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Legal Methods of Mainstreaming Climate Change Adaptation in Chinese Water Management

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This book is funded by Jiangsu Provincial Department of Education Project (2015SJB531) and Project Funded by China Postdoctoral Science Foundation (2015M581847).

ISBN 978-981-10-0402-5 ISBN 978-981-10-0404-9 (eBook)
DOI 10.1007/978-981-10-0404-9

Library of Congress Control Number: 2015960401

Printed on acid-free paper

This Springer imprint is published by SpringerNature
The registered company is Springer Science+Business Media Singapore Pte Ltd.

Preface

Climate change adaptation is a new challenge for vulnerable societies such as China, and I am honored to be involved in finding solutions for China's development dilemma. As an indispensable response to adaptation issues, our legal system is expected to be developed for better resilience and higher adaptive capacity. Yet, as a legal issue, climate change adaptation is distinguished from traditional environmental problems and mitigation in a variety of ways. Its legal challenges to extant regulations and regimes need to be clarified and profoundly understood before possible legal responses are proposed, and before a brand new Climate Change Law is enforced. All my past five years of reflection and research has been centered with these questions and this book marks the culmination of it.

Wuhan University has always been an important place for me, since it is there my academic journey set sail and my life was greatly enriched. Professor Ke Jian of Wuhan University has kindly been my mentor of both academic dedication and personal life in the past seven years. His vision and passion for environmental law, his sympathy for those marginalized, and his perseverance of academic independence have influenced me in various ways. I would also like to show gratitude to Prof. Xia Jun from the Chinese Academy of Science. Without his help of introducing some key government officials to me, I could not conduct effective interviews and field visits in order to get fresh information on adaptation for the completion of this book.

My Ph.D. study in the University of Western Sydney (UWS), co-financed by UWS and the Chinese Scholarship Council, was a very delightful and enjoyable experience. Motherly Professor Donna Craig and late Michael Jeffery had academically supervised me and constantly provided me with a lot of inspirations and insights. Michael entrusted Donna to help me finalize my thesis before he passed away. Publishing this book is the best way to commemorate him and express my condolence. My colleagues in the UWS are such a bunch of kind and generous people that they are always ready to offer help and provide valuable suggestion on academic research. I am very privileged to be part of them.

I feel greatly indebted to those friends who support me during my stay in Australia. For Craig, Kym, Chris, Olga, Danielle, and all other friends who listen to my English very patiently and encourage me continuously, I sincerely thank them so much. Special appreciation belongs to Kym who has taken so much time and patience to read and revise two of my long articles and track the changes word by word, even though she has a heavy workload. Her love and consideration gives me so much courage when I face challenges and difficulties. I have also been so lucky to know Marie and Pak, the couple who have treated me just like their own daughter. They have come and picked me up for dinner and bible study nearly every Friday for three years, no matter rain or shine. Their dedication and passion for God's mission and their unconditional love to Chinese students set a very good example for me to treat other people likewise.

Finally, I would like to express my gratitude and love for my parents who are very diligent. I am so proud of them for they are so open-minded, humble, and trustworthy. My wise and thoughtful dad has always been my mentor who would like to listen to me, share, and grow with me. Mum always keeps me in her prayer. Only after being far away from them have I started to understand the Chinese saying 'a mother always worries about her travelling son.' Their endless love and support have made the completion of this book possible.

Suzhou Xiangbai He
2015

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Acronyms

AA	Administrative Agreements
AIWM	Adaptive and Integrated Water Management
Canadian Act	Canadian Environmental Assessment Act 2012
CAS	Chinese Academy of Science
CASS	Chinese Academy of Social Science
CCICED	China Council for International Cooperation on Environment and Development
CCL	Climate Change Law
CEAA	Canadian Environmental Assessment Agency
CFDH	Changjiang Flood Control and Drought Relief Headquarter
CMA	China Meteorological Administration
CNCCP	China's National Climate Change Program
CPAACC	China's Policies and Actions for Addressing Climate Change
CPNWR	Comprehensive Plan of National Water Resources
CWRC	Changjiang Water Resources Commission
DRCs	Development and Reform Commissions
DRR	Disaster Risk Reduction
DWC	Dialog on Water and Climate
EES	Epistemological, Ethical and Scale
EIA	Environmental Impact Assessment
EIDM	Environmental Information Disclosure Measures
EIS	EIA Statement
EPA	US Environmental Protection Agency
EPL	Environmental Protection Law of People's Republic of China
ESD	Ecological Sustainable Development
FDO	Flood Control and Drought Relief Office
GEF	Global Environment Facility
GMF	Genetically Modified Food
GWP	Global Water Partnership
HSBC	Honkong and Shanghai Banking Corporation Limited
IPCC	Intergovernmental Panel on Climate Change

IPPP	Interim Procedures of Public Participation in EIA
IRBM	Integrated River Basin Management
IUCN	International Union for Conservation of Nature and Natural Resources
IWRM	Integrated Water Resources Management
MDB	Murray–Darling Basin
MDBA	Murray–Darling Basin Authority
MDGs	Millennium Development of Goals
MEP	Ministry of Environmental Protection
MFA	Ministries of Foreign Affairs
MOA	Ministry of Agriculture
MWR	Ministry of Water Resources
NCC	National Climate Centre
NCCCC	National Coordination Committee on Climate Change
NDRC	National Development and Reform Commission
NDRC-MCA	National Disaster Reduction Center of the Ministry of Civil Affairs
NEF	New Economics Foundation
NLGCC	National Leading Group on Climate Change
OECD	Organization for Economic Co-operation and Development
PP	Precautionary Principle
RBCs	River Basin Commissions
RCCC	Research Centre for Climate Change
RMWA	River Murray Waters Agreement
RPEIA	Regulation on Planning Environmental Impact Assessment
SEA	Strategic Environmental Impact Assessment
SEPA	State Environmental Protection Administration
SFDH	State Flood Control and Drought Relief Headquarters
SIA	Social Impacts Assessment
SNWD	South to North Water Division
SP	Subsidiarity Principle
SSIC	Social Survey Institute of China
SWRM	Strictest Water Resources Management System
TBMR	Tai Basin Management Regulation
TGD	Three Gorges Dam
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
WFD	Water Framework Directive
WRPB	Water Resource Protection Bureau
WUA	Water Users Association
WWF	World Wildlife Fund

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Abstract

The management of the China's water resources is facing two main challenges: implementing the integrated water resources management (IWRM) regime and adapting to water-related climate change impacts. While separate efforts in promoting the IWRM implementation and climate change adaptation are being made, this book proposes an innovative approach of mainstreaming climate change adaptation considerations within the IWRM regime, in order to deliver sustainable and robust water management decisions and outcomes. Mainstreaming adaptation in this book refers to the incorporation of climate change adaptation-related factors into water development planning and ongoing sectoral decision-making process. Current water management regime and practices have not considered adaptation factors. Thus, this book attempts to contribute to the literature through analyzing the rationale of mainstreaming adaptation in the IWRM-related legal and institutional frameworks and proposing applicable recommendations for related water managers.

