The process of innovation during transition to a water saving society in China

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Abstract

To achieve an efficient use and allocation of limited water resources and thus resolve increasing water use conflicts due to fast rising societal water demands, in 2000, the Chinese government started a management strategy of ‘Construction of a Water Saving Society (WSS)’. It is guided by the principle that socio-economic development should consider the carrying capacity of the ecosystem and focuses on institutional innovation, building on the water rights concept. This paper explores the innovation process during the transition towards WSS by investigating the development course of the innovation process during the transition towards WSS, and the adaptive capacity of the existing water management regime underlying the innovation process. Accordingly, an analysis framework consisting of three types of governance activities and factors determining a regime’s adaptive capacity was developed, based on the theory of transition management and adaptive governance. The Tianjin and Zhangye WSS experiments were selected for a deep understanding of local innovations. It is revealed that co-evolution of all three types of governance activities that are claimed to be essential for transition has taken place. However, the current adaptive capacity of the regime still needs further enhancement to support the transition towards the desired WSS in China. Finally, some general insights are provided for policy innovations in other political economies.

Keywords: China; Policy experiment; Transition; Water Saving Society

1. Introduction

China is one of the most water scarce countries in the world. Its water availability per capita was estimated to be 2,156 m³/year in 2007 (Xie, 2009). The situation is even worse in North China, where the water availability is about 500 m³/capita (Cai, 2008), which has been further aggravated by climate change (Ding et al., 2007). However, water productivity is only US$3.60/m³ in China and much lower in comparison with that of $35.80/m³ for high-income countries ranked by the World Bank. This is largely due to inefficient water allocation among different uses and low water use efficiency (Xie, 2009). It is estimated that, given the current water consumption situation, water demand in
North China will increase by $82 \times 10^9$ m$^3$ in 2050 under the current rapid social-economic development. This would in turn result in a $200–250 \times 10^9$ m$^3$ gap between demand and supply (Hu et al., 2005). Obviously, traditional supply-oriented water management alone is not sufficient to fundamentally resolve the conflict between increasing water demand and the limited water supply in China.

In fact, since the 1980s, many efforts have been made to manage water demand and to increase water use efficiency. Water-saving became the national development strategy in the 7th Five-Year Plan for National Economic and Social Development and had already been institutionalized in the 1988 Water Law (Hu & Wang, 2004). The approach used to manage water-saving mainly relied on command-and-control measures, and focused on the development of technologies and infrastructures.

However, this approach has a limited ability to deal with the complexity of water supply-demand systems. Thus, in the 10th National Five-Year Plan (2000–2005), central government promoted the strategy of ‘Construction of a Water Saving Society (WSS)’. This strategy underlines a paradigm shift from an engineering-centred approach of water supply management towards an integrated approach of water management to achieve effective allocation and efficient use of water (Wang et al., 2002). ‘Construction of WSS’ is guided by the principle that socio-economic development should be based on the carrying capacity of the water resource system. The central element of the WSS construction is institutional innovation which builds on the water use rights concept (Chen & Yang, 2006). Initial water use rights are allocated by a Total Amount Control (TAC) mechanism and by quota management. At the macro level, the TAC mechanism allocates a certain amount of water to a specific administrative unit for annual consumption. Accordingly, local socio-economic development plans should be formulated to adjust regional economic structure to meet the TAC. At the micro level, the quota management mechanism specifies the water consumption for the residential sector as well as that for production in the agricultural and industrial sectors, based on the TAC (Hu & Wang, 2004; Chen & Yang, 2006). The implementation of the water use rights system is supported by various policy instruments, including direct control (e.g. water withdrawal permission), economic instruments (e.g. water prices), public participation (e.g. Water User Associations), and certification systems (e.g. certification of water-saving products). In addition to institutional development, infrastructure is another essential element of the WSS construction, such as water-saving technologies and alternative sources, and equipment for monitoring water quantity and quality (Chen & Yang, 2006). Furthermore, the construction of WSS also depends on the water-saving awareness of the whole society, as well as on knowledge that provides theoretical and practical insights for a WSS (Liu et al., 2004).

Overall, construction of WSS represents a new regime delivering sustainable water management facing climate change and rapid societal development. Challenges remain in how to facilitate the transition towards this new regime. Such a transition process contains a complex development of new configurations of old and new regime components (Voss, 2007), and extensive uncertainties about the impacts of the WSS components in the unpredictable policy environment. A better understanding of this process is claimed to be essential for facilitating the transition process (Pahl-Wostl, 2007b).

Various studies have contributed to the understanding of societal changes in different systems, ranging from socio-technical systems (e.g. Geels, 2002) to socio-ecological systems (e.g. Van der

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1 There is no unified and precise definition of the carrying capacity of the water resource system in the context of WSS. In general, it refers to the capacity of the water resource system in a specific basin and region to support socio-economic development and, meanwhile, keep the environment in a healthy state (Chen & Yang, 2006).
Brugge, 2009). These studies have provided useful theoretical and practical insights about the trajectory of the transition that involves multi-phases, multi-level co-evolution, and multi-actor interactions. However, far less attention has been contributed to the features of the regime that shape the transition (Van der Brugge, 2009). Resilience research claims that transition in natural resource management requires a sufficient degree of adaptive capacity of the regime, which enables the regime to cope with novelties, such as unpredictable changes in natural and societal environment as well as in management practices, without significant declines of its crucial functions (Folke et al., 2002). Enhancing adaptive capacity to cope with those novelties requires not only learning of new solutions to adapt to changes in the environment but also the ability to deal with various uncertainties surrounding the new solutions (Pahl-Wostl, 2007b).

