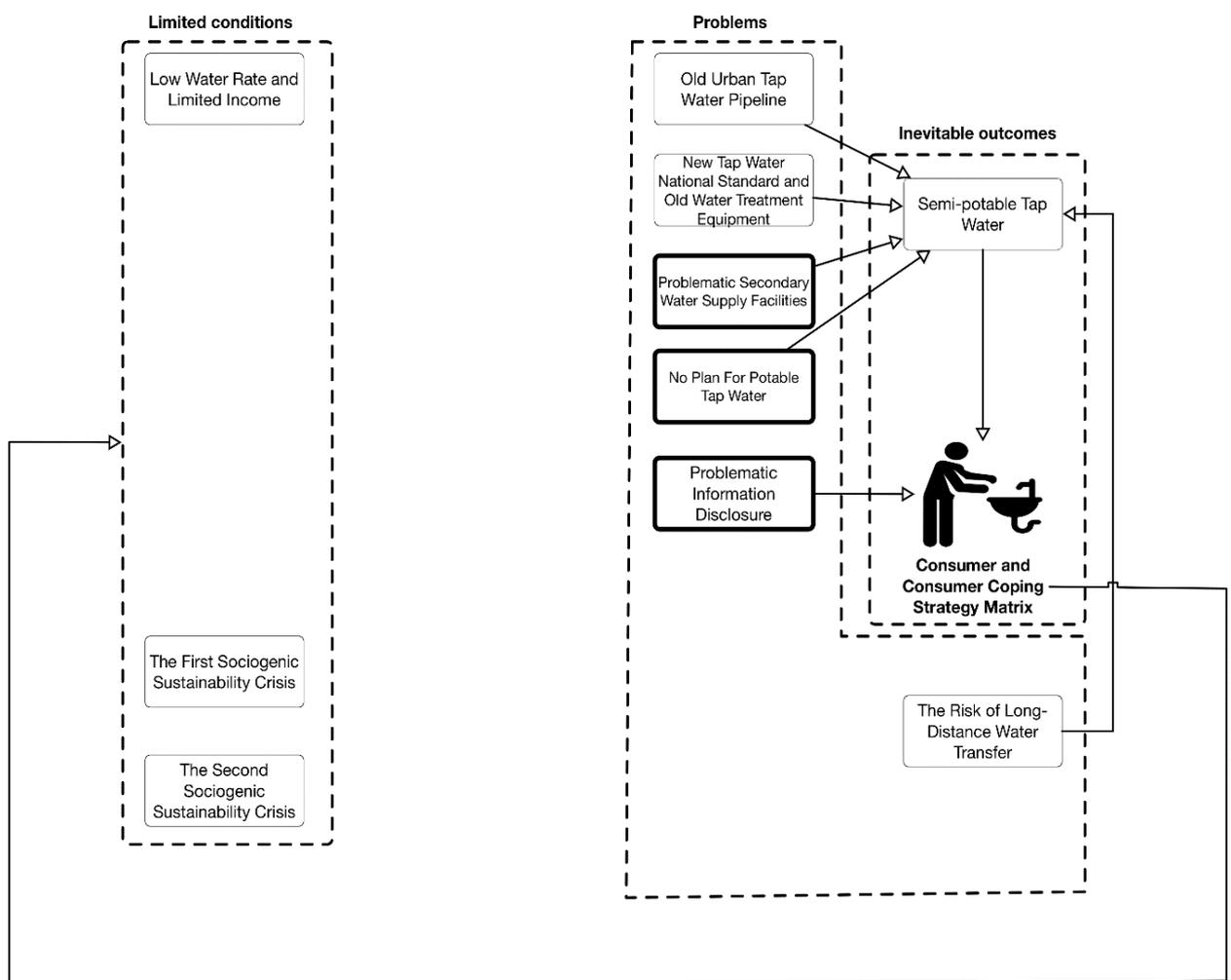


Figure 6.8: The influence of Consumer Coping Strategy Matrix on the Hybrid Institutional Architecture

## 6.7 Conclusion

On the basis of interview materials from four interviewees from key positions, this chapter demonstrates the Hybrid Institutional Architecture of Harbin's urban tap water provision system. Through highlighting the limited conditions, the problems and the inevitable outcomes of the three major agents in tap water provision system, it illustrates the complicated synchronisation of the Hybrid Institutional Architecture that has been ignored in previous research for a long time. The emergence of semi-potable tap water and the Consumer Coping Strategy Matrix cannot be attributed to any single problem or the limited condition existing in any single agent in the system. It needs to be recognised and studied as an inevitable outcome of the interactions between multiple limited conditions and problems. As the result of the Consumer Coping Strategy Matrix, the general system keeps in a stable self-balance status and is immune from any internal or external stimulations. Therefore, a vicious circle between the Hybrid Institutional Architecture and the Consumer Coping Strategy Matrix is established, which further strengthens the existence of both, whereas nourishing and justifying the consumer's Institutionalised distrust in semi-potable tap water.

# Chapter 7 Conclusion

## 7.1 The retrospection of research rationale

In terms of an analysis of interview materials, previous Chapter present a concrete case study of Hybrid Institutional Architecture in Harbin's current urban tap water provision system. This section aims to retrospect the answer of three subordinate research questions and one main research question raised in Section 1.2. It illustrates the main contributions of theoretic thread functioning as the skeleton of this thesis analysis.

The first subordinate research question is: what kind of tap water is supplied to China's tap water consumer? To reply this question, this thesis coined two concepts, the semi-potable tap water, and potable tap water, to describe the quality of tap water supplied from China's current urban tap water provision system from consumer's perspective. Semi-potable tap water is defined as the tap water supplied from 'source to consumer' urban semi-tap water provision system with a semi-potable quality that demands extra treatments to have a potable quality. Meanwhile, potable tap water is defined as the tap water that has been treated by the consumer through extra treatment to have potable quality in the 'consumer to sip' potable water production process. These two definitions highlight the fact that given tap water's distinctive quality degree between undrinkable water and potable water, consumer coping strategies and consumption work need to be adopted to transform the semi-potable tap water into potable tap water.

The second subordinate research question is: on the basis of the answer to the first question, what kind of system is supplying the aforementioned tap water? To answer this question, this thesis first identifies China's current urban tap water provision system as a 'source to consumer' semi-potable tap water provision system. To highlight the core of this system, this thesis coined the concept of Hybrid Institutional Architecture. The Hybrid Institutional Architecture is defined as an institutional architecture of China's

urban tap water provision system that encapsulates the institutional incoherencies in power/money/water flows and embodies them into hybrid components in administration and operation of the system. As the outcome of the Hybrid Institutional Architecture, 'source to consumer' tap water provision system is only capable of producing semi-potable tap water, which gives rise to the emergence of 'consumer to sip' potable water production process, which enables consumers to adopt Consumer Coping Strategy Matrix to produce potable water by themselves. The combination of 'source to consumer' semi-potable tap water provision system and 'consumer to sip' potable water production process forms a 'source to sip' urban potable water provision system, which, to a large extent, disguises the systematic flaws existing in its two subordinate systems.