Centered with this mainstreaming approach, this book addresses three overarching questions: First, what is the capacity of Chinese water laws and institutional arrangements in achieving sustainable development? Alternatively, to what extent do water laws contribute to climate change adaptation? Second, could water-related climate change impacts be mainstreamed in the IWRM regime and legal framework? Finally, if the answer to the second question is yes, then what is the best legal method to implement adaptation mainstreaming?

An investigation and examination of existing legal and institutional frameworks on the water management regime and practice is essential, as this is where adaptation could be mainstreamed, and their capacity in achieving sustainability largely determines the capacity against vulnerability and negative climate change impacts. By analyzing research literature and water management practices, the progress and deficiencies of these water-centered legal and institutional frameworks in delivering an effective IWRM regime are demonstrated. Following that, corresponding recommendations are brought out to illustrate how legislation could be improved and how institutional settings could be reformed with the objective of delivering sustainability and reducing non-climatic vulnerability.

Current and future water management frameworks and regimes will no doubt shape the way ahead for water-based adaptation. At the same time, it is also important to realize that climate change adaptation-related policies, legislation, and institutional arrangements will challenge and reframe the paths and approaches of managing water resources. This interactive relationship first requires assessing the adaptation-related legal and institutional frameworks to see to what extent effective adaptation strategies are facilitated and supported. Secondly, it entails a reflective discourse where the legal assumptions, institutional arrangements, management approaches, and dominant water management regime are reviewed in the context of climate change adaptation. Since the potential compatibility and synergy between the IWRM regime and the climate change adaptation is the premise of an adaptation mainstreaming approach, their distinctions and common points will be compared in this book.

To provide specific recommendations for Chinese water managers, the last part of this book first aims to propose recommendations for the development of a meaningful and supportive legal and institutional enabling environment where adaptation mainstreaming in the IWRM regime takes place. Reforming legal principles, legal instruments and institutional settings are recommended for that purpose. Nonetheless, an effective enabling environment does not necessarily result in adequate consideration of adaptation—more specific adaptation factors need to be identified to illustrate how to practice mainstreaming from both substantive and procedural perspectives for Chinese water managers. Integrated water planning from a substantive aspect and environmental impact assessment from a procedural perspective are highlighted as two illustrative case studies to demonstrate how legal principles, instruments, approaches, and institutional settings developed in this book are employed to achieve climate-proofing water management strategies and outcomes.

Chapter 1
Introduction

1.1 Water Resources and Water Problems in China

China is a country with vast territory, complex topography, and diverse climate and water systems. Water is the lifeblood for agriculture and lifeline for China's national economy, and there is a close relationship between water resources and Chinese civilization. The Yellow and Yangtze River are well-known to every Chinese for their contribution in breeding and feeding the nation. Water-related issues have always been at the center of national governance. The history of Chinese civilization is the one contending with water disasters, in order to generate benefits for people or to demonstrate the dynastic legitimacy. In the ancient society, water management issues, especially irrigation and flooding, have involved both the survival of the nation and the destiny of the country. Eminent examples are Da Yu who was appointed as a tribe ruler due to his achievement in fighting against floods to save people's lives, and Dujiangyan which has benefited Chengdu Plain for thousands of years. In a contemporary society, water is still the core element underpinning sustainable development of economy, society and environment. Currently, the heated debate on ways to apply the 'strictest of water control system' illustrates the attention water management attracts in Chinese society.

Affected by the eastern monsoon, approximately 98 % of China's surface water is recharged by precipitation, which decreases gradually in a spatial gradient from coastland to hinterland. As a consequence, runoffs are also decreasing progressively from the southeastern coast to the northwestern highlands, resulting in an uneven spatial distribution. The north-western part of China is subject to arid and semiarid zones, where the annual precipitation depth is lower than 400 mm. In contrast, the humid and semi-humid south-eastern zones make up 93 % of the water resources within 53 % of the nation's territory.[1] This spatial disparity does not match with the distribution of population, arable land and productivity. Temporally, precipitation

[1]Chen and Xia (1999).

X. He, *Legal Methods of Mainstreaming Climate Change Adaptation in Chinese Water Management*, DOI 10.1007/978-981-10-0404-9_1

within four months of flood season may make up 60–80 % of the annual total.[2] The ratio of maximum to minimum annual precipitation recorded possibly exceeds 8 in north-western China, but only ranges between 2 and 3 or less than 2 in southern and south-western part.[3] The seasonal variation of runoff is also great as affected by seasonal variation of precipitation. Rivers in northern areas have a greater seasonal runoff variation with the maximum runoff of consecutive four months accounting for more than 80 % of the annual total in some areas; while in contrast, this ratio is about 60 % for rivers in the southern areas.[4] This temporal pattern of precipitation further intensifies the uneven spatial distribution of water resources.

As the main body of freshwater resources, numerous rivers exist in China, all of which total approximately 420 thousand km in length. The basin area of 5000 rivers is above 100 km^2, that of 1500 above 1000 km^2.[5] Nine river basins are geographically divided, including the Yangtze, Yellow (Huang), Hai-Luan, Huai, Song-Liao, Pearl (Zhu), Southeast, Southwest, and Northwest. On a national level, seven important rivers which have national significance in water supply, ecology and socio-economic development, are frequently used as examples to illustrate their average annual runoff (Fig. 1.1). While all these seven rivers run through multi-provinces, it is generally recognized that managing water resources in China largely depends on how to manage these seven significant rivers.

Main Water Problems in China

Any water management regime is supposed to deal with mainly three water problems: too much water (flood), too little water (water shortage, drought) and too dirty the water (water pollution and degradation of aquatic ecosystems). Each problem presents very distinctive challenge to a nation's development trajectory and requires corresponding legal response. China's water resources have been under considerable pressures, including but not limited to water shortages, water pollution, groundwater overexploitation and uneven water distribution. Worrisome water problems result in substantial negative environmental and social impacts as well as economic losses, which threaten China's sustainable development. Analyzing water problems on a national level is of significance to set the background for China's water laws and institutions.

Water Resources Scarcity

Accounting for inter-year variation, the average volume of internal renewable water resources in China is estimated to be approximately 2812 billion m^3per year, including both surface water and groundwater.[6] Although China's total volume of water resources ranks sixth in the world, the amount of water resources per capita is

[2]Ibid.

[3]Ministry of Water Resources (2004).

[4]Shen and Liu (2008).

[5]GWP-China, *China Water Resource—Physical Geography*. <http://www.gwpchina.org/EChinaGWP/GWPOther.aspx?NewsID=20f4f59e-b390-46a2-ab79-f7f73daca66e&DisplayOrder=05>.

[6]Jiang (2009).