Decentralized policy experimentation has been claimed to be one of the determining factors for the success of China’s economic reform in the last decades (Qian 2000; Lin et al., 2003; Heilmann, 2008a; Wang, 2009b). Selected local governments are given opportunities to experiment on various instruments to implement specific new economic policies, taking into account local conditions (Thun, 2006). In this process, ‘learning-by-doing’ the new policies takes place at both the local level and national level, as the local experiences feed back to the central government which always exercises some control over the whole process (Pei, 2006; Heilmann, 2008a). Amongst other things, the outcomes of such learning contain the changes required for the whole regime, e.g. additional regime components and corresponding configuration (Lin et al., 2003). Also, such experimentation identifies and deals with uncertainties such as whether or not and how the new policy might work, and the impacts of the new policy on the unpredictable political context (Heilmann, 2009). In addition, the experimentation serves as a crucial tool for overcoming policy deadlock (Heilmann, 2008b) and for minimizing political resistance and risks (Lin et al., 2003; Heilmann, 2008a). Policy experimentation is the focus of the adaptive management approach, which has been advocated for increasing the resilience of a social-ecological system. It enables learning about the complexity and uncertainties of a socio-ecological system, such as the interactions between policy invention and the ecological system (e.g. Folke et al., 2002; Berkes et al., 2003). This implies policies are not perceived as ‘magic bullets’ to solve the problems but are cast as hypotheses to be tested against uncertainties (Lee, 1999; Sendzimir et al., 2006). The Chinese experience is particularly interesting since it can be described as ‘experimentation under hierarchy’ which is quite unique (Heilmann, 2009). Furthermore, it has proven to be effective up to now in supporting economic reform but not in the provision of social goods, which require a broader societal involvement. In fact, the development of WSS also included an experimentation period (between 2001 and 2010), during which pilot projects were conducted in various regions.

Thus, this paper attempts to explore the innovation process during the transition towards WSS in detail, with special attention on the adaptive capacity of the regime, by investigating: (1) the development course of the innovation process during the transition towards WSS in China; and (2) the adaptive capacity of the existing water management regime underlying the innovation process.

In the next section, we outline our conceptual basis and research method. Then we present the innovation process of WSS construction in detail. In the discussion section which follows, we analyse the innovation process and examine three factors that shape the adaptive capacity of the regime. The final

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2 To avoid confusion with local experiments, we use the term ‘innovation process’ to illustrate the overall process of policy experimentation.
section draws conclusions, discusses the general relevance of the findings, and suggests some issues requiring further study.

2. Conceptual framework and method

Figure 1 depicts the analytical framework we developed for this study, based on the theory of transition management and adaptive governance.

In order to explore the course of the innovation process during the transition, it is important to understand the co-evolutionary nature of transitions. To investigate whether such co-evolution has taken place in the course of the WSS innovation process, we adapted a normative model of transition management introduced by Loorbach (2007) (the ‘Innovation Process’ part of Figure 1). This model provides a framework for structuring the transition management practices and for analysing activities during the transition process. It distinguishes three different types of governance activities that are located at the strategic, tactical, and operational levels.

The transition begins at the strategic level with the emergence of a new management paradigm and long-term visions of a desired regime state. In the context of WSS, activities at this level can include defining what the WSS is and the feasibility of constructing the WSS. The emerging paradigm and visions will then be translated into actions at the tactical level that aim at overcoming the barriers in the regime structure for transition. This is the level where plans or guidelines for the whole innovation process are developed to address the change of regime structure. Also, a structural process of diffusion of local innovations can take place at this level. Governance activities at the operational level search for solutions to realize the objectives formulated in the activities at strategic and/or tactical level. This is the

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3 The term ‘level’ used here does not refer to any hierarchical relationship but only provide a structure for analysis.
level where policy experiments are implemented and bottom-up initiatives take place. Finally, activities at the strategic and/or tactical level may be adjusted by learning through monitoring and evaluating local innovations at the operational level.

Except for the co-evolutionary process described above, we also briefly investigated the co-evolution of different structural components in the regime at both tactical and operational levels to provide a comprehensive picture of the transition process towards WSS. These structural components include culture, institution\(^4\) and physical infrastructures (Van der Brugge, 2009).

To investigate the adaptive capacity of the regime underlying the co-evolutionary transition, we considered three factors that are commonly expected to shape the adaptive capacity of a regime (see the ‘Adaptive capacity’ part of Figure 1).

First, a polycentric governance system is expected to enable a higher adaptive capacity within a regime (Gunderson et al., 2002; Pahl-Wostl, 2009). It is thought that one single governmental unit, or authorities at one single level, cannot respond adequately to internal and external shocks faced by a highly complex and uncertain social-ecological system (Ostrom, 1998; Ostrom, 2001; Pahl-Wostl, 2009). A key aspect of the polycentric system is that it contains an institutional setting where organizations at multiple levels can ‘exercise considerable independence to make and enforce rules within a circumscribed scope of authority for a specified geographical area’ with their local knowledge and social capitals (Ostrom, 2001; Folke et al., 2005). Governance in the polycentric system consists of a decision-making authority in a nested hierarchy, and aims to find the right balance between bottom-up and top-down control (Folke et al., 2003; Pahl-Wostl, 2009). On one hand, such a structure creates an environment, for example, where lower administrative units and/or non-state actor groups experiment with and learn about innovative solutions to problems occurring in their specific parts of the system (Imperial, 1999; Andersson & Ostrom, 2008); these are activities at the operational level. On the other hand, such a multi-level structure contains explicit mechanisms addressing cross-level issues (Lebel et al., 2006). Responsibility for the coordination of various resources to move towards a desired regime still resides within a higher level of government entity; this is the tactical level. Often, innovation in natural resource governance requires local government to bear substantial costs. If the local governments are given decision-making autonomy within their administrative boundary, they may prefer to invest more in other more economically profitable programmes. Thus, the capacity of the governmental entities at the higher level to provide sufficient positive incentives to ensure the commitment of local governments to innovations is a prerequisite for a high adaptive capacity in the polycentric system (Andersson & Ostrom, 2008).

Second, learning is essential for increasing the adaptive capacity of a social-ecological system and thus of the management regime (e.g. Berkes et al., 2003; Folke et al., 2005; Gunderson & Light, 2006; Sendzimir et al., 2006; Kato & Ahern, 2008). Monitoring is a central element of the learning process (Folke et al., 2003). According to the adaptive management approach, monitoring is essential to support testing the hypotheses about uncertainties identified at the outset of an experiment (Gunderson & Light, 2006; Sendzimir et al., 2006). In an ideal policy experimentation process, the policies themselves and the way to implement the new policies are ‘conceptualized as hypotheses to be tested and constantly refined’ during the process (Lee, 1999; Berkes et al., 2003). Monitoring of both local experiments

\(^4\) The terms ‘culture’ and ‘institution’ include different components in different studies. Here, culture consists of ‘paradigm, discourse, values, and knowledge bases’. ‘Institutions’ include formal regulations and procedures as well as informal societal norms (Van der Brugge, 2009).
and the whole policy innovation process can test these hypotheses and provide insights to decision-makers regarding whether and how innovative policies work. Thus, monitoring mechanisms should already be integrated and institutionalized at the beginning of the innovation process. By developing proper monitoring indicators, it should be possible to investigate whether the objectives of the activities at both tactical and operational levels have been achieved, as well as to test experimental hypotheses if they exist (GWP, 2006). However, monitoring alone does not trigger learning, and the management regime must have the ability to integrate information gained from monitoring into the decision-making process (GWP, 2006; Pahl-Wostl, 2007a) at the operational, tactical, or even strategic level. This means that mechanisms specifying how to feed back information to the decision-making process should be developed at the outset. Furthermore, learning is likely to be maximized when efforts are made to provide opportunities for exchanging the results of innovations and experiments across the whole multi-level regime (Ostrom, 2005).