Chapter 4 examined the three institutional incoherencies in power/money/water flows respectively. The institutional incoherency in power flow was examined through institutional analysis of legal, policy and administration aspects of urban tap water provision system, along with a discussion of dysfunction of the third party, such as NGOs and industrial associations. The institutional incoherency in money flow was demonstrated through analyses of China's tap water rates and marketization reform of urban public utility. Finally, the institutional incoherency in water flow was illustrated from two aspects: the developmental trajectory of China's water standards, and the comparison between strict standard and the grim situation of China's fresh water. Moreover, to unveil the Hybrid Institutional Architecture in a practical sense, Chapter 6 presented a case study of Harbin's current tap water provision system based on interview materials.

The third subordinate research question is: on the basis of the answers to the first and second question, what are the consumer's reactions and responses in the aforementioned tap water and tap water provision system? To answer this question, the definition of Consumer Coping Strategy Matrix is coined in this thesis. It is defined as a matrix of all China's tap water consumer's coping strategies in dealing with semi-potable tap water. This concept integrates the meanings of two concepts introduced in Chapter 1, consumer coping strategy and consumer's consumption work. It has seven facilitating factors: tradition,

government's tacit consent, market, media's propaganda, low tap water rate, water crises and social memory, and knowledge and information gap. As a production process of potable water, it makes the consumer share the responsibility of water production with other agents in 'source to consumer' urban semi-potable tap water provision system. Moreover, there is a mutual self-reinforcement between the normalisations of the Hybrid Institutional Architecture, semi-potable tap water, and Consumer Coping Strategy Matrix, which enables the stable and self-balanced operation of 'source to consumer' urban semi-potable tap water provision system.

The main research question of this thesis is: what is the consumer's institutional trust and/or distrust in China's tap water? Given the answers to all three subordinate research questions, this thesis highlights three factors: consumer's powerlessness in 'source to consumer' semi-potable tap water provision system, consumer's dual identities in 'consumer to sip' potable water production process, and the problematic public propaganda. Accordingly, this thesis argues that Chinese tap water consumer has an institutionalised distrust in semi-potable tap water. This institutionalised distrust is evidenced in the prevalent adoption and normalisation of Consumer Coping Strategy Matrix. The outcome of such an institutionalised distrust is catastrophic. The combination of Hybrid Institutional Architecture and Consumer Coping Strategy Matrix have formed a dialectical relationship with the water crisis. On the one hand, they stimulate the development of each other mutually. On the other, they also keep a balance with each other. Once this balance is thrown off, a sociogenic water sustainability crisis would outbreak. The outbreak of sociogenic water sustainability crisis demands a certain contingent combination model composed of five interconnected conditions: history condition, geography condition, political condition, environmental condition, and culture condition. Chapter 5 presents case studies of two sociogenic water sustainability crises occurred in Harbin. The first crisis is water scarcity and overexploitation of the groundwater resource; the second is Songhua River Toxic Spill Crisis.

## 7.2 The recapitulation of basic findings

According to the retrospection of research rationale, this section summarises the basic findings of this thesis.

First, this thesis coined a series of crucial yet undeveloped concepts: the semi-potable tap water, the Hybrid Institutional Architecture, the Consumer Coping Strategy Matrix, the normalisation of semi-potable tap water, the institutionalised distrust in semi-potable tap water, and the incoherencies in power/money/water flows, and the sociogenic water sustainability crisis. As has been emphasised in Chapter 1, none of these concepts has been systematically examined in the context of China in previous literatures.

Second, by presenting the definitions of these concepts, this thesis also illustrates their interconnections. The Hybrid Institutional Architecture and incoherencies in flows of power, money, and water result in the general and widespread phenomenon of the normalisation of semi-potable tap water and institutional distrust for the consumer, plus the Consumer Coping Strategy Matrix. The imbalance between the Hybrid Institutional Architecture, the Consumer Coping Strategy Matrix, and the water crisis also performs as the trigger of systemic generation of sociogenic water sustainability crises and water scandals of various kinds. This is evidenced by the Harbin case study and the information on ground and surface water resources, which demonstrates the systemic inability to modify the institutional architecture to reduce the frequency and risks of sustainability crises and the lack of transparency and accountability for crises when they are occurring. As a vicious circle, all of these contributes to the institutionalisation and normalisation of distrust.

Third, the in-depth analysis of these concepts also speaks back to the theoretical frameworks reviewed in Chapter 2. The concept Hybrid Institutional Architecture is established on the basis of Harvey's concept of Instituted Economic Process and Swyngedouw's concept of nexus of power/money/water. The former provides a 'source to sip' holistic analytical perspective to analysis the tap water provision system; the

latter highlights the intertwining of water's tangible physical attributions and intangible elements such as power and money. Moreover, Wittfogel, Swyngedouw, Bakker, Molle and Kaika highlight the internal political incoherency in water resources administration mechanisms in other countries; Polanyi and Bakker's theoretical accounts paves the way for an analysis of the inconsistency in money flow that circulating in and encapsulated by Hybrid Institutional Architecture. Meanwhile, the definition of Hybrid Institutional Architecture contributes to these theoretical accounts as a concrete case reflecting the political and economic incoherency existing in China. Compared to abstract theoretical accounts, it functions more like a practical summarization of how all these accounts would really operate in a specific context that has never been fully investigated yet. Likewise, the concept of Consumer Coping Strategy Matrix is also built up on the ground of Harvey's concept of Consumer Coping Strategy and Glucksmann's concept of Consumer Consumption Work. It opens up a new research perspective for these two concepts, which enriches their potential and boots their explanation power in the context China. As can be expected, it will bring up more in-depth research on consumer's coping strategy and consumption work.

Fourth, this thesis expands the research scope of urban tap water provision from the limited, conditioned research perspectives focusing on science, technology, and engineering to consumer's behaviours, attitudes, and reactions. This is the first research that stresses the consumer's coping strategy in China's urban tap water provision system and its associated influences on the development of this system. The concept of Consumer Coping Strategy Matrix has a huge academic potential, because it can be used to explain not only China's tap water provision system, but also many other issues such as food consumption, and can be related to the analysis of other important themes, such as China's air pollution.

Fifth, this thesis also elaborates the discussion in three themes that have not been fully explored in China's academia, the power conflict between government departments, the development trajectory of water standards, and the essential reason for the prosperous market of bottled and barrelled water. The analyses around these themes provided a powerful theoretical probe for this thesis to establish a distinctive theoretical framework other than many research on China's urban tap water provision.

Sixth, this thesis coined the concept of the contingent combination model of China's sociogenic water sustainability crisis in the case study of Harbin. This analysis not only differentiates the sociogenic aspect of sustainability crisis but also provides a new research optic for scholars and government officials to scrutinise the causes and influence of water crisis, so as to have new modifications in their research on and response to the water crisis.