Item	Songhua River	Liao River	Hai River	Yellow River	Huai River	Yangtze River	Zhu River
Basin Area (ten thousand km^2)	55.7	22.9	26.4	75.2	26.9	180.9	44.4
River Length	2308	1390	1090	5456	1000	6300	2214
Annual Average Rainfall Depth	527	473	559	475	889	1070	1469
Annual Average Runoff(hundred million m^3)	762	148	228	658	622	9513	3338

Fig. 1.1 The annual runoff of China's seven great rivers. *Source* Global Water Partnership (GWP)-China

far less than one third of the world average due to its dense population. Statistics shows that nearly thirty million people living in rural areas cannot get access to enough water while, among 668 urban cities, more than 400 of which require more water.[7] Satellite photographs confirm hundreds of lakes disappearing and, water tables fell and many springs ceased to flow.[8] Water deficit issues are more severe in Northern China, with only 19.5 %of nation's total water resources, while the population accounts for 53.5 %, cultivated land 64.8 % and GDP 45.2 %.[9] The Yellow river meandering through parts of Northern China has been notorious for its chronic water deficit and intensive exploitation. It used to dry up seven times in the past twenty-two years, lasting 1050 days in total, with a distance of more than 300 km of dried river reaches in the average. This great gap of water resources has not only seriously damaged people's livelihood and economic development but also endangered ecosystems along the lower stream and its estuary.[10] Uneven spatial and temporal distribution of water resources, rapid economic development and urbanization with a large growing population, and poor water resources management have been the main factors contributing to water scarcity in China. With the rising water consumption in industry and irrigation, and also the improvement of people's living standards, the water shortage problem will become increasingly severe and will become a major constraint for further development.

Water-stressed areas with water deficit and shortages have resorted to groundwater to make up the difference, in a unsustainable and exhaustive way. The past few decades have seen groundwater extraction increase at an alarming rate. In the

[7]Jiao (2008).

[8]Geng and Yi (2006).

[9]Chen (2001).

[10]Wang et al. (2004).

1980s, there were only 56 areas of groundwater overexploitation. However, this number had gone up to 164 by the end of the 1990s and 400 by 2012. Northern China has experienced much more severe groundwater overdraft than Southern China due to its poor precipitation and intensive irrigation pattern. The excessive exploitation of groundwater, as a result, not only makes work more difficult and expensive to access, but has caused a series of secondary ecological and social problems, such as land subsidence, seawater intrusion and groundwater pollution.

Water Pollution

Besides the challenge of water availability, water quality is arguably a more serious problem for Chinese government. Together with water scarcity, it has been acting a formidable factor threatening China's food security, economic development, and quality of life. In some areas, high incidents of particular cancer could be attributed to organic water pollution.[11] In addition, ecological impacts of water pollution are so severe that they may drive some rare aquatic animals to the brink of extinction.[12] China's former SEPA (State Environmental Protection Administration, the former body of Ministry of Environmental Protection) minister acknowledged that serious water pollution had affected people's health and social stability, and became the bottleneck thwarting China's sound and rapid economic and social transformation.[13] Moreover, In the past three decades after the reform and open policy in 1980s, water pollution has expanded from coastal developed areas to inland developing areas, from surface water to groundwater, and from urban area to rural areas.[14] According to the 2014 China Environment Bulletin published recently, nearly 40 % of surface water and 60 % of groundwater monitored are classified as poor and extremely poor. 20 % of major cities do not have access to purified drinking water sources, while in rural areas, more than half of the residents do not have clean and safe driving water.[15] High volumes of untreated household, industrial and agriculture wastewater are regarded as the dominant pollution source for both surface and underground water.

Uneven Water Distribution

China's population, cultivated land and economic activity are poorly matched with the natural distribution of water resources. For example, around 18 % (134 million hectares) of the country is considered arable and permanent crop land,[16] of which two-thirds lies to the north of the Yangtze River, while this region has only 19 % of China's water resources. In particular, the Yellow, Huai and Hai River Basins account for one-third of China's population and GDP while only 7.7 % of its water

[11]Lu et al. (2008).
[12]Moore (2013).
[13]Xinhua (2007).
[14]Xie (2009).
[15]Ibid xxi.
[16]OECD (2007, 34).

resources. Sparsely populated and mountainous southwestern areas are blessed with five times of freshwater possession than those populous and arid northern areas.[17] On the other hand, water utilization efficiency differs significantly among river basins, which intensify the problem resulted from uneven water distribution. Over 90 % of available water resources (including both surface water and groundwater) are utilized in the Hai River Basin and 50 % in the Yellow River Basin while less than 15 % of water resources are used in the Yangtze and Pearl Basins in the south.[18] Moreover, another growing water pressure of mal-distributed water comes from exceptionally inefficient irrigation water use in agriculture and water-intensive coal mining industries which are both taking place in Northern China. This discrepancy in water demand, compounded with lopsided allocation among population, economy and arable land will largely aggravate water challenges confronted Chinese water managers.

Frequent Floods and Droughts

China is both blessed and cursed by its monsoon seasons and seven major rivers, most often resulting in frequent floods and droughts.[19] Throughout thousands of years of history, China's water managers have been confronted by large-scale floods and droughts. Successful water governance has always been critical in determining the central government's sovereignty and local officials' political promotions. Failure to control these extreme water events will destabilize and endanger the ruler's sovereign power and legitimacy in the form of insurrection and massive migration.[20] Due to the uneven temporal and spatial distribution of water resources, floods are pervasive in South China while droughts are primarily affecting the north and inland areas.[21] One tenth of China's territory, populated by two thirds of the population and producing approximately 70 % of all agricultural and industrial output is below the flood level of major rivers.[22] Around 450 million people live in places prone to floods, including the Yangtze, Yellow, Huai and Song-Liao River Basins.[23] The Yangtze River has been notorious for large scale floods, of which the 1998 disastrous flood affected thousands of people and caused huge loss of life, and economic and social damage. Every year, 1500 casualties are recorded because of floods.[24] The mass deforestation, flood plain reclamation and wetland disappearance happening in the southern rivers exaggerate the flood risk.[25]

[17]UN Food and Agriculture Organization (2010).
[18]Water Entitlements and Trading Project (WET Phase 1) (2006).
[19]Jing J (2000, 29)
[20]Lee (2006, 4).
[21]Yang and Pang (2006).
[22]World Bank (2001).
[23]World Bank (2002, 21).
[24]Jiao (2006a).
[25]Lee (2006, 9).

At the same time, with rapid social and economic development, higher population density and more frequent economic activity are being conducted in flood-prone areas, increasing the vulnerability to floods.[26]

In addition, unplanned over-exploitation for agricultural use and urbanization are contributing to severe water scarcity throughout Northern China. Due to their slow and gradual development over time, droughts have not been allocated as much attention as floods. Currently, Chinese decision makers are more aware of drought problems since large scale droughts are frequently occurring in the past few years, causing serious impacts on food security. Remarkably, recent years have witnessed a converse phenomenon: even the relatively water-rich regions of the country appear to be experiencing increasing natural water shortages.[27] Current water management regime has to respond to these changing challenges to meet the goal of water security.

1.2 Climate Change: a Context, a Threat and an Opportunity

The starting point of this book is the assumption that climate change is real and anthropologic factors are the main reasons contributing to it. Nevertheless, it is worthwhile to clarify climate change from climate variability, especially in the realm of water management, before we go too far and too detailed on climate change.