Third, the adaptive capacity of a regime is determined by the availability and coordination of various resources to respond to the changes within the socio-ecological system (Smith, 2005). First, sufficient economic resources are among the major resources required to build the adaptive capacity of a regime to respond to new paradigms and solutions (Smit et al., 2001; Folke et al., 2005; Van der Brugg, 2009). Furthermore, trained and skilled personnel equipped with sufficient knowledge about the new policies, and with a mindset which values the importance of the institutional dimension, is also essential for increasing the adaptive capacity of the regime in transition (Smit et al., 2001).

Given the nature of our research objectives, we applied a qualitative approach in the research design. A case study method was used to understand details of local innovations. Two cases with different water resource and socio-economic conditions, at different stages of the innovation process, were selected. A triangulation approach was employed for data collection. A literature review and document analysis were the main data collection methods. Data sources included government policy documents and reports, government websites, politicians’ speeches, and academic literature. In addition, face-to-face interviews with experts were conducted to gain insights into local innovations and thus gain a more holistic picture of the innovation process. Experts included water managers at both municipal and district levels in Tianjin (Table 1).

3. The WSS innovation process

3.1. An overview

According to the ‘Guidelines for Pilots of WSS Construction’ (MWR, 2002), the overall innovation processes of WSS construction started in 2001 and were divided into two experimental phases. The first phase was promoted by the Ministry of Water Resources (MWR) and implemented during the 10th National Five-Year Plan (2001–2005) and at the beginning of the 11th National Five-Year Development Guidelines (2006–2010). The second phase was promoted by the MWR, the National Development and Reform Commission (NDRC), and the Ministry of Construction (MOC) and was planned to be

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5 Given the practical difficulties of individual researchers approaching officials throughout China, we only reached water managers in Tianjin. Experts in Tianjin included an officer at the Water Resource Department of the Tianjin Municipal Water Resource Bureau and Water-Saving Office, and a former Vice-Director of the District Environmental Protection Bureau.
implemented during the implementation of the 11th Five-Year Guidelines for National Economy and Social Development. Table 2 presents the goals and scope of both phases.

During each period, there were pilot projects at different administrative or hydrological levels. Local innovation consisted of pilot projects designated by both central government and provincial/local governments. Central government designated 12 pilot projects during the first phase and expected to have 100 in the second phase (NDRC et al., 2006). The nationally designated pilot schemes, if successfully implemented, are expected to serve as demonstrations for other regions with similar features. This methodology of innovation is termed to be ‘proceeding from (experiment) points to surface (youdian daomian)’ in China.

3.2. Governance activities at different levels during the WSS innovation process

In this section, we present governance activities at strategic, tactical, and operational levels during the WSS innovation process. Since the second experimental phase was still ongoing during data collection, this study focuses on the activities of the first experiment phase.

Table 2. The overall innovation process of WSS construction: its goals and scope.

<table>
<thead>
<tr>
<th>Phase 1 Goals</th>
<th>Phase 2 Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>To explore what WSS is and to experiment with different approaches to WSS</td>
<td>To extend the pilot areas, based on the lessons learned from Phase 1</td>
</tr>
<tr>
<td>To encourage local innovations with tailored approaches</td>
<td>Demonstrations and pilot projects at the provincial and river basin levels</td>
</tr>
<tr>
<td>Scope</td>
<td>Large and middle-sized cities, including the water-scarce Gansu Corridor, the eastern coastal region, water abundant areas in South China with severe water pollution, and the receiving area of the Eastern and Middle Route\textsuperscript{a} of the South–North Water Transfer (SNWT)</td>
</tr>
</tbody>
</table>

Source: (MWR, 2002).

\textsuperscript{a}The Middle Route project of the SNWT will divert water from Danjiangkou Reservoir by the Haijiang River, a tributary of the Yangtze River, to Beijing. The Eastern Route will take water from downstream of Yangtze (Berkoff, 2003).
Table 3. Major activities at the strategic level.

<table>
<thead>
<tr>
<th>Year</th>
<th>Activities</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Formulation of 10th Five-Year Plan</td>
<td>• The first announcement of WSS construction at the national level</td>
</tr>
<tr>
<td>2001</td>
<td>Minister of MWR claimed the water rights system as the foundation of WSS</td>
<td>• Developing primary theoretical foundation of WSS: water rights</td>
</tr>
</tbody>
</table>
| 2002 | Revision of the Water Law | Strengthening:  
• Promoting water-saving technologies  
• Building up the water-saving industry, agriculture, and service sector |
| 2002 | Formulation of Guidelines for Pilots of WSS Construction (MWR, 2002) | Specifying the objectives of WSS:  
• To avoid water waste caused by inappropriate economic structure, production, and consumption  
• To ensure drinking water safety with limited water resources  
• To enhance water use effectiveness |
| 2003 | MWR sent out the Notice on Strengthening Pilots of WSS Construction (MWR, 2003a) | Claiming the theory of water rights and water markets as the guidance for WSS  
• Suggesting approaches towards WSS: institutional development, especially a market-based approach, is the central component of WSS construction |
| 2005 | The State Council sent out Notice on short-term key tasks of saving-society construction (State Council, 2005) | Promoting WSS construction, such as further experiment and exploration of the water right system |
| 2005 | President Hu Jintao’s speech at the ‘Symposium of Population, Resources, and Environment’ | States that ‘the construction of WSS is the basic strategic measure for water scarcity in China’ |

3.2.1. Governance activities at the strategic level. Table 3 shows activities at the strategic level and their major outcomes. These activities developed long-term visions and examined the feasibility of WSS construction.

3.2.2. Governance activities at the tactical level. At the tactical level, overall plans have been developed to translate the WSS vision into action. These governance activities include designation of different types of local WSS pilots, the issuing of policy documents to provide practical guidelines, and the specifying of tasks for different periods.