Seventh, the example of water is symptomatic of the wider societal phenomenon of incidences of pollution scandals, construction failures, environmental degradations, etc. As such, this thesis makes a strong case about water, but one of much wider significance to a range of other environmental and social challenges.

### **7.3 Living with distrust: the latent social injustice**

Living with institutional distrust, it seems like Chinese tap water consumer's powerlessness has been normalised in line with the normalisation of semi-potable tap water, the Hybrid Institutional Architecture, and the Consumer Coping Strategy. As has been discussed in section 3.6 and 3.8, it is such normalisation and its mutual self-reinforcement that makes consumer's dual roles and their coping strategies 'invisible' in the general 'source to sip' potable water provision system. Thus, consumer's powerlessness, as well as its associated social injustice, are perfectly veiled by such seemingly potable tap water provision system, whose operation is fully relying on the combination of 'source to sip' urban semi-potable tap water provision system and 'consumer to sip' potable water production process. In other words, a huge social injustice is nourished by the normalisation and implementation of consumer coping strategies in China. With a consumer stratification from Consumer Coping Strategy Matrix (introduced in section 3.5.5), those who are in higher class always keep stronger Consumer Coping Capacity to deal with sociogenic sustainability crises.

Such social justice has three aspects: consumer's institutional distrust in semi-potable tap water, the stability and self-balance of Hybrid Institutional Architecture, and the consumer's stratification based on Consumer Coping Strategy Matrix.

To consumers, they are living with institutional distrust in tap water, which also can be considered as a type of institutional insecurity in society. As section 3.9 has shown, Hybrid Institutional Architecture and Consumer Coping Strategy Matrix has formed a dialectical balance with the water crisis. Thus, once a water crisis is serious enough to outweigh the combination of the two, the latent social injustice and consumer's powerlessness would turn the consumer into the trigger of sociogenic water sustainability crises as has happened twice in Harbin's history, as demonstrated in Chapter 5. It is only in these crises that such social injustice and consumer powerlessness become 'visible' to the public.

However, it is extremely important to note here that the strong stability and self-balance of the Hybrid Institutional Architecture in 'source to consumer' urban semi-potable tap water provision system is by itself the root of consumer's powerlessness, and the biggest contribution to the form of the latent social injustice behind such powerlessness. The power gap between consumer and the Hybrid Institutional Architecture has reached a high level that it has been normalised by both the officials working in the architecture and consumers themselves. Such normalisation has been revealed in the case study of Chapter 6.

Finally, section 3.5.5 demonstrates the consumer's stratification based on Consumer Coping Strategy Matrix. Presumably, this stratification has intricate connections with consumer's stratification based on other variations, particularly residence location and personal income. However, such argument needs to be examined by practical studies in the future.

This stratification is latent because the institutional inconsistency in flaws of power/money/water of the Hybrid Institutional Architecture are, to a large extent, disguised by the compensation of 'consumer to sip' potable water production process and the consumer's normalisation. However, as has been highlighted before, once the dialectical balance between water crisis and the seemingly 'source to sip' urban potable

tap water provision system break out, it would immediately expose the social injustice behind the consumer stratification, making the most vulnerable people suffer the most destructive pollution.

How to counteract such latent social injustice is still an open question. However, what can be assured is that consumers must develop an awareness to 'de-normalise the normalisation'. In other words, the normalisation of semi-potable tap water, the Hybrid Institutional Architecture, the 'consumer to sip' potable water production process, and the consumer's powerlessness and insecurity must be 'de-normalised' to reveal and capture the social injustice hiding inside them. It is only by identifying and acknowledging such social injustice can China's current urban tap water provision system begin to make progress. Thus, the author of this thesis would like to elaborate his research in this field in the future with a dream that Chinese consumers can enjoy their deserved potable tap water as their peers in developed countries.

# References

- Anderson, S., Hamilton, K. and Tonner, A., 2016. Social labour: Exploring work in consumption. *Marketing Theory*, 16(3), pp.383–400.
- Anon 2004. *Trust and Distrust In Organizations: Dilemmas and Approaches*. Russell Sage Foundation.
- Bachmann, R. and Zaheer, A., 2006. *Handbook of Trust Research*. Edward Elgar Publishing.
- Bakich, O., 2000. Emigre Identity: The Case of Harbin. *South Atlantic Quarterly*, 99(1), pp.51–76.
- Bakker, K. and Bridge, G., 2006. Material worlds? Resource geographies and the 'matter of nature'. *Progress in Human Geography*, 30(1), pp.5–27.
- Bakker, K., 2005. Neoliberalizing Nature? Market Environmentalism in Water Supply in England and Wales. *Annals of the Association of American Geographers*, 95(3), pp.542–565.
- Bakker, K., 2007. Trickle Down? Private sector participation and the pro-poor water supply debate in Jakarta, Indonesia. *Geoforum*, 38(5), pp.855–868.
- Bakker, K., 2013. *Privatizing Water*. Cornell University Press.
- Bakker, K.J., 2003. From public to private to ... mutual? Restructuring water supply governance in England and Wales. *Geoforum*, 34(3), pp.359–374.
- Banerjee, S., Bowie, N.E. and Pavone, C., 2006. *An Ethical Analysis of the Trust Relationship*. Edward Elgar Publishing, pp.303–317.
- Barnett, J., Rogers, S., Webber, M., Finlayson, B. and Wang, M., 2015. Sustainability: Transfer project cannot meet China's water needs. *Nature*, 527(7578), pp.295–297.
- Beck, U., 1992. From Industrial Society to the Risk Society: Questions of Survival, Social Structure and Ecological Enlightenment. *Theory, Culture & Society*, 9(1), pp.97–123.
- Beijing Consumer Association, 2001. Beijing water supply contract is abolished (Text in Chinese). [online] ah315.cn. Available at: <<http://www.ah315.cn/display.asp?id=4960>> [Accessed 3 Mar. 2017].
- Braudel, F., 1992. *Civilization and Capitalism, 15th-18th Century: The structure of everyday life*. Univ of California Press.
- Bromiley, P. and Harris, J., 2006. *Trust, Transaction Cost Economics, and Mechanisms*. Edward Elgar Publishing, pp.124–143.
- Bulletin of First National Census for Water (Text in Chinese)*. pp.1–22.
- Chen, M., 2009. Why Chinese drink hot water and Westerners drink cold water (Text in Chinese). [online] blog.sina.com.cn. Available at: <[http://blog.sina.com.cn/s/blog\\_4bbb74a50100csd3.html](http://blog.sina.com.cn/s/blog_4bbb74a50100csd3.html)> [Accessed 3 Mar. 2017].
- Chen, M., 2008. 城市供水管网水质二次污染与防治对策. *净水技术*, 27(5), pp.5–9.