Climate Variability Versus Climate Change

Climate variability has been one of the most important parameters to be considered and managed by water managers. Eelco even argues that 'water management is all about managing climate variability.'[28] In fact, an optional water management regime is usually determined and shaped by the need to deal with climate variability and the demands of the society.[29] Nowadays, climate variability is still posing, and will continue to pose, great challenges to water management practices. Addressing climate change impacts in the water sector cannot be separated from responding to climate variability. This has been acknowledged by many climate change researchers. For example, most of the literature defines adaptation as responses to the impacts of 'climate change and variability',[30] or 'climate variability and change.'[31] However, they are fundamentally different in terms of their contexts,

[26]Jiao (2006b).
[27]Gleick (2008, 79, 86).
[28]Beek (2009, 51).
[29]Ibid 61.
[30]See, eg, Leary (1999).
[31]Parry et al. (2007, 727).

managing approaches and institutional responses. 'Climate variability refers to shorter term (daily, seasonal, annual, inter-annual, several years) variations in climate, including the fluctuations associated with El Niño (dry) or La Niña (wet) events.'[32] By contrast, climate change is a long-term trend in climate averages that has been observed over the past centuries, and long-term changes in variability (e.g. in the frequency, severity and duration of extreme events).[33] Climate variability reflects a year-to-year fluctuation in the climate record, while climate change means alteration of the composition of the global atmosphere and is *in addition to* natural climate variability observed over comparable periods.[34] Besides, climate variability is relatively more predictable than climate change. The differences between them determine that it is crucial to ask whether current water management regimes which are developed based on climate variability could accommodate different challenges from climate change. This book will not specifically analyze the approaches to manage climate variability but rather focus on the ways to respond to incremental challenges brought by climate change.

Climate Change: a Reality

Previously said, the foremost support for this assumption of climate change comes from series of assessment reports of the Intergovernmental Panel on Climate Change (IPCC). This authoritative scientific panel composed of international prestigious scientists and experts has confidently declared that future warming caused by the emission of Greenhouse Gases (GHG) is probably unavoidable.[35] Furthermore, no matter with which realistic mitigation scenarios, 'it suffices to acknowledge that climate change will play out over the globe in a multitude of dynamic, feedback-plagued and nonlinear physical and biological trends that will be uneven spatially and temporally across the planet and will pose numerous policy trade-offs.'[36] Climate change may generate benefits for many communities and species (for example, changing rainfall pattern may contribute to grain production in some parts of the world), but its adverse effects are projected to outweigh its benefits, especially in developing countries.[37] The increasing risks of natural disasters, sea-level rise, water crises and food shortage are often cited as examples of those adverse impacts.

[32]Climate Kelpie, *Climate Variability and Climate Change—What's the Difference?* http://www.climatekelpie.com.au/understand-climate.

[33]Ibid.

[34]United Nations Framework Convention on Climate Change (1992) art 1, 2.

[35]IPCC (2007).

[36]Ruhl (2010, 363, 378).

[37]Risse et al. (2008, 5).

Climate Change: a Threat for China

As a developing country with a large population, uneven economic development and a fragile ecological environment, China is extremely vulnerable to the impacts of climate change.[38] According to The Hongkong and Shanghai Banking Cooperation Limited (HSBC)'s report 'Scoring Climate Change Risk', China was found to be the third most vulnerable country among G-20 countries after India and Indonesia in terms of their exposure, sensitivity and adaptive capacity.[39] A changing climate will have large effects on ecosystems and our society. Changes within China generally include average temperatures increase, sea-level rise, glacial retreat and annual precipitation reduction in North and Northeast China, and rainfall increase in Southern and North-western China. Extreme climatic events and hydrological events such as heat waves, floods and droughts are projected to become more frequent in the future, and water resource scarcity will continue across the country.[40] These threats are particularly severe in agriculture and animal husbandry, forestry, natural ecological systems and water resources, and in coastal and ecological fragile zones. Hence, climate change policy and law proposed in China should not only be about taking advantage of changes to capture and harness benefits but effectively avoiding and minimizing harms on human and environment to make life better.

Climate Change: an Opportunity for Water Management

Climate change is not only a context and a threat, but also could serve as an opportunity. The interpretation as a context means that any development activity undertaken must consider climate change harms in order to deliver certain

[38]China's National Climate Change Programme (2007). The noun of 'vulnerable'—'vulnerability' should be defined clearly before we go further. 'Vulnerability' is broadly defined as the capacity to be harmed (See Suarez et al. 2009, 151). According to the IPCC 2001, it is defined as 'the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.' (IPCC 2001, 869.) Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed (who or what is at risk), its sensitivity (the degree to which people and places can be harmed), and its adaptive capacity. According to this definition, 'vulnerability must be understood as people vulnerable to something—natural hazards of various types and—having various social characteristics that make them likely to be harmed by a particular hazard to a greater or lesser extent'.(Cannon 2008, 350, 351.) Vulnerability could be due to the inherent nature of a particular system or region, but also may be due to the function of economic, social and political factors. In some cases, these two reasons of vulnerability could be coupled with each other. For example, rural communities in the upper Yangtze River, which rely on pasture and agriculture, are extremely vulnerable due to their fragile ecology and poverty. Determinants of the system's vulnerability are broad, ranging from natural endowment to eco-social conditions. For instance, the vulnerability of a river basin is generally expressed as a function of resources stress, development pressure, ecological security and management challenges. (Gain et al. 2012).

[39]Knight et al. (2011, 4).

[40]China's Policies and Actions for Addressing Climate Change (2008).

flexibility or resilience.[41] Some decisions made today may have a long-term influence on future measures. Water plans, dams and water transfer projects are prominent examples, of which influences could reaches long as twenty to fifty years. Therefore, a climate change-oriented ideology much be embedded in related decision-making process. As a threat or challenge, climate change requires decision makers to address those negative climatic impacts, either through mitigation to reduce the process of climate change or through adaptation with respect to unavoidable impacts. Emerging climate change impacts on human and environment have put unprecedented requirements on our legislation and we have to grasp the nettle. More importantly, climate change pressures could also act as an opportunity to resolve some chronic problems in the process of implementing environmental law and natural resources management law. Although climate change often exacerbates current problems, it also pushes decision makers to a threshold to promote much needed technological, social-economic and institutional innovation. Well-designed climate policies and action are expected to both address climate problem and 'break the logjam in environmental law' by radiating a powerful influence and driving important improvements in environmental law.[42] The attention paid to climate change could also raise awareness for holistic measures, institutional reforms and behavioral changes that have long been overdue and that are win-win options for society, with or without climate change. This has been the case in some other countries. For example, in response to three of the most severe droughts on record, Melbourne in the state of Victoria, Australia, dramatically reduced per capita water consumption and institutionalized permanent water-saving rules accepted by the public. This demonstrates how climate-related extreme events can help people on the ground adapt water polices for sustainability.[43] Horne asserts, with regard to water reform in Australia, that while most actions on water management are often characterized as responses to climate change, the prospect of climate change in reality becomes a driver to address past inaction or inappropriate action.[44] The identification of climate change as both a context and a threat has been very much understood and responded, more or less, by both international and domestic communities. Unfortunately, the opportunities it brings in providing a much-needed catalyst to problem solving have long been ignored.