Table 4 gives an overview of the WSS pilot schemes in the first phase, together with their objectives, whilst Table 5 lists some key policy documents developed by central government during the first phase and summarizes their major outcomes.

Outside of the experiment process, central government also issued a series of policies to facilitate WSS construction, ranging from supporting infrastructure changes (e.g. ‘Guideline for water-saving technologies, No.17’ (NDRC et al., 2005)), regulating institutional components of the regime (e.g. ‘Water withdrawal permission and water fee collection management regulation’ (State Council, 2006)), to guiding the implementation of novel policies (e.g. ‘Suggestion for strengthening farmers’
Water User Associations’ (MWR et al., 2005), or ‘MWR’s several suggestions on water rights transfer’ (MWR, 2005a, b).

3.2.3. Governance activities at the operational level. At the operational level, governance activities consist of innovations that pursue the tactical governance goals. This level is where policy experiments are implemented. In the case studies which follow, we look at the WSS experiment in Zhangye and Tianjin (a pilot in the ‘9-city’ group) to illustrate what has taken place in the local pilots.

Table 4. Pilot schemes in the first phase of the innovation process of WSS construction.

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhangye</td>
<td>First WSS pilot; validating basic questions of WSS: what is WSS, the needs of WSS construction, and how to build up WSS, and whether water rights can be the foundation of WSS construction</td>
</tr>
<tr>
<td>Mianyang</td>
<td>Exploring the approach of WSS construction in water abundant areas</td>
</tr>
<tr>
<td>Dalian</td>
<td>Exploring the approach of WSS construction in the coastal areas with rapid economic growth</td>
</tr>
<tr>
<td>9 cities</td>
<td>Polluted areas in South China and the receiving area of the eastern and middle line of the SNWT. (It is claimed that a precondition of SNWT is water use efficiency)</td>
</tr>
</tbody>
</table>

Source: (Hu, 2008).

Table 5. Key policy documents development during tactical activities.

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| 2002 | Guidelines for Pilots of WSS Construction (MWR, 2002)                  | • Specifying the goals and principles, scope, and measures of piloting WSS construction  
• Suggesting approaches towards WSS:  
  – enhancing society’s awareness of water-saving in daily life and in production;  
  – building up mechanisms and a management system, through various policy instruments;  
  – saving and protecting water at each step of water deployment and use;  
  – outlining an action plan, with monitoring and evaluation.                                                                 |
| 2003 | Notice on Strengthening Pilots of WSS Construction (MWR, 2003a)       | Pointing out that:  
• Different measures should be applied for constructing WSS in water-scarce and water abundant areas  
• WSS construction should be integrated with regional water resource management plans  
• The management paradigm change is important                                                                 |
| 2005 | Evaluation indicator system of WSS construction (interim) (MWR, 2005a, b) | Exploring monitoring and evaluation system for WSS experiments                                                                                                                                                                                                                                                                          |
| 2007 | Overall Plan of WSS construction pilots in the supplying and receiving area of the Eastern and Middle Routes of the South-North Water Transfer (SNWT) (MWR, 2007) | Specifying:  
• Principles and objectives of WSS pilots in this area  
• Scope of pilot schemes  
• Major tasks of each pilot scheme |
4. Case studies: the WSS experiment in Zhangye and Tianjin

4.1. Background

Tianjin is located in the water-scarce Haihe River Basin, with a water availability per capita of 370 m$^3$ (including water transferred from outside) (Tianjin WCD, 2006a). Water shortage has long been a constraint of the socio-economic development in Tianjin. Since the 1980s, Tianjin has taken efforts to save water through different technologies and measures. It was designated as a pilot ‘Water-Saving City’ by the National Water Saving Office (NWSO) between 2001 and 2004. Despite the dominant focus on the development of infrastructures and water-saving technologies, the construction of a ‘Water-Saving City’ at that time also explored the institutional dimension of water management, for example, by formulating the ‘Tianjin City Water Saving Regulation (Municipal People’s Congress, No. 62)’ (Tianjin Municipal People’s Congress, 2003), developing the water quota system, exploring the water price mechanism, etc. (NWSO, 2001). In 2005, Tianjin was named as an example of a ‘national Water-Saving City’ by the NDRC and MOC, whilst in the following year it was designated as one of the ‘national WSS pilots in the receiving area of the Eastern and Middle Route of the SNWT’.

Zhangye City has a long history of irrigation-based agriculture, the water for which mainly comes from the Heihe River. Since the 1990s, the rapid increase of water demand in Zhangye City has resulted in dramatic ecosystem degradation downstream. In 2001, the State Council focused a lot of attention on the Heihe River problem and formulated the ‘Heihe River Water Allocation Scheme’. The scheme requested Zhangye to release at least 580 million m$^3$ of water downstream, which meant reducing the traditionally irrigated areas by 40,000 ha. It was under these conditions, in 2002, that Zhangye was designated as the first WSS pilot in China (Ma & Han, 2008).

4.2. Local planning

Concrete local pilot plans were developed by the local government and then examined by the MWR. Local planning was led by the local Water Conservancy Department (WCD) with inputs from other concerned departments. In addition, research institutes at the national level provided technical support during the plan development phase. The Zhangye WSS construction pilot plan was co-developed by the local government, the General Institute of Water Resources and Hydropower Planning and Design (GIWRHP; an MWR think tank), and by the MWR Hydraulic Development Research Institute. The local government also invited experts from the research institutes of the State Council, the National Planning Committee, and the MOC to provide suggestions for the Plan (MWR, 2003b).

The Tianjin Plan was co-developed by local government and research institutes, and the GIWRHP, with inputs from the MWR and National Water-saving Office (WSO). As well as these groups, Tianjin also invited experts from the national research institutes, universities, the Haihe River Basin Commission, and other local governments in the receiving area of the Eastern and Middle Routes of the South-North Water Transfer (Zhu et al., 2007). Neither international actors nor non-state actors (except for experts from research institutes) were involved in decision-making at the tactical level or in the local experiment (MWR, 2003b).
4.3. Implementation

Table 6 shows the implementation of the WSS experiment in Zhangye and Tianjin. Since WSS construction is expected to be an institutional-oriented transformation, we have paid special attention to innovations in the institutional dimension of the regime.

In fact, since 2001 (prior to the pilot period), the Zhangye government had already initiated pilots in two large irrigation districts. The lessons learned from the pilots were diffused within Zhangye City during the experiment period. Meanwhile, local regulations for water rights and water prices were formulated (Hu & Wang, 2004).