- Cheng, M., Chen, X. and Zhou, M., 2002. 60起管网及二次供水污染事故分析. *环境与健康杂志*, 19(1), pp.91–93.
- Cheng, Z., 2006. *Drinking Water from Mopanshan Reservoir (Text in Chinese)*. p.002.
- China Water Safety Charity Fund, 2015. *Report of 29 Cities' tap water quality (Text in Chinese)*. [online] *finance.cnr.cn*. Available at: <[http://finance.cnr.cn/gundong/20150201/t20150201\\_517597645.shtml](http://finance.cnr.cn/gundong/20150201/t20150201_517597645.shtml)> [Accessed 11 Mar. 2015].
- China Water Supply Service Promotion Alliance, 2013. *Research reports on the satisfaction rate of urban drinking water supply service of 70 cities in China*. pp.1–53.
- China Youth Daily., 2005. *The timeline of Songhua River Spill Incident (Text in Chinese)*. [online] *news.qq.com*. Available at: <<http://news.qq.com/a/20051203/000452.htm>> [Accessed 3 Dec. 2016].
- Coleman, J.S. and Coleman, J.S., 1994. *Foundations of Social Theory*. Harvard University Press.
- Cosier, M. and Shen, D., 2009. *Urban Water Management in China*. *International Journal of Water Resources Development*, 25(2), pp.249–268.
- Cosson, M. and Giusta, M.D., 2004. *The Costly Business of Trust*. *Development Policy Review*, 22(3), pp.321–342.
- Cronon, W., 2009. *Nature's Metropolis: Chicago and the Great West*. W. W. Norton & Company.
- Crow-Miller, B., 2015. Discourses of deflection: The politics of framing China's South-North water transfer project. *Water Alternatives*, 8(2), pp.173–192.
- Cui, Z., 2008. 磨盘山,污染逼近新水源. p.004.
- de Freitas, C., Marston, A.J. and Bakker, K., 2015. Not-quite-neoliberal natures in Latin America: An introduction. *Geoforum*, 64(C), pp.239–245.
- Deng, G., 2002. *Water environment pollution situation and control- Case of Harbin city (Text in Chinese)*. *黑龙江水利科技*.
- Dong, L. and Wang, P., 2013. 城市供水服务满意度评价体系构建研究. *水利经济*, 31(2), pp.35–39.
- Dongbeinet, 2006. “三人班”“大贵”两村曾计划搬迁 磨盘山水源地保护法规尚未出台-磨盘山-黑龙江新闻. [online] *heilongjiang.dbw.cn*. Available at: <<http://heilongjiang.dbw.cn/system/2006/04/28/050377538.shtml>> [Accessed 23 Jun. 2015].
- Dongbeinet, 2007. 磨盘山隐忧牵动冰城 2006龙江记忆之二十二\_黑龙江新闻网. [online] *hljnews.cn*. Available at: <[http://www.hljnews.cn/fouxw\\_yw/2007-02/06/content\\_162434.htm](http://www.hljnews.cn/fouxw_yw/2007-02/06/content_162434.htm)> [Accessed 23 Jun. 2015].
- Dongbeinet, 2009. *Farewell to Songhua River (Text in Chinese)*. [online] *heilongjiang.dbw.cn*. Available at: <<http://heilongjiang.dbw.cn/system/2009/11/13/052211760.shtml>> [Accessed 13 Jun. 2015].
- Dongbeinet, 2011. 哈尔滨水源地磨盘山水库亟待清源得‘法’-磨盘山-东北网黑龙江. [online] *heilongjiang.dbw.cn*. Available at: <<http://heilongjiang.dbw.cn/system/2011/08/09/053326418.shtml>> [Accessed 22 Jun. 2015].

- Dongbeinet, 2012. 《哈尔滨市磨盘山水库饮用水水源保护条例》11月实施-磨盘山,饮用水-东北网黑龙江. [online] heilongjiang.dbw.cn. Available at: <<http://heilongjiang.dbw.cn/system/2012/10/31/054334582.shtml>> [Accessed 22 Jun. 2015].
- Donghao Ren, Xin Zhang, Zhenhuang Wang, Jing Li and Xiaoru Yuan, 2014. WeiboEvents: A Crowd Sourcing Weibo Visual Analytic System. 2014 IEEE Pacific Visualization Symposium (PacificVis). IEEE, pp.330–334.
- Guan, E., 2015. 中國變革六十年: 關爾回憶錄(一) .
- Farrell, H., 2004. Trust, distrust, and power. *Distrust*.
- Glucksmann, M.A., 2009. Formations, Connections and Divisions of Labour. *Sociology*, 43(5), pp.878–895.
- Glucksmann, M.A., 2013. Working to consume: consumers as the missing link in the division of labour.
- Gong, J. and Liu, H., 2012. The truth of tap water (Text in Chinese) . [online] weekly.caixin.com. Available at: <<http://china.caixin.com/2012-05-07/100387396.html>> [Accessed 22 Jun. 2015].
- Gopal, K., Tripathy, S.S., Bersillon, J.L. and Dubey, S.P., 2007. Chlorination byproducts, their toxicodynamics and removal from drinking water. *Journal of Hazardous Materials*, 140(1), pp.1–6.
- Goss, J., 2006. Geographies of consumption: the work of consumption. *Progress in Human Geography*, 30(2), pp.237–249.
- Granovetter, M., 2008. The Impact of Social Structure on Economic Outcomes. *Journal of Economic Perspectives*, 19(1), pp.1–19.
- Guidance on experimental work of water rates cost disclosure (Text in Chinese)*.pp.1–6.
- Gurtman, M.B., 2004. Trust, Distrust, and Interpersonal Problems: A Circumplex Analysis. *Journal of Personality and Social Psychology*, 62(6), pp.1–14.
- h2o-china.com, 2003. Treasury bonds will fade in water infrastructure investement (Text in Chinese). [online] h2o-china.com. Available at: <<http://www.h2o-china.com/news/18042.html>> [Accessed 3 Mar. 2017].
- Harbin Daily, 2008. The approaching pollution to Mopanshan Reservoir (Text in Chinese). [online] news.sina.com.cn. Available at: <<http://news.sina.com.cn/c/2008-03-24/011413620319s.shtml>> [Accessed 18 Jun. 2015].
- Harbin Municipal Archives Bureau, 2014. History of Harbin's urban drinking water provision (Text in Chinese). [online] hrb-dangan.gov.cn. Available at: <<http://www.hrb-dangan.gov.cn/rdzt/lyxgslzt/2014/05/12325.html>> [Accessed 13 Jun. 2014].
- Harbin Municipal Government, 1998a. *Harbin Municipal Chorography: The Construction of Municipal Public Facilities* (Text in Chinese) . 黑龙江人民出版社, pp.1–30.
- Harbin Municipal Government, 1998b. *Harbin Municipal Chorography: The Urban Plan* (Text in Chinese) . 黑龙江人民出版社, pp.1–16.