[41]Originally adopted to describe 'the ability to absorb change and disturbance and still maintain the same relationships between populations or state variables', (Holling 1973, 1, 14.) resilience to climate change is usually defined as 'the ability of a social system to respond and recover from disasters (or other climate change impacts) and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat.' (Cutter et al. 2008, 598, 599.) It not only includes the ability to return to original state after disturbance, but also consist of the ability to advance the state through learning and adaptation—adaptive capacity one may argue. (Adger et al. 2005.) If vulnerability is the ability to be harmed, resilience is the ability to recover.

[42]Wiener (2008).

[43]Brunner and Lynch (2009, 81).

[44]Horne (2013, 137, 140).

In line with this analysis, water resources should be managed, and will continue to be managed, under a climate change context—climate change impacts on water resources must be identified, assessed and considered in future water management strategies and activities. The challenges and problems climate change brings to water management should be resolved by water managers through a range of water management strategies such as water demand management and water pollution prevention. As an opportunity, the new climate change challenge requires serious reflections on the present perceptions and practices of water management, which in some cases encourages a fundamental change in our water management approaches. This reflective discourse may herald a win-win opportunity for both water management and climate change adaptation. For instance, one of the important aspects of this approach is that it raises the awareness about the vulnerability of ecosystems and groups.[45] A further likely benefit is to allay concerns about change and promote transformation.

1.3 When Water Meets Climate Change

Although climate change has brought significant impacts on various ecosystems and natural resources, water resources are more vulnerable among them and can be strongly and adversely hit by climate change. This has been verified, to some extent, through abundant evidence of hydro meteorological records and climate projections. More importantly, water is also the primary medium through which climate change influences other ecosystems, people's livelihoods and well-being.

Environmental impacts initiated by climate change are not only demonstrated in absolute changes, such as increasing temperature, reduced glacier coverage and rising sea levels due to thermal expansion of the oceans, but also showed in changes of natural variability for which we have developed corresponding methods.[46] The former brings an unprecedented fact that never been tested by our legal system, whereas the latter adds another level of urgency to our water crisis at home and abroad. Among those key climatic variables, temperature and precipitation will have significant secondary knock-on effects on water management by altering water quantity, water quality and the occurring pattern of extreme water events. As a consequence, the impacts of accumulating GHG emissions 'threaten not only the availability of water to satisfy human needs for drinking water, agricultural irrigation, and industrial uses, but also the integrity of aquatic ecosystems and the ecosystem services that they supply to humans living in coupled socio-ecological systems.'[47] For that reason, how to adapt water laws and management regimes to indisputable climatic changes should be given higher priority by the governments around the globe.

[45]Wilk and Wittgren (2009, 15).

[46]Ruhl (2010, 363, 383).

[47]Craig (2010, 709,712).

The IPCC identifies that 'water and its availability and quality will be the main pressures on, and issues for, societies and the environment under climate change.'[48] It further notes that 'adaptation to changing conditions in water availability and demand has always been at the core of water management.'[49] These statements of the IPCC for the first time connect water resources management with climate change adaptation. Without recognizing and addressing climate change impacts on water resources, it is impossible to achieve sustainable development which, in a large part, is concerned with water security. Therefore, bearing in mind the vulnerability of water resources as well as its significance to the nation, this book will underscore the adaptive capacity of China's water laws and institutional arrangements in absorbing and minimizing climate change impacts—not only its status quo, but also the way forward.

In China, climate change impacts on water resources have been researched and discussed quite elaborately in the past few years by hydrologists.[50] Special scientific reports on climate change vulnerability and adaptation in China's major river basins have also been published to illustrate how climate change affects and will affect different river basin water resources from a scientific perspective.[51] This chapter will not devote too much efforts in explaining water-related climate change impacts in detail. Instead, it will provide a general picture of climate change impacts on China's water resources to understand their challenges to water management. Previously said, Some of them are incremental impacts to water problems identified earlier in this Chapter, while some are emerging ones.

Impacts on Water Quantity and Water Quality

The average surface temperature in China rose by 1.1 °C from 1908 to 2007, with 1990s being the warmest period in China over the past 100 years.[52] The rising temperature due to climate change may affect the potential evaporation during the crop-growing season, increasing the demand for agricultural irrigation water. It is also expected that water consumption will increase due to anthropogenic factors such as socioeconomic development, population growth and people's lifestyle change. On the other hand, statistics show that there has been a dry trend, with considerable variation among regions of China in the past 50 years. Annual precipitation decreased gradually since the 1950s in northern and northeastern China while it increased significantly in southern and southwestern China.[53] The changing precipitation pattern also reflects in various river basins. For instance, the Pearl and Yangtze River basins became wetter and increased their runoff as a result, while Yellow and Songhua River basins in Northern China experienced drier season and

[48]Bates et al (2008, 7).

[49]Parry et al. (2007, 181).

[50]Piao et al. (2010), Zhang et al. (2009).

[51]Eg., the climate change impacts reports on the Yangtze River Basin, Poyang Lake, Huai River Basin, Hai River Basin, Songhuajiang River Basin have been published.

[52]Wang and Zhang (2011, 77, 78).

[53]Ibid.

declined their annual runoff. The changing water precipitation patterns coupled with the increasing water demand exaggerates the challenges Chinese Government is confronting in managing uneven spatial water distribution. Furthermore, the above changes will also largely determine water distribution among agriculture, industry and domestic use and among different users, which may intensify conflicts and event bring new tensions among competing users.

Based on the changes in temperatures and water quantity, the IPCC predicts that regions enduring higher water temperatures and increased precipitation will likely see a deterioration in water quality from sedimentation, nutrients, agricultural chemicals, and dissolved organized substances.[54] This makes the water pollution in China even worse. In those circumstances, the goal of improved access to adequate safe drinking water will be challenged by climate change. In a nutshell, while current water resources management policies and practices in China have already experienced difficulties in resolving the increasing water demand and water pollution due to social and economic development, climate change also brings additional uncertainty in water supply, water demand and water protection.[55]

The Shrinking and Melting of Glacial Areas

China ranks fourth in the world in terms of both area and ice volume of glaciers by its approximately 60,000 Km^2 coverage and 5590 Km^3 volume.[56] Unfortunately, scientists report that, as a result of climate change, overall areas occupied by glaciers have shrunk by about a third over the past century.[57] The water resources of the Sanjiangyuan region—the headwaters of the Yangtze, Yellow, and Lancang (Mekong) rivers which depend on melting glaciers, appear to be diminishing.[58] It is predicted that glacial areas in this region will reduce by 11.6 % until 2060 compared with that in 1970, increasing runoff by 28.5 % in the same period and with the zero-balance line of glaciers will go up by about 50 m.[59] Increased glacial melting would mean more water over the short term. Yet, after the glaciers are gone, available water resources will decline, driving the ecosystem at its source to be more drought and desertification.[60]