In Tianjin, although neither institutionalization of water rights allocation nor re-organization of the management structure were accomplished during the pilot period as planned, ‘the formulation process of local supportive regulations as well as the implementation of WSS related policies developed by the central government sped up during this period’ (Anonymous, 2010a).

In addition to the institutional component, both local governments have long realized the importance of the infrastructure component of the regime. In Zhangye, an increase of channel efficiency of more than 10% was achieved through the rehabilitation of the irrigation system during the pilot period (Hu & Wang, 2004). In Tianjin, activities included further research and development of technologies, especially to diversify water sources (e.g. unconventional water resources use), promoting diffusion of water-saving technologies and the rehabilitation of water-saving infrastructures, and improving irrigation infrastructures (Wang, 2009a, b). In fact, during the process of constructing a ‘Water-Saving City’ before the WSS experiment, a series of local regulations had been formulated to support the improvement and adoption of water-saving infrastructures.

4.4. Resource availability during the experiment

4.4.1. Financial resources. Central government did not set up a separate funding for WSS construction or a separate investment channel for local WSS experiments in the first experiment phase (Anonymous, 2010a). It is stipulated in the ‘Notice on strengthening pilots of WSS construction’ that ‘the investment for pilot infrastructure construction should be raised by the local government itself through multiple funding channels’ (MWR, 2003a). For example, at the municipal level in Tianjin, the investment used for pilot projects during the experiment period was mainly from traditional funding channels such as central government’s investments on infrastructure projects or collected water fees. At the lower administrative level, for example in the Hangu district6, ‘only 30,000 Yuan were provided annually by the district government to the district Water-Saving Service Centre for public awareness-raising. The district government’s support on water-saving infrastructures was exclusively applied to two large factories in the district. The fund originated from the water fees they paid.’ (Anonymous, 2010b).

4.4.2. Personnel resources. After the experimental period of the construction of the ‘Water saving city’, the Tianjin government established a new organizational structure for WSS construction (Figure 2);

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6 Hangu District has a total area of 442 km² and was not designated by the municipal government as a pilot area.
Table 6. The institutional dimension of WSS experiments in Zhangye and Tianjin.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Zhangye</th>
<th>Tianjin</th>
</tr>
</thead>
</table>
| **Water rights** | Formulated local policies of initial water rights and water rights transfer:  
- ‘Suggestions for water rights transfer in agriculture sector in Zhangye (interim)’  
- ‘Water use quota for agricultural in Zhangye (interim)’  
- ‘Ecosystem water quota in Zhangye (interim)’  
- ‘Water use quota for industry in Zhangye (interim)’  
- ‘Water use quota for domestic sector in Zhangye (interim)’  
(Zhangye WSS construction pilot leader group office, 2004) | Primary institutionalization of the initial water rights allocation (e.g. ‘Measures of water rights management (interim)’) was planned but not implemented during the experiment period (Tianjin WCD, 2006a) |
| | Explored different management approaches in different Irrigation Districts  
- Created a ‘Water User Association (WUA) + Water ticket’ water rights allocation and transfer system in irrigation districts (Hu & Wang, 2004) | One pilot transferred water from a reservoir and part of an Irrigation District in one county to a domestic sector branch |
| | In large Irrigation Districts (IDs):  
- Water resource allocation schemes, as a tool for Total Amount Control were developed  
- A quota system was defined for different water use in the agricultural sector, which resulted in initial water rights for each relevant administrative/hydrological level and individual farmers  
- Water use rights were issued to individual farmer water users  
- The pilots were further diffused to other IDs during the experiment period (2002–2004) (Hu & Wang, 2004) |  
- Demonstrated Total Amount Control in Chaobaixin River (Wang, 2005)  
- Developed and implemented 404 water use quotas for different sector branches (Wang, 2005)  
- The command-and-control approach of a distributing ‘water supply quota’ used before is still a dominant approach of water allocation (Anonymous, 2010a)

| **Water prices** | Formulated ‘Management method for water price in Zhangye (interim)’:  
- increased water price for industrial and domestic use  
- set up quantity-based water prices for agriculture water use | Conducted pilots of quantity-based water prices for agriculture water use in several counties (Tianjin WCD, 2006b)
| **Adjustment of economic structures to fit water supply** | Strengthened the adjustment of the economic development structure in industrial and agricultural sectors using command-and-control, technology-know-how, and financial support (Tianjin WCD, 2006a; Ma & Han, 2008) |  
| **Management structure** | Set up Water Management Bureaus at both municipal and lower administrative levels for integrated water management (Wang et al., 2002) | Prepared the establishment of the Tianjin Water Management Bureau for the integrated management of both urban and rural water, different sources of water, and different components of water management operations (Tianjin WCD, 2006a) |
| **Encouraging stakeholder participation** | Established 790 WUAs since 2001 (Zhangye Water Management Bureau, 2006) | Established 124 WUAs since 2004

^Interviewee requested anonymity.

bWUA establishment was initiated by the Global Environmental Facility (GEF) in 2004.
such a structure is representative of most local WSS construction. There are two types of organizations existing at the municipal and district, or even lower administrative levels: the Water Saving Leader Group (WSLG) and the WSO. The municipal WSLG is the decision-making body of the WSS construction in Tianjin, which decides on the objectives of implementing WSS and key issues of the WSS construction, and coordinates tasks involving different departments. It is headed by the Vice Deputy of Tianjin who is joined by the Deputy of WCD and the Vice Deputies of nine other relevant departments. The WSLG at the lower level follows a similar function and structure to the municipal one.

Generally, the municipal WSO is the implementation organization of the WSLG and led by the municipal WCD. The WSO is responsible for formulating water use quotas for key industries, water allocation planning, establishing municipal WUAs, raising public awareness of WSS, etc. The WSO at lower levels, sometimes also called a Water-Saving Service Centre, is led by the WCD or Construction Departments (CD) and is technically supported by the municipal WSO.

In fact, no additional personnel were especially assigned to be in charge of the WSS experiment and construction in the municipal WSO. The responsible persons came from the WCD and were given tasks related to WSS in addition to their regular work. Under the WSO, there is a Water-Saving Management Institute staffed by 40–50 people (Water manager of Tianjin WCD, personal communication, 15 March 2010). At the district level, for instance, ‘the Hangu Water-Saving Service Centre is only equipped by less than 10 people. In addition, no training about the WSS construction was provided to the staff at the district level’ (Anonymous, 2010b).