- Harbin Municipal Government, 1999. *Harbin Municipal Chorography: The Population* (Text in Chinese). 黑龙江人民出版社.
- Harbin Municipal Government, 2003. 哈尔滨市人民政府关于磨盘山水库供水工程输水管线临时用地有关事宜的通告. [online] harbin.gov.cn. Available at: <<http://www.harbin.gov.cn/info/news/index/detail1/311356.htm>> [Accessed 20 Jul. 2015].
- Harbin Municipal Government, 2007a. Historical Evolution. [online] harbin.gov.cn. Available at: <[http://www.harbin.gov.cn/english/Harbin\\_Overview/Historical\\_Evolution.htm](http://www.harbin.gov.cn/english/Harbin_Overview/Historical_Evolution.htm)> [Accessed 29 Sep. 2015a].
- Harbin Municipal Government, 2007b. 哈尔滨市人民政府关于磨盘山水库供水二期配水管网工程建设临时用地有关事宜的通告. [online] harbin.gov.cn. Available at: <<http://www.harbin.gov.cn/info/news/index/detail1/195035.htm>> [Accessed 20 Dec. 2015b].
- Harbin Municipal Government, 2009. 哈尔滨市调整城市居民生活供水价格相关情况新闻发布会实录-中国哈尔滨. [online] harbin.gov.cn. Available at: <<http://www.harbin.gov.cn/info/news/zwxxgk/xwfb/detail/117022.htm>> [Accessed 12 Jan. 2017].
- Harbin Railway Yearbook Edition Committee, 2006. *Harbin Railway Yearbook 2005* (Text in Chinese). pp.1-1.
- Harbin Statistic Bureau, 2014. *Harbin Statistical Yearbook*. China Statistics Press.
- Harbin Yearbook Editing Committee, 1987. *Harbin Yearbook 1985-1986* (Text in Chinese). pp.1-4.
- Harbin Yearbook Edition Committee, 2014. *Harbin Yearbook 2013* (Text in Chinese). pp.1-3.
- Hardin, R., 2002. *Trust and Trustworthiness*. Russell Sage Foundation.
- Harvey, D., 2001. *Spaces of Capital*. Taylor & Francis.
- Harvey, M., 2015. *Drinking Water: A Socio-Economic Analysis of Historical and Societal Variation*. Routledge.
- Heilongjiang News Net, 2006. 20个月女童坠入口径25厘米的废井 营救过程一波三折-救助-黑龙江新闻. [online] heilongjiang.dbw.cn. Available at: <<http://heilongjiang.dbw.cn/system/2006/09/04/050538497.shtml>> [Accessed 28 Oct. 2015].
- Heilongjiang News Net, 2009. 哈尔滨供水单位罗列涨价理由：磨盘山工程是主因-水,价-东北网黑龙江. [online] heilongjiang.dbw.cn. Available at: <<http://heilongjiang.dbw.cn/system/2009/12/09/052257342.shtml>> [Accessed 12 Jan. 2017].
- Heilongjiang Scientific Consultative Committee, 2011. The research on emergency response of Songhua River Toxic Spill Incident. [online] hljskgw.org. Available at: <[http://www.hljskgw.org/news\\_n.asp?id=525&did=5](http://www.hljskgw.org/news_n.asp?id=525&did=5)> [Accessed 5 Dec. 2016].
- Hu, A. and Wang, Y., 2003. How to establish water-saving society in China. *Study on National Conditions*.
- Hu, J., 2001. In Order to Have Freshwater (Text in Chinese). p.002.

- Huang, C.C., Deng, G., Wang, Z. and Edwards, R.L., 2013. *China's Nonprofit Sector: Progress and Challenges*. Transaction Publishers.
- Huang, T., Liu, H., Shi, G., Ding, S. and Mao, C., 2006. Analysis on departmental interests conflict in reform of integritied administration of water affair in Zibo city (Text in Chinese). *水利经济*, 12(1).
- Huang, Y. and Chen, X., 2000. Water Demand Management Present and Development Trend of China (Text in Chinese) . *水科学进展*.
- Ji, H., 2011. Seeking For New Water Source (Text in Chinese). p.C02.
- Ji, P., 2010. Research on China's Urban Water rates Reform.
- Jia, Z., 2000. 中国建设项目审计案例. 清华大学出版社.
- Kaika, M., 2003. Constructing Scarcity and Sensationalising Water Politics: 170 Days That Shook Athens. *Antipode*, 35(5), pp.919–954.
- Kirschner, L.A. and Grandy, E.B., 2006. The Songhua River Spill: China's Pollution Crisis. *Natural Resources & Environment*.
- Kong, S., Gu, P. and Jia, L., 2011. Condition and Utilization of Water resources in Harbin City (Text in Chinese). *黑龙江环境通报*.
- Li, S., 2000. *Chronological History of Harbin* (Text in Chinese) .
- Li, Z., 1997. 评魏特夫的《东方专制主义》 *Commentary on 'Oriental Despotism: A Comparative Study of Total Power'* (Text in Chinese). 中国社会科学出版社.
- Li, Z., 2012. The dream of clean water in Harbin (Text in Chinese). [online] nbd.com.cn. Available at: <<http://www.nbd.com.cn/articles/2012-02-08/632374.html>> [Accessed 18 Jun. 2015].
- Liang, C. and Yang, D., 2006. *Crisis and breakthrough of China's environment 2005* (Text in Chinese). 社科文献出版社.
- Lin, H. and Han, X., 2007. Problems and Suggestions of Mopanshan Reservoir's Water Source Protection (Text in Chinese). pp.1–2.
- Ling, W., 2012. 茶叶与早期东方城镇的发展. [online] puercn.com. Available at: <[http://www.puercn.com/czs/cycg/19783\\_2.html](http://www.puercn.com/czs/cycg/19783_2.html)> [Accessed 3 Mar. 2017].
- Liu, B. and Speed, R., 2009. Water Resources Management in the People's Republic of China. *International Journal of Water Resources Development*, 25(2), pp.193–208.
- Liu, H., 2016. Bottled water consumption and production in China are expected to boom, posing increased environmental threats, writes Liu Hongqiao. chinadialogue.net.
- Liu, J., 2004. 五常大力发展十大特色产业. p.002.
- Liu, S. and Wan, X., 2005. 饮用水氯消毒及余氯控制技术展望. *水土保持研究*, 12(5), pp.268–270.
- Liu, X., 2015. The capacity of China's Environmental Protection NGOs need to be strengthened. [online] h2o-china.com. Available at: <<http://www.h2o-china.com/news/227342.html>> [Accessed 17 Apr. 2016].