Lakes that depend on glaciers have already shown signs of shrinkage or are drying up as a result of the massive water shortages in headwater regions.[61] This will affect the livelihoods of 500 million people who rely on the glaciers melt water for their agriculture, domestic and ecological water use. For instance, the agriculture sector might be influenced by glacial melt and crop production might decrease due

[54]Bates et al. (2008, 53).
[55]Cheng and Hu (2012, 253, 270).
[56]China Daily (2007).
[57]Gleick (2008, 79, 88).
[58]China Environment (2009).
[59]Wang et al. (2005).
[60]Xu and Ma (2009).
[61]Asian Scientists (2012).

to water shortage.[62] In some areas, the melting glaciers, disappearance of lakes or wetlands and the degradation of grassland have changed local people's livelihoods by forcing them to become ecological refugees.[63]

The increasing water quantity resulting from glacial melting, if coinciding with the very intensive monsoonal activity from June to August, could bring devastating floods for some regions.[64] The temporary abundance of water resources and the potential drought conditions in the long run will present China's water managers with ever increasing challenges. Moreover, the glacial melting in mountainous areas could lead to the formulation of moraine-dammed lakes, which increases the risk of 'glacial lake outburst floods'. This will endanger lives and threaten livelihoods of people living in the vicinity.[65] For instance, according to a study, there have been 143 potentially dangerous glacial lakes identified in Himalaya region of China, of which 91 are identified as high and very high risk of outburst.[66] The melting glaciers and the secondary disasters caused by it have severely affected people in the Sanjiangyuan region. Many local residents have been forced to migrate due to worsening environment conditions, which is partly the result of climate change-induced impacts.

Increasing Extreme Weather Events

Climate change is usually accompanied with frequent droughts and floods. Although it is scientifically inappropriate to attribute any single extreme weather event to climate change, there is scientific consensus that extreme events are becoming increasingly frequent and intense due to climate change.[67] Song Lianchun, the Dean of the National Climate Centre, stated that: '[G]lobal warming is largely to blame for the country's extreme weather events.'[68] Data shows that since the 1990s, there has been an obvious increase in flood frequency in the Yangtze River Basin due to the heavy precipitation induced by climate change.[69] Drought has also become a new common phenomenon in its upper and central stream in recent years, with an increase in frequency and severity.[70]

In addition to droughts and floods, other extreme weather events such as typhoons have also increased significantly, resulting in other secondary disasters.[71] Climate change is widely acknowledged to aggravate the frequency, intensity and damage degree of those disasters through these extreme events.[72] Not only have

[62]The Times of India (2010).
[63]Wen (2009, 8).
[64]Carmody (2010, 8).
[65]China Environment (2009).
[66]Wang (2009).
[67]Cannon and Müller-Mahn (2010, 621, 622).
[68]Zhu (2011).
[69]Xu and Ma (2009, 44).
[70]Wang (2012, 923, 925).
[71]Zhang et al. (2009, 34, 35).
[72]Yang et al. (2007).

they caused great economic damage and had a severe impact on social economic development, but also have negatively affected people's livelihood.

Impacts on Water Infrastructures

By altering global hydrological circulation, increasing the frequency and intensity of the hydrological extremes, climate change breaks the regular operational pattern of hydrological cycles, which consequently will affect the design, operation and maintenance of water facilities.[73] Given the assumption that water infrastructure construction is the best solution to water problems such as floods and water scarcity, Chinese government has developed an integrated system of hydraulic structures.[74] These engineering initiatives have benefited the nation's water resource management tremendously in the past 50 years. However, they are under risk due to the uncertainty and complexity of climate change, not only in normal operations but also in the context of security.

First, most of these projects were designed in accordance with past historical records or short-term environmental variability predication,[75] which is now challenged by uncertain climate change impacts. For instance, dams designed to prevent and resist the one hundred year flood may be at risk and out of operation because of the increasing intensity of floods resulting from climate change. Second, the changes in water status may affect the function of hydraulic engineering projects. For example, the increasing droughts in some sub-basin areas will likely affect the function of water projects primarily designed for flooding control. Third, the security of these water facilitates are under uncertain risks due to the possibility of secondary geological disasters such as landslide and detritus stream triggered by climate change-related extreme weather events. Fourth, whether climate change will bring adverse effects to the stability, feasibility and water availability of water diversion projects like the South-to-North Water Transfer (SNWT) project is uncertain and demands urgent investigation.[76] Due to the frequency of severe droughts in the central portion of the Yangtze River, the success of the middle line of the SNWT project from the tributary Han River to Beijing and Tianjin depends on a further diversion project from the Yangtze River to the Han River.[77] This not only exacerbates the conflicts among these cities and regions, but also questions the legitimacy of the SNWT project in a changing climate.

Impacts on Water-related Socio-economic System

Projected change in climate is not only an environmental concern, but also has serious social and economic implication. Relevant country level studies suggest that

[73]Su et al. (2008).

[74]Wang (2012, 923, 925).

[75]Matthews and Wickel (2009).

[76]Xu and Ma (2009, 57).

[77]Neteasy (2011).

the increasing water variability due to climate change affects economic development significantly,[78] either promoting or constraining further development. In addition, water, food and energy are so closely related that a change in one can affect the others. For instance, changes in water quantity and distribution will severely affect electricity generation. Food security is another concern because of climate change impacts on irrigation water and farming structure. In the Yangtze River basin, for instance, it is anticipated that food production may be cut by 14–23 % by 2050 due to temperature rise, water scarcity and loss of arable land.[79]

Extreme weather events and natural disasters, such as floods and droughts, may increase the risk of humanitarian emergencies, and thus the risk of instability and dislocation in vulnerable basins and far beyond that.[80] Another crisis that needs to be mentioned is the emerging climate change displaced persons,[81] which could again bring about new tensions and conflicts, particularly in regions with large numbers of internally displaced persons and refugees,[82] affecting China's economically, socially, environmentally and culturally in a broader, longer and more persistent way. These challenges or potential risks have to be managed properly in order to achieve the sustainable water development goal.

When climate change meets water, above anticipated changes demonstrate departure from known natural variability and predictability, and behavior in ways beyond the control or spectrum of legal instruments and institutions. Not surprisingly, they inevitably give rise to the demand to formulate new regulations, undertake innovative institutional responses and resolve emerging disputes. However, it is judicious to ask whether existing laws and institutional framework up to the task of managing water-related climate change effects before proposing a new one. It is apparent that most of these water-related climate change impacts are not independent or isolated to existing water problems. While it is important to manage existing traditional water problems, water-related climate change impacts cannot entirely be ignored by the present water management regime. The traditional water management goals, paths, policies and process will inevitably be challenged by these impacts and should be taken into account. In Cannon and Müller-Mahn's words:

> climate change is having an effect not only on the object of development practice (people, natural resources and other assets, livelihoods) but also on the way that the development process is conceived and translated into policy by the subjects of those processes.[83]

Consequently, China's water managers must reflect, improve or transform the current management regime in order to adapt to these incremental and emerging climate change impacts.

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[78]Grey and Sadoff (2006, 1, 8).

[79]Wen (2009, 11).

[80]Ban (2007).

[81]Asian Development Bank (2011), Pan et al. (2011).