### 4.5. Monitoring and evaluation

Table 7 shows five different types of monitoring in the local pilot process in Tianjin, which is representative of the monitoring of local WSS pilots in China. The MWR and Tianjin WSLG conducted a

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7 The MWR suggested such an organizational structure. The differences between the regions are possibly which Departments are involved in the leading group.
mid-term check and final overall evaluation of the local WSS pilot (Water manager of Tianjin WCD, personal communication, 15 March 2010; Tianjin WCD, 2006a).

The mid-term check consisted of visiting and listening to a report from the local officials. The final overall examination by the MWR in 2009 included inspection of a set of written reports, such as ‘The summary report of WSS pilot in Tianjin’, reports of single projects, summary reports of the seven pilots within the city, and different reports on design and finance, legislation and standards development, and on technology development during the experiment period.

In addition to examination, the MWR and WSLG also conducted a final evaluation. The evaluation was based on an interim evaluation indicator system of WSS construction designed by the MWR in 2005. This system consisted of not only quantitative but also qualitative indicators of institution building and management improvement. The evaluation system of Tianjin WSS included six indicators related to institutions: the coverage of the districts/counties that implement the organizational structural reform; the proportion between the assigned water quota and actual consumption; the water fee collection rate; the existence of a ‘rights trading’ platform and mechanism (yes/no); the number of rural Water User Associations; and existence of a municipal sector Water User Association (yes/no) (Tianjin, 2006a). Only two of them are qualitative. Water managers expressed their preference on quantitative indicators, such as the evaluation system of ‘the construction of a water-saving city’ previously developed by the MOC.

At the local level, the Tianjin WSLG organized yearly conferences. At these conferences, the relevant officials from different districts reported the progress of the WSS construction in their districts. Additionally, all involved Departments exchanged their experiences about WSS construction.

Despite the yearly conferences and mid-term checks at the local level, the local experiment process was not adjusted. As one water manager said, ‘we focused more on how to achieve all the activities that have already been written in the ‘Pilot Action Plan’ (developed in 2006). We do not have time and energy to make adjustments. In addition, in my opinion, the process was on track.’ (Water manager of Tianjin WCD, personal communication, 15 March 2010).

Finally, no comprehensive ex ante impact assessments aimed at explicitly identifying possible uncertainties accompanying ‘WSS construction’ were found in either Tianjin or Zhangye. This implies that no hypotheses about those uncertainties were explicitly tested during the experiment.

4.6. Dissemination of the lessons learned

In the first experiment phase, four ‘National symposiums of national water resource management and WSS pilot experience exchange’ were organized by MWR in different pilot cities. The lessons from different designated pilots were disseminated. The successful lessons from Zhangye have been disseminated extensively in China, not only through national symposiums, but also through media and publications made by both central and local governments. As a result, a vast WSS construction ‘political tourism’ from other provinces has been launched.

Since the Tianjin experiment was only examined by the MWR and the municipal government in 2009, all the lessons learned have not yet been extensively disseminated to other regions. However, experiences from it have already been exchanged during the national symposiums in 2007 and 2008.
Furthermore, lessons learned from the first experiment phase were fed back to the formulation of the 11th Five-Year National Development Guidelines of WSS Construction which guides the second experiment phase. For example, the Guidelines include measures to deal with problems that occurred in the first phase, such as linking WSS construction with local governments’ performance indicators, setting up special funding channels for experiments, etc. (NDRC, MWR & MOC, 2006).

5. Discussion

5.1. The development course of the WSS innovation process

All three levels of governance activities – strategic, tactical, and operational – have been identified in the WSS innovation process.

From 2001, the innovation process started with activities at the strategic level, which addressed the necessity, theoretical background, long-term strategic objectives, and definition of the WSS. Those activities provided orientation and rationales for the activities at both tactical and operational levels. On one hand, these activities reflect the ongoing paradigm change of water management from ‘traditional hydraulic engineering’ to ‘resource water conservancy’ that promotes institution-oriented water management in China. On the other hand, they show the great attention given by central government to water scarcity and the importance of efficient resource use. No significant changes have been identified from the outcomes of these activities, i.e. a strategic goal and vision of WSS, since the first statement of the WSS.

Activities at the tactical level can be categorized into three types. The first is the formulation of policy documents to guide the local innovation process, such as ‘Guidelines for pilots of WSS construction’ (MWR, 2002). Throughout the innovation process, areas with different water conditions, socio-economic backgrounds and political importance have been systematically selected as pilots for WSS construction. In fact, the systematic innovation was complemented by ad hoc exploration of new policy instruments, such as water rights transfer at different scales (Speed, 2009). The second type of activity is the formulation of complementary institutions (including interim regulations) to facilitate reform and support local innovations, such as institutions regulating water withdrawal permission, water fee collection, etc. These regulations had not yet been formulated at the beginning of the innovation process, but appeared during the innovation process. The third type of activity is the dissemination activities of the local experiment lessons. These activities have facilitated the transfer of knowledge of how to implement the WSS to other regions, which reduces the transaction costs for the transition towards WSS in those regions (Hu & Wang, 2004).

At the operational level, activities have mainly focused on exploring how to technically implement the novel policy instruments or policy ideas proposed by central government within the WSS framework. The institutional innovations at this level have ranged from water rights, water prices, adjustment of economic structures to fit water supply, improvement of management structure, to stakeholder participation. In Zhangye, institutional innovations were rather rapid during the experiment period, such as formulation of a series of local regulations of new policy instruments (including

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8 Referred to below as the 11th Five-Year Guidelines of WSS.
9 In the first period, local governments’ commitment to WSS construction was not accounted for in its performance evaluation by central government.
interims), up-scaling the lessons from experiment points to other localities in the city, improving management structure at each level within the municipality, etc. In addition, the Zhangye pilot provided a test run for the concept of WSS and a water rights system in the absence of explicit national guidelines. In Tianjin, incremental changes took place in the institutional dimension during the experiment period. Progress was relatively slow, compared to the Zhangye pilot. However, the progress aspect is not sufficient to judge the performance of the Tianjin pilot. The incentives were significantly higher for the Zhangye government than for the government of Tianjin and probably other cities, as discussed later. In addition, it can be expected that WSS construction, where various actors and re-configuration of regime components are involved, may need more time beyond the experiment period. In both cases, different types of policy instruments, especially command-and-control, successfully adjusted the economic structure to fit the water supply. However, the sustainability of command-and-control and its impacts on the social system are questionable.