- Liu, Z., 2002. 水资源统一管理的体制性障碍和前瞻性分析. 中国水利, 2(1), pp.17–20.
- Long, C.P. and Sitkin, S.B., 2006. *Trust in the Balance: How Managers Integrate Trust-Building and Task Control*. Edward Elgar Publishing.
- Luhmann, N., 1979. *Trust*.
- Luo, K., 2014. 自来水安全标准质疑. 10 Oct., pp.1–99.
- Lv, S., 2015. The limitations and reconstruction of China's institution of integrited administration of water affair (Text in Chinese). *水利经济*, 33(2), pp.28–31.
- Ma, L., 1998. 论政府管理中的条块关系. 政治学研究, (4), pp.71–77.
- Ma, Z., Chang, D., Wu, J., Zhou, F. and Chen, H., 2014. *Research Report on Pricing Policies for Water Pollution Prevention & Control*. *nwpcp.mep.gov.cn*.
- McGuire, M.J., 2006. Eight revolutions in the history of US drinking water disinfection - ProQuest. *American Water Works Association Journal*.
- McGuire, M.J., 2014. Boiled in China: A Personal Source of Safe Drinking Water. [online] [safedrinkingwaterdotcom.wordpress.com/boiled-in-china-a-personal-source-of-safe-drinking-water](http://safedrinkingwaterdotcom.wordpress.com/boiled-in-china-a-personal-source-of-safe-drinking-water). Available at: <<https://safedrinkingwaterdotcom.wordpress.com/2014/01/13/boiled-in-china-a-personal-source-of-safe-drinking-water/>> [Accessed 3 Mar. 2017].
- Meyer, S.B. and Ward, P.R., 2009. *Reworking the sociology of trust: making a semantic distinction between trust and dependence*. The Australian Sociological Association.
- Ministry of Environmental Protection, P. R. China General Administration of Quality Supervision, Inspection and Quarantine, 2002. National Environmental Quality Standards for Surface Water. *中国环保产业*, (6), pp.8–9.
- Ministry of Environmental Protection, P. R. China, 2015. 2014 China Environment Conditions Bulletin (Text in Chinese). [online] [jcs.mep.gov.cn](http://jcs.mep.gov.cn). Available at: <[http://jcs.mep.gov.cn/hjzl/zkgb/2014zkgb/201506/t20150605\\_303011.shtml](http://jcs.mep.gov.cn/hjzl/zkgb/2014zkgb/201506/t20150605_303011.shtml)> [Accessed 3 Mar. 2017].
- Ministry of Environmental Protection, P. R. China General Administration of Quality Supervision, Inspection and Quarantine, 2002. 地表水环境质量标准. *中国环保产业*, (6), pp.8–9.
- Ministry of Housing and Urban-Rural Development, 2016. *中国城市建设统计年鉴2015*. 中国建筑工业出版社.
- Ministry of Water Resource, P. R. China, 2005. The guidance on 'deepen the water administration institution reform' (Text in Chinese). [mwr.gov.cn](http://mwr.gov.cn).
- Ministry of Water Resource, P. R. China, 2011. *China Water Statistic Yearbook 2011*. 中国水利水电出版社.
- Ministry of Water Resource, P. R. China, 2014. 2012 China Water Resources Bulletin (Text in Chinese). [online] [mwr.gov.cn](http://mwr.gov.cn). Available at: <[http://www.mwr.gov.cn/zwzc/hygb/szygb/qgszygb/201405/t20140513\\_560838.html](http://www.mwr.gov.cn/zwzc/hygb/szygb/qgszygb/201405/t20140513_560838.html)> [Accessed 4 Apr. 2017].

- Ministry of Water Resource, P. R. China, 2017. 2015 China Water Resources Bulletin (Text in Chinese). [online] mwr.gov.cn. Available at: <[http://www.mwr.gov.cn/zwzc/hygb/szygb/qgszygb/201701/t20170119\\_785887.html](http://www.mwr.gov.cn/zwzc/hygb/szygb/qgszygb/201701/t20170119_785887.html)> [Accessed 3 Mar. 2017].
- Molle, F., Mollinga, P.P. and Wester, P., 2009. Hydraulic bureaucracies: Flows of water, flows of power. *Water Alternatives*.
- Morris, R.D., Audet, A.M., Angelillo, I.F., Chalmers, T.C. and Mosteller, F., 1992. Chlorination, chlorination by-products, and cancer: a meta-analysis. *American Journal of Public Health*, 82(7), pp.955–963.
- Nahapiet, J. and Ghoshal, S., 1998. Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23(2), pp.242–266.
- National Bureau of Statistics, P. R. China, 2011. 哈尔滨市总人口为1063.5万人 南岗人口居各区之首\_大洋网. [online] dayoo.com. Available at: <[http://www.dayoo.com/roll/201105/13/10000307\\_104198994.htm](http://www.dayoo.com/roll/201105/13/10000307_104198994.htm)> [Accessed 27 Oct. 2015].
- National Peoples Congress Standing Committee, P. R. China, 2015. China's Oversees NGO Management Law. [online] npc.gov.cn. Available at: <[http://www.npc.gov.cn/npc/xinwen/lfgz/flca/2015-05/05/content\\_1935666.htm](http://www.npc.gov.cn/npc/xinwen/lfgz/flca/2015-05/05/content_1935666.htm)> [Accessed Apr. 2016].
- National Urban Water Supply Regulation*.
- Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Health (Text in Chinese)*.pp.1–4.
- Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Housing and Urban-Rural Development (Text in Chinese)*.pp.1–5.
- Notice of the General Office of the State Council on Issuing the Provisions on the Main Functions, Internal Bodies and Staffing of the Ministry of Water Resources (Text in Chinese)*.pp.1–3.
- Opinion on Promoting Marketisation Process of Municipal Public Utility Industry (Text in Chinese) .
- Organization Committee of Central Government, 2002. Notice on establish local water affair agency (Text in Chinese). zwgk.gd.gov.cn.
- Pahl, R.E., Wallace, C.D. and Courtenay, G., 1986. Isle of Sheppey Survey, 1981: Divisions of Labour.
- PANYAKAPO, M., SOONTORNCHAI, S. and PAOPUREE, P., 2008. Cancer risk assessment from exposure to trihalomethanes in tap water and swimming pool water. *Journal of Environmental Sciences*, 20(3), pp.372–378.
- Polanyi, K., 1957. *The economy as instituted process*. Trade and market in the early empires.
- Provisional Regulation of Investment in Capital Construction of Water Conservancy (Text in Chinese) .