[82]Ban (2007).

[83]Cannon and Müller-Mahn (2010, 621, 622).

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Chapter 2
Developing Sustainable Water Legal Framework in China: Prepare for Adaptation

It is acknowledged that water management is notoriously compartmentalized into specialties of different aspects.[1] This fragmentation has frequently and urgently appealed a much more integrated approach to coordinate water-related interests in tandem, of which integrated water resources management regime proposed by the international water community is regarded as a great achievement. While the integration of various water management aspects is still making its progress through breaking down vested interests, the advent of climate change complicates this process from a much broader and deeper scale. Water management regime, now and in the future, not only needs to deal with water conflicts in an integrated model, but is expected to go beyond conventional water management scope to absorb and accommodate climate change effects. Putting the difficulties of identifying direct, cumulative and spillover climate change effects on water use aside, the capacity of extant water management regime in resolving internal water crisis no doubt will affects its role and ability in responding to external climatic challenges. The extent to which it could pass the test of climate change generally defines the adaptive capacity of a set water management regime.

'Adaptive capacity', according to the IPCC, is 'the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behavior and in resources and technologies.'[2] Effective and sustainable water management delivered by a set regime more or less adds up to a higher adaptive capacity which enables the society (including both public and private sectors) to prepare for, respond to, and recover from, climate change impacts quickly.[3] Unsustainable ways of water use, on the other hand, not only enlarge the deficit of adaptation owed by lack of development, legal or financial support, but create more difficulties for adaptation by making aquatic system more vulnerable. This leads to a serious review and assessment of China's water management regime which is framed by structured legal and institutional system, to see how it could deliver sustainable water outcomes.

[1]Burton and May (2004, 31, 36).
[2]IPCC (2007, 727).
[3]Klein and Smith (2003, 317, 320).

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2.1 A Theoretical Introduction of the Integrated Water Resources Management (IWRM)

Modern water industry has realized that the development of a more integrated water management regime should be promoted with all due speed and support. Yet, it was not born in one minute and paid with no price.

Under the backdrop of immense pressure to alleviate poverty and develop its economy in the first 20 years of the Reform and Opening up Policy, China had undergone through an intensive water resources exploration without giving adequate consideration of the water use efficiency and aquatic environment. For instance, the 'treatment after pollution' pattern had dominated the China's overall water management paradigm for decades.[4] This paradigm has been criticized widely due to its negative effects on water utilization and protection. Having been aware of the importance of managing water resources in a holistic, integrated and preventative way, the Chinese government commenced water reform in the late 1990s by establishing a comprehensive legal framework, reforming institutional arrangements and implementing the IWRM regime.[5] Before analyzing China's legal framework on the IWRM, this part will first analyze IWRM to clarify its conception, principles, features and criticisms.

The Evolution of the IWRM

The concept of IWRM was initiated in Mar del Plata, Argentina, at the UN Conference for Water in 1977. The 1990s strengthened the development of IWRM, thanks, in part, to the efforts of several conferences and international organizations, for example the International Conference on Water and Environment, at which the well-known Dublin Principles were formulated.[6] The Dublin Principles were later consolidated into Chap. 18 of Agenda 21 in Rio de Janeiro in 1992. In the same year, IWRM was formally put forward as a part of the portfolio of measures designed to achieve sustainable development by the Rio United Nations Conference on Environment and Development (UNCED).[7] It was not until 2002 at the World Summit on Sustainable Development in Johannesburg, South Africa, that IWRM was recognized as one of the key components to achieve sustainable development. Now it is being implemented in many countries, expecting to achieve the best balance among social equity, economic development and environmental sustainability.[8]

[4]Varis and Vakkilainen (2001, 93–104).

[5]Jiang (2009, 3185–3196).

[6]Rahaman and Varis (2005).

[7]Ibid.

[8]Lenton and Muller (2009, 3).

According to Radif, 'IWRM is based on the perception that water is an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilization.'[9] This integrated approach requires developing water policy options that recognize and incorporate these elements in ways that could promote the sustainable, efficient and equal use of water resources. Among the various understandings and explanations of IWRM, a popular definition is given by the Global Water Partnership (GWP).[10] It describes the IWRM regime as

> a process that enables the co-ordinated management of water, land and related resources within the limits of a basin so as to optimize and equitably share the resulting socio-economic well-being in an equitable manner without compromising the long-term health of vital ecosystems.[11]

Although there are other definitions given, by various organizations and, at conferences, most of them are actually based on the Dublin Principles: (1) water has an economic value and should be recognized as an economic good; (2) water is an integral part of the ecosystem and is a finite resource; (3) human activities affect the productivity of water resources greatly; water management requires a coordination of planning and policy-making at all levels; (4) water management needs the integration of land, water other related resources, which demands the cooperation among different institutions; (5) water has to be managed at a basin, watershed, lake or aquifer level through active participation of the stakeholders at all levels in a decentralized approach; (6) as a participatory approach, water management should involve water users and stakeholders; women should play a central part in the water provision, management and safeguarding.[12] The Dublin Principles have, to a large extent, extended our understanding of water resources and water management. IWRM represents a fundamental transformation of the decision-making process towards a more integrated, cooperative and participatory approach of water management. Mitchell encapsulated IWRM into three key elements: coordination, stakeholder participation and the existence of a different level of decision-making at which integrated resource management can be pursued.[13] His understanding has more procedural and institutional applications, which distinguish IWRM from traditional fragmented, hierarchical and sectoral water management approaches. Nonetheless, it is worthwhile to point out that IWRM is not a simple amalgamation of the existing management of water, land and other related resources, or the assembly of multiple water development concerns. On the contrary, it reflects a paradigm shift in water management, both from a substantive perspective and a procedural perspective.

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[9]Radif (1999).

[10]For more information about the GWP, please visit <http://www.gwp.org/en/About-GWP/>.

[11]Global Water Partnership and International Network of Basin Organizations (2009, 18).

[12]Pangare et al (2006, 79).

[13]Mitchell (1990, 1–21).

Some key principles of the IWRM regime, such as basin-level management, public participation, good governance and information sharing, have been widely recognized and implemented by both developed and developing countries. In order to implement IWRM, most water management strategies and practices should be guided and developed based on these principles. Nonetheless, this does not mean that IWRM is a panacea for water management in every country or every basin. In fact, each country has its priorities, governance approaches and political realities, which must be taken into account to respond to specific condition and needs of that country. For instance, the scale of IWRM is defined differently according to various specific contexts. Canadian IWRM involves four interlocking scales: watershed, sub-watershed, tributary and site, while IWRM in the EU under the WFD (Water Framework Directive) occurs within a network of river basin districts.[14] Even within one country, various levels of government (national, regional and local) apply IWRM within their own social, economic, cultural and political context. By implementing these principles, IWRM is expected to provide pragmatic, incremental, promising approaches and more practical frameworks for various countries and river basins to address water problems within their own context.[15]

Not surprisingly, the IWRM concept and implementation also encounters some skepticism. There are some concerns that IWRM is an unrealistic and impractical approach, difficult to be put into practice and lacking in operational definition and measurable criteria.[16] One recurrent criticism is the multiple, undefined interpretation of the word 'integrated'. In one of his articles criticizing IWRM, Biswas listed more than 30 sets of issues that should be integrated, such as the integration of social welfare, economic development and environmental protection, the integration of surface water and groundwater, the integration of water, land and other resources, the integration of water quantity and quality and the integration of industrial, domestic and agricultural water use.[17] It is true that there has never been a clear definition of 'integration' due to the complicated crosscutting nature of water resources.