Loorbach (2007) claims that a regime transition results from the iterative co-evolution between the three levels of governance activities introduced above. Did such a co-evolution take place? First, outcomes of activities at the strategic level have been translated into guidelines and plans of WSS construction at the tactical level (see Table 5) and have provided rationales for the experiment and implementation of WSS construction at the operational level. Furthermore, the theories about WSS and water rights developed at the strategic level were validated by the first pilot in a water scarce area – Zhangye City. Second, the linkages between the activities at the tactical and those at the operational levels are manifested in two aspects: (1) the approaches developed at the tactical level were put into local experiments for validation; and (2) the overall action plans developed at the tactical level guided activities at the operational level. Finally, despite the ongoing innovations at the operational level, except for the 11th National Five-Year Guidelines of WSS at the tactical level which drew lessons from the first experiment phase, there was little regular feedback to the tactical level from the activities at the operational level.

In addition, we also found evidence of co-evolution of different regime structural components at the tactical and operational levels. At the tactical level, there has been a reconfiguration of institutional components by the formulating of complementary regulations to facilitate the transition. At the operational level, in both case studies, investment has been spent on infrastructure, such as on irrigation system improvement, and on research and development of new water sources. However, infrastructure improvement still lags behind, evidenced for example by the lack of measurement equipment for water abstraction in Zhangye (Zhu et al., 2007). In terms of the cultural dimension of the regime, the development of local regulations and experiments in water rights and price systems in both case studies reflect an understanding among local water managers about the essence of the WSS. However, beyond the two case studies, empirical evidence shows that understanding of the WSS at the local level still needs to be improved. In some other national designated WSS pilot areas, the pilot was regarded by local governments as just another funding source from the central government to support water infrastructure construction (Zhu et al., 2007). Within the institutional dimension, a decision-making structure and other institutions have been developed and adjusted to pursue the WSS in both cases.

5.2. Adaptive capacity of the existing regime underlying the innovation process

The co-evolutionary process of the three levels which leads to transition requires the regime to have a highly adaptive capacity. In the following sections, we explore the adaptive capacity of the existing
regime underlying the innovation process by analysing three factors: governance approach, monitoring and learning, and resource availability in the innovation process.

5.2.1. Governance approach. Our findings show that central government has played an indispensable role in the whole innovation process. It has directed and coordinated the whole process by setting up long- and middle-term visions, issuing guidelines, and formulating an overall plan and supportive regulations (key governance activities at the strategic and tactical level). By recognizing the limitations of a one-size-fits-all blueprint governance model, central government selected a number of experimental locations that are representative of different water availability and socio-economic conditions. This in turn explores various uncertainties that the implementation of novel policy instruments in the ‘WSS package’ may face in local environments. At the same time, central government has encouraged local governments to develop innovative approaches to implement new policy instruments tailored to their local circumstances. Thus, governments of selected local pilots have also been active participants in the experiment process. Furthermore, the ‘pilot plans’ in both case study areas were developed through a multi-level learning process, in which local water managers’ local knowledge was blended with expert high-level knowledge from major national research institutes and ministries. However, there has been little participation from non-state actors, such as NGOs, in decision-making for both tactical and operational activities. These actors may bring insightful technical inputs and different perspectives for WSS innovation as well as actively facilitating the transition process.

In sum, the whole innovation process is a systematic process coordinated by central government with significant decision-making power located at the local level for innovation and implementation. Such a polycentric structure has encouraged the emergence of local innovative solutions to implement the WSS and explored uncertainties in future implementation of WSS. This in turn results in an enhancement of the adaptive capacity of the regime.

Due to the financial decentralization, local governments have the authority to decide on the objectives and action plan of the WSS experiment and its implementation, i.e. scope of the actions, and allocation of resources. Thus, it is essential to provide local governments with proper incentives to ensure their commitment to innovation. In Zhangye, the local government faced an urgent water shortage problem, due to the dramatic water supply reduction of 580 million m³ commanded by the State Council to ensure water supply for downstream regions. Whether this command could be achieved determined the possible promotion or demotion of the local governors. Furthermore, due to its role as the first WSS pilot, the Zhangye pilot and its water rights development drew great attention from central government. Thus, in the Zhangye case, the urgency of the problem, attention from the top level (especially the State Council), and the possibility of promotion provided local governors with positive political incentives to drive the rapid institutional innovation and implementation.

In Tianjin, although water-saving has been a long-term goal of the local government due to its low water availability, water shortage did not appear to be such an urgent problem as in Zhangye. Furthermore, local policy makers appeared to favour water-saving technologies or adjustment of water prices rather than the development of a water rights system. Two reasons for this preference could be that: (a) the former can bring direct and quick impacts on water consumption; and (b) the policy makers in charge of WSS may only have had short-term positions, which does not match with the long time scale of the transition towards institutional-oriented WSS (Anonymous, 2010b). Additionally, water-saving performance as well as WSS innovation and implementation were not directly linked to the
evaluation of the local governor’s performance. Thus, although there has been attention from the MWR to promote a ‘water rights’ based WSS in the designated pilots, the institutional innovation progress in Tianjin was not as rapid as in Zhangye; in fact, most WSS pilots may face a similar situation to that of the pilot scheme in Tianjin. Furthermore, since central government had not set up separate funding and investment channels for the WSS experiments and innovation, there were no monetary incentives provided to local government.

In sum, during the first experiment phase, in general, governance activities at the tactical level did not provide enough incentives for localities to innovate and implement ‘water rights’ oriented WSS. A link between WSS innovation and evaluation of the local governor’s performance, as well as special funding for WSS innovation, was needed. However, to overcome the existing institutional barriers, local policy experiments were ‘protected’ by being temporarily exempt from existing laws.

Drawing from the lessons learned during the first experiment phase, central government stated in the 11th Five-Year Guidelines of WSS that WSS construction has to be a part of local governments’ performance indicators and a special funding channel has to be set up for pilots. Since local government is the major actor in innovation and implementation, designing these positive incentives for local government will probably encourage local innovation of institutions and thus facilitate the transition towards WSS.