- Pu, W., 2005. Commentary on 'Guidance on Deepening the Reform of Water Management' (Text in Chinese). [online] h2o-china.com. Available at: <<http://www.h2o-china.com/news/34619.html>> [Accessed 28 Jul. 2016].
- Qin, H. and Qian, P., 2008. The 30 years development of China's urban public utility (Text in Chinese). [online] theory.people.com.cn. Available at: <<http://theory.people.com.cn/GB/49154/49156/8082106.html>> [Accessed 1 Mar. 2017].
- Ray, I., 2007. Women, Water, and Development. *Annual Review of Environment and Resources*, 32(1), pp.421–449.
- Rui-bo, Z., 2007. A Study of Public Crisis Management Leadership—With the Case of Jilin Petrochemical Corporation Explosion and Water Pollution Crisis [J]. *Journal of China Executive Leadership Academy*.
- Seidman, I., 2015. *Interviewing as Qualitative Research*. Teachers College Press.
- Shan, J., 2016. Groundwater 80% polluted. [online] globaltimes.cn. Available at: <<http://www.globaltimes.cn/content/978117.shtml>> [Accessed 28 Jul. 2016].
- Shen, D. and Jiang, S., 2005. The Institutional Analysis of China's Integrative Administration of Water Affair. *水利学报*, 36(09), pp.1143–1146.
- Shen, M. and Chen, F., 2002. 我国水权理论研究述评. *浙江社会科学*, (5), pp.175 – 180.
- Shieh, S. and Brown-Inz, A., 2013. *The Overview of China's NGO*. pp.1–18.
- Simon, H.A., 1972. Theories of bounded rationality. *Decision and organization*.
- Su, Y., Xu, F., Wu, C. and Wu, J., 2005. Why it is Xie Zhenhua (Text in Chinese). [online] southcn.com. Available at: <<http://www.southcn.com/weekend/commend/200512080003.htm>> [Accessed 3 Dec. 2016].
- Sultana, F. and Loftus, A., 2012. *The Right to Water*. Routledge.
- Sun, X., 2009. Introduction: The Development of a Water Rights System in China. *dx.doi.org*, 25(2), pp.189–192.
- Sun, X., Speed, R. and Shen, D., 2013. *WATER RESOURCES MANAGEMENT CHINA*. Routledge.
- Swyngedouw, E., 2004. *Social Power and the Urbanization of Water*. Oxford University Press on Demand.
- Swyngedouw, E., 2005. Dispossessing H2O: the contested terrain of water privatization. *Capitalism Nature Socialism*.
- Swyngedouw, E., 2006. Power, Water and Money: Exploring the Nexus. *Human Development Occasional Papers (1992-2007)*.
- Swyngedouw, E., 2009. The Political Economy and Political Ecology of the Hydro-Social Cycle. *Journal of Contemporary Water Research & Education*, 142(1), pp.56–60.

- Tan, G., 2016. *The Construction and Operation of the Railway in the Middle East (1896-1917): The Development of Russian Forces in China (Text in Chinese)*. 聯經出版事業公司.
- Tao, T. and Xin, K., 2014. Public health: A sustainable plan for China's drinking water. *Nature*, 511(7511), pp.527–528.
- Tao, X. and Ma, Z., 2014. 哈尔滨推进松花江水源工程建设. [online] hlj.xinhuanet.com. Available at: <[http://hlj.xinhuanet.com/wq/2014-11/11/c\\_133781386.htm](http://hlj.xinhuanet.com/wq/2014-11/11/c_133781386.htm)> [Accessed 13 Jan. 2017].
- The guidance on 'deepen the water administration institution reform' (Text in Chinese)*. pp.1–5.
- The People Net, 2000. The Groundwater Over-Exploitation in Harbin (Text in Chinese). [online] people.com.cn. Available at: <<http://www.people.com.cn/GB/channel1/10/20000720/152533.html>> [Accessed 31 Oct. 2016].
- The People Net, 2006. 国家批准磨盘山供水二期工程建设 投资约18.5亿--时政--人民网. [online] politics.people.com.cn. Available at: <<http://politics.people.com.cn/GB/4798734.html>> [Accessed 10 Jan. 2017].
- The State Council's Decision on Promoting the Hydraulic Reform (Text in Chinese)* .pp.1–6.
- The UNEP mission team, 2005. UNEP Report on Chemical Spill Incident in the Songhua River - United Nations Environment Programme (UNEP). [online] unep.org. Available at: <<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=466&ArticleID=5107&l=en>> [Accessed 3 Dec. 2016].
- The World Bank, 2017. Renewable internal freshwater resources, total (billion cubic meters) | Data. [online] data.worldbank.org. Available at: <<http://data.worldbank.org/indicator/ER.H2O.INTR.K3>> [Accessed 3 Mar. 2017].
- TOM, 2015. The successful public relation marketing events in water utility industry in 2015. [online] xiaofei.tom.com. Available at: <<http://xiaofei.tom.com/2015-12-25/0013/26472697.html>> [Accessed Apr. 2016].
- Tong, Z. and Liu, S., 2005. 供水管网水质安全及其保障措施探讨. *净水技术*, 24(1), pp.49–53.
- Trentmann, F. and Taylor, V., 2005. From users to consumers: water politics in nineteenth-century London.
- Vinacke, H.M. and Wittfogel, K.A., 1959. Oriental Despotism: A Comparative Study of Total Power. *The American Historical Review*, 64(2), p.387.
- Wan, R., 2001. 加入WTO后我国供水服务业的应对措施. *中国给水排水*, 17(2), pp.30–31.
- Wang, C., 2009. 哈尔滨水价听证疑点重重. [online] cyol.net. Available at: <[http://www.cyol.net/zqb/content/2009-12/10/content\\_2976051.htm](http://www.cyol.net/zqb/content/2009-12/10/content_2976051.htm)> [Accessed 12 Jan. 2017].
- Wang, J., 2015. 哈市启动松花江供水工程 北建净水厂南开新水源. [online] ifeng.com. Available at: <[http://hlj.ifeng.com/news/detail\\_2015\\_03/01/3598190\\_0.shtml](http://hlj.ifeng.com/news/detail_2015_03/01/3598190_0.shtml)> [Accessed 24 Jun. 2015].
- Wang, H., 2008. 磨盘山水源地保护区内农业生态补偿机制研究. *环境科学与管理*.

- Wang, L., 2010. 1958-1982 Methyl Mercury Pollution in Songhua River(Text in Chinese). China Water Pollution Control and Policy Innovation Conference.
- Wang, M., 2005. ‘水利社会’的类型 The type of hydrualic society (Text in Chinese). 读书.
- Wang, S., 2000. 水权和水市场——谈实现水资源优化配置的经济手段. 中国水利, (11), pp.6 - 9.
- Wang, W., 2012. The truth of the quality of China's domestic drinking water (Text in Chinese). [online] BBC. Available at: <[http://www.bbc.com/zhongwen/simp/focus\\_on\\_china/2012/06/120625\\_cr\\_drinkingwater\\_bywangwei\\_luo.shtml](http://www.bbc.com/zhongwen/simp/focus_on_china/2012/06/120625_cr_drinkingwater_bywangwei_luo.shtml)> [Accessed 21 Nov. 2015].
- Wang, X., 2006. 城市供水系统水质安全性与余氯控制的研究.
- Wang, Y., Duan, H. and Wang, F., 2005. The pain of Songhua River (Text in Chinese). [online] news.sina.com.cn. Available at: <<http://news.sina.com.cn/c/2005-11-28/10518425200.shtml>> [Accessed 3 Dec. 2016].
- Wang, Y. and Bi, L., 2011. 公共规制经济学. 清华大学出版社.
- Water Act of the People's Republic of China 1988 (Text in Chinese).
- Welch, D., 2017. Consumption in Perspective. *Sociology*, 51(4), pp.897–903.
- Wen, J., 2013. 200,000 Wu Chang Residents get Water Supplied From Mopanshan Reservoir (Text in Chinese). p.003.
- Wheeler, K. and Glucksmann, M., 2016. *Household Recycling and Consumption Work*. London: Springer.
- Williams, C., 2012. *Researching Power, Elites and Leadership*. SAGE.
- Wu, C., 2003. 减少部门条块分割,形成协助制度——试论我国环境管理体制的改善. 行政与法, (4), pp.20–22.
- Wu, J., 2015. System-dynamics-based emergency strategy analysis for urban water supply crisis in water pollution accidents caused by dangerous chemicals - A case study of Harbin water crisis caused by explosion of Jilin Chemical Company. *Xitong Gongcheng Lilun yu Shijian/System Engineering Theory and Practice*, 35(3), pp.677–686.
- Xie, J., 2009. *Addressing China's Water Scarcity*. World Bank Publications.
- Xie, L., 2011. 哈尔滨寻水. p.009.
- Xinhua Daily Telegraph, 2014. How does the smelly tap water become standardised? (Text in Chinese). [online] news.xinhuanet.com. Available at: <[http://news.xinhuanet.com/mrdx/2014-03/25/c\\_133211757.htm](http://news.xinhuanet.com/mrdx/2014-03/25/c_133211757.htm)> [Accessed 10 Apr. 2017].
- Xinhuanet, 2005. The experence and lessons of Harbin water suspension emergency (Text in Chinese). [online] gov.cn. Available at: <[http://www.gov.cn/yjgl/2005-11/28/content\\_111595.htm](http://www.gov.cn/yjgl/2005-11/28/content_111595.htm)> [Accessed 7 Dec. 2016].
- Xinhuanet, 2006. The investigation team of State Council for Songhua River Spill Incident has been estalbished (Text in Chinese). [online] chinasafety.gov.cn. Available at:

- <[http://www.chinasafety.gov.cn/wangluocankao/2005-12/06/content\\_148956.htm](http://www.chinasafety.gov.cn/wangluocankao/2005-12/06/content_148956.htm)> [Accessed 3 Dec. 2016].
- Xinhuanet, 2011. Exploring Mopanshan Water Treatment Plant (Text in Chinese). [online] [hlj.xinhuanet.com](http://hlj.xinhuanet.com). Available at: <[http://hlj.xinhuanet.com/news/2011-06/03/c\\_13908917\\_2.htm](http://hlj.xinhuanet.com/news/2011-06/03/c_13908917_2.htm)> [Accessed 13 Feb. 2017].
- Xinhuanet, 2012. The confusion of water quality (Text in Chinese). [online] [news.xinhuanet.com](http://news.xinhuanet.com). Available at: <[http://news.xinhuanet.com/politics/2012-05/10/c\\_111928668.htm](http://news.xinhuanet.com/politics/2012-05/10/c_111928668.htm)> [Accessed 20 Jan. 2016].
- Xinhuanet, 2015. 冰城节水任重道远 哈尔滨水资源利用状况调查. [online] [hlj.xinhuanet.com](http://hlj.xinhuanet.com). Available at: <[http://www.hlj.xinhuanet.com/news/2015-03/23/c\\_134088836.htm](http://www.hlj.xinhuanet.com/news/2015-03/23/c_134088836.htm)> [Accessed 13 Jun. 2015].
- Xu, B. and He, Y., 2002. 改善城市供水管网水质的实践与探讨. *给水排水*, 28(12), pp.13–16.
- Xu, B., 1996. 试论中国水工业. *给水排水*, (2), pp.55–57.
- Xu, L., 1996. 中央专项拨款管理存在的问题. *经济研究参考*, (33), pp.34–35.
- Xu, Y., 2006. Promoting integrated administration of water affair and urban development - empirical research on Chongqing city (Text in Chinese). *城市发展研究*, 13(1), pp.63–66.
- Yan, W., 2015. 规范适度发展凤凰山旅游. [online] [hljjjb.com](http://hljjjb.com). Available at: <<http://www.hljjjb.com/File/hljjjb/2015-5-7/20150506062224.htm?id=59389>> [Accessed 18 Jun. 2015].
- Zhang, B., 2004. *Research on the Integrated Management of Water Affairs in Town and Country (Text in Chinese)*. Tianjin University.
- Zhang, D., 2012. 六年凿山引水 冰城独拥甘泉\_振兴东北. [online] [chinaneast.gov.cn](http://chinaneast.gov.cn). Available at: <[http://www.chinaneast.gov.cn/2012-05/31/c\\_131622141.htm](http://www.chinaneast.gov.cn/2012-05/31/c_131622141.htm)> [Accessed 22 Jun. 2015].
- Zhang, K., Liu, J., Wang, Y. and Li, H., 2005. 二次供水水质污染的现状及其防治措施分析. *山东建筑大学学报*, 20(3), pp.49–51.
- Zhang, X., 2005. Sixteen orders: an on-the-spot report of Harbin's drinking water recovery. [online] [bjwatergroup.com.cn](http://bjwatergroup.com.cn). Available at: <[http://www.bjwatergroup.com.cn/268/2006\\_1\\_5/268\\_2113\\_1136430815328.html](http://www.bjwatergroup.com.cn/268/2006_1_5/268_2113_1136430815328.html)> [Accessed Oct. 2015].
- Zhang, X., 2006. Emergency water treatment technology in Songhua River and North River Pollution (Text in Chinese) .
- Zhang, X., Su, Y., Li, Q. and Gai, D., 2006. 生活饮用水细菌学指标的影响因素. *环境与健康杂志*, 23(2), pp.152–153.
- Zhao, J., Ye, Y., Chen, H., Wei, J., Liu, Y., Sheng, X. and Li, T., 2012. 北京地区部分居民饮水习惯调查及其影响因素分析. *环境与健康杂志*, 29(10), pp.942–944.
- Zhou, L. and Baptista Nunes, M., 2013. Doing qualitative research in Chinese contexts. *Library Hi Tech*, 31(3), pp.419–434.

- Zhou, Z., 2014. *The marketisation of China's urban water affair and its supervision mechanism (Text in Chinese)*. 水利水电出版社.
- Zhou, Z., 2005. 打破职责同构:条块关系变革的路径选择. *中国行政管理*, (9), pp.103–106.
- Zhu, X., 2008. *中国自来水业规制体系改革研究*. 辽宁大学.
- Zukin, S., 2004. *Point of Purchase: How Shopping Changed American Culture*. Routledge.