5.2.2. Monitoring and learning. First, the indicators used for evaluation of WSS construction and experiment are mostly quantitative, which has limited their ability of evaluating institutional changes, for example, in the water rights system. The preference of quantitative indicators over qualitative ones for assessing management activities also reflects the resistant technocratic paradigm of water experts and managers at different levels. Besides, evaluating institutional changes in a quantitative manner, such as by counting the number of WUAs and the number of areas that have had institutional reform, may cause ‘number-seeking’ behaviour in the local governments rather than ensuring the quality of new institution developments and policy innovations. At a national level, despite the existence of qualitative indicators in the interim ‘Evaluation indicator system of WSS construction’ (MWR, 2005a, b), no guideline clearly specifies how they are to be used. For water managers in China who have long applied an engineering approach, a clearer guidance of how to perform evaluations in a qualitative manner would be useful.

Second, in Tianjin, we found that local government had little intention of adjusting the planned experiment based on middle-term monitoring, which raises the question of whether the pilot in Tianjin was a learning-oriented experiment or just a normal policy implementation process to achieve pre-set objectives. This rather distorts the learning objective of policy experimentation.

Despite the pitfalls of monitoring and learning, various diffusion mechanisms have been employed by central government to spread knowledge of how ‘WSS construction’ can work in different contexts. These mechanisms enable learning beyond the selected pilot project locations and provide inputs to the local experiments in other locations.

Finally, although uncertainties about the feasibility of WSS construction with novel instruments have generally been dealt with through local experiments, those uncertainties were not explicitly identified by comprehensive ex ante impact assessment and tests. This lowers the potential of any policy experiment to enhance the adaptive capacity of the regime. In addition, given the high complexity and uncertainties of a water resource management system, radical experiments such as that in Zhangye, undertaken
without any *ex ante* assessment, may bring long-term negative impacts on the whole local socio-ecological system or even external impacts on other locations.

5.2.3. **Resource availability.** As one of the major resources that determines adaptive capacity, financial resources for the WSS experiment have been quite limited at the municipal and lower administrative level of Tianjin. Since local government can decide what to innovate and how to allocate their resources for the innovation, a lack of financial resources can significantly inhibit the innovations at the lower administrative level.

Providing a separate fund to WSS experimental locations, as emphasized by central government in the *11th Five-Year Guidelines of WSS*, could partly alleviate the financing problem. However, a high dependence on state funding sources can make a WSS construction vulnerable. Multi-sources of funding, i.e. from central and local governments as well as from the private sector, are desirable. In this case, government should formulate regulations and incentive mechanisms to ensure the security of investment by private actors as well as the desired performance by the private actors when privatizing public services (*GWP*, 2000).

Second, in the Tianjin case, a new organizational structure of the WSS experiment could overcome a major barrier in WSS construction involving the interests and responsibilities of different departments. This is very important for implementing innovative integrated intervention, such as water-saving in the agriculture sector. However, we also found a lack of personnel available for implementing the WSS experiment. This may partly contribute to the fact that the ‘experiment’ was treated as an ‘implementation’ issue rather than something that could be adjusted after monitoring. In addition, with limited knowledge about how to implement and evaluate ‘water rights’ oriented WSS, those personnel responsible, who have long approached problems from their more traditional engineering perspective, may guide the transition towards an undesirable direction: a traditional ‘engineering fix’. Thus, capacity building should not only include technical training, as planned in the *11th Five-Year Guidelines of WSS*, but also emphasize institutional aspects.

6. **Conclusion**

This study has enhanced our understanding of the innovation process during the transition towards WSS in China. First of all, the development course of such a process was investigated. It has been shown that the co-evolution of governance activities at strategic, tactical, and operational levels, which is claimed to be essential for transition, has taken place. However, although aggregated lessons from local experiments were fed into the national strategy of WSS construction, regular feedback from the activities at an operational level to those at the tactical level are missing. In addition, our study indicates that a co-evolution of structural components of the regime has also taken place at both tactical and operational levels.

Next, we explored the adaptive capacity of the existing regime underlying the co-evolutionary process by examining the following three areas: governance approach, monitoring and learning, and resource availability. First, our study shows that the governance structure of the innovation process is polycentric. Central government has taken a strong leadership role in the whole process and left sufficient decision-making power to local governments to develop their tailored approaches towards WSS, using their local knowledge. Local governments, such as that in Zhangye, took the opportunity to experiment on different policy instruments, even when relevant legislation (e.g. that for water rights trading) had not yet been formulated. Such a governance approach for institutional innovation encouraged local innovation and
explored uncertainties of WSS construction in the implementation context, resulting in an enhancement of the adaptive capacity of the regime. However, that adaptive capacity was limited by the lower incentives central government provided to local governments to ensure their commitments to the ‘water-rights’ oriented WSS innovation in the first phase. Second, our analysis reveals that the adaptive capacity of the regime is further limited due to insufficient learning from monitoring in policy experiments. The ability of experiments to learn from and deal with uncertainties has been distorted by the failure to regularly incorporate monitoring results into ongoing experiments, by an insufficient monitoring indicator system, and by the fact that there has been no explicit identification of uncertainties at the beginning of experiments. Finally, we found the lack of financial and personnel resources for local WSS experiments to be an additional factor limiting the adaptive capacity of the regime. The monitoring and resource factors also explain why there was insufficient feedback from the activities at operational level to those at the other two levels. Thus, we conclude that the adaptive capacity of the regime still needs further enhancement to support the transition towards the desired WSS regime in China.

However, that innovation process can still provide some general lessons about innovation during transition for other political economies. First, the innovation process of WSS highlights that, rather than viewing policy experiments to be risky or threatening their position (a view taken by some Western politicians), the Chinese central government regards policy experiments as a way to explore complexity and uncertainty in the fluid social–political context where the novel policies would be implemented. Second, the WSS innovation process in China consists of not only local experiments but also top-down coordination that sets up long-term vision and middle-term objectives and plans, as well as facilitates dissemination of lessons from local experiments. This systematic innovation process that combines various local experiments and innovations has evoked regime change. Finally, the WSS innovation process demonstrates that it is essential to provide a protective space for local innovations in which barriers for those local innovations are removed (for example, exempting them from existing regulations).

Analysing co-evolution of different governance activities and underlying adaptive capacity of the existing regime has provided fruitful insights into the innovation process during the transition towards WSS construction. However, our study was constrained by its limited scope of interviewees, which exclusively consisted of government officers. The inclusion of perspectives from different non-state actors may provide additional insights, for example, on the re-configuration process and on the long-term sustainability of the innovation process. For future research, multi-actor interactions, as another key complexity in the transition, might also deserve attention. In addition, a detailed cross-country comparison of such innovation processes can improve our understanding of diverse external factors influencing innovation processes.

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References


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