Nonetheless, this book argues that it is not necessary and possible to give a unified definition that could apply in different countries and river basins. Some basins may need to focus on the integrated management of surface water and groundwater while other basins may need to manage water quality and quantity in an integrated way. Integration has to be defined according to water management practices, problems and future needs in a specific context. What really matters is the integrated paradigm and approach of managing water resources. Furthermore, IWRM should be deemed as 'an empirical concept which is built up from the on-the-ground experience of practitioners, and a flexible approach to water

[14]Gain et al. (2013, 14).

[15]Lenton and Muller (2009, 3).

[16]Biswas (2004).

[17]Ibid., 251–2.

management that can adapt to diverse national and local contexts.'[18] It is not a theory that needs to be proved by scholars, but instead, 'it is a set of common-sense suggestions as to what makes up important management aspects.'[19]

Three Pillars of the IWRM

Theoretically, for IWRM per se, first, it should not be seen as a single approach but as a wide range of approaches involving institutional, legal, economic and environmental measures to manage water and related resources.[20] Second, it is better to be regarded as a holistic and systemic process—it entails changes or transformations in policies, laws, institutional structures rather than a once-for-all project or investment, which focuses more on the ultimate outcome or impact.[21] Third, it is a dynamic and iterative process, both temporally and spatially. Plans and strategies of IWRM need to take into account future scenarios and they are subject to changes along with the changing situation.[22] The process perspective of IWRM implies that it should be developed as a circular rather than a linear course. In a cyclic process, the previous step is able to shape the next one. Regarding IWRM as a process also enables it to respond to new challenges and opportunities rather than seeking an ending point.[23] In addition to the diverse understanding of the term 'integrated', the practices of IWRM in different jurisdictions, likewise, are varied because of the particular contextual realities of water resource endowments, development priorities and social-economic challenges. Although it is hard to find out a panacea for a successful IWRM, some crucial features of better water management practices are available as suggested below:[24]

(1) sound investment in infrastructure—to store, abstract, convey, control, conserve and protect surface and ground water;
(2) a strong enabling environment—the enabling environment includes all of the social structures that make IWRM function, such as proper goals set for water use, protection and conservation; enforceable legislative framework and policies; financial and incentive structures;
(3) clear, robust and comprehensive institutional framework—laying out institutional forms and functions, building institutional capacity, developing human resources, establishing transparent processes for decision-making and stakeholder participation;
(4) effective use of available management and technical instruments—for such purposes as water resources assessment, water resources management

[18]Danka J. Thalmeinerov, *Introduction to IWRM* Global Water Partnership <www.gwpforum.org>.
[19]Hassing et al. (2009, 4).
[20]Lenton (2011).
[21]Lenton and Muller (2009, 12).
[22]Pangare et al. (2006, 48).
[23]Lenton and Muller (2009, 208).
[24]Ibid., 8–9.

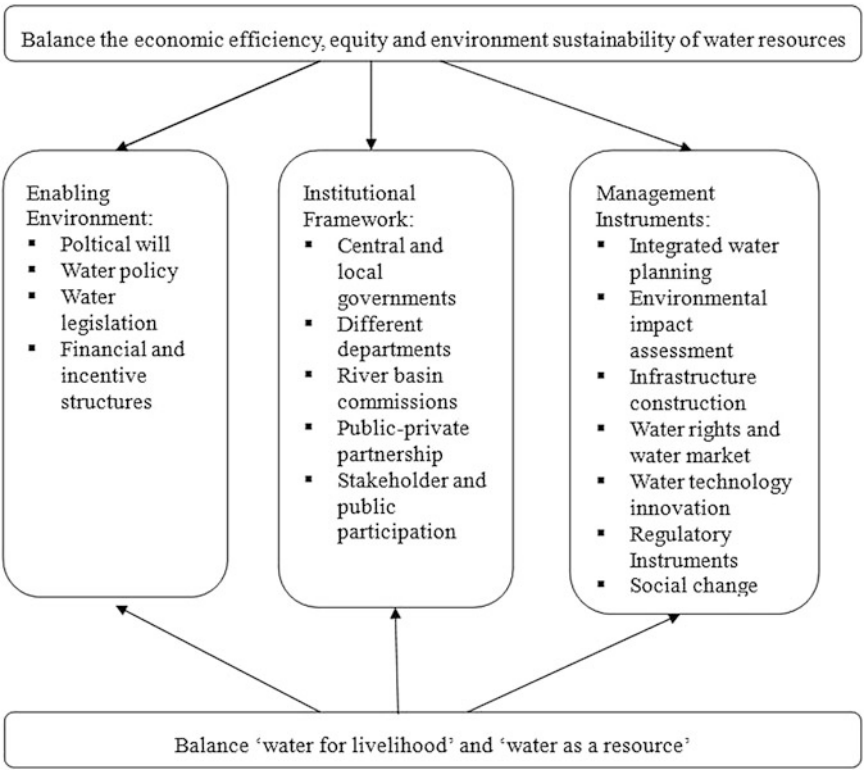

Fig. 2.1 The three pillars of the IWRM—enabling environment, institutional framework and management instruments. *Source* Hassing et al. (2009)

planning, demand management and social change, conflict resolution, allocation and water use limits, using value and prices for efficiency and equity, information management and exchange.

In some of the literature where infrastructure construction is regarded as a water management approach, (2)–(4) are widely referred to as the three pillars of IWRM, attempting to balance 'water for livelihood' and 'water as a resource' (Fig. 2.1).[25] These three pillars provide a relatively comprehensive vision of effective IWRM—from the existence of well-functioning institutions to an enabling policy and legal environment; from the recognition of water as economic good to its environmental value and; from infrastructure investment and good water governance to feasible management mechanisms. Based on the research scope of this book, only the policy and legislative framework of the first pillar, institutional arrangements of the second

[25]Hassing et al. (2009, 4).

pillar and management instruments of the third pillar will be discussed in detail in this book.

Unfortunately, in practice, these different aspects and approaches have been treated differently and, in some cases, inappropriately. For example, among various management instruments employed by water managers, too much emphasis has been placed on water market, partly due to the recognition of water as an economic good under the Dublin Principles and the economic description in the Washington Consensus.[26] 'Far more attention has gone into increasing the efficiency of water use through transfers into higher value-added areas or through new technologies than to equity and social justice central to human development'.[27] In China, the priority of water reforms is focusing on 'efficiency' without considering human rights with respect to water.[28] Water is an economic good, but at the same time, it is also a social good.[29] In 2002, the UN Committee on Economic, Social and Cultural Rights declared water as not only a limited natural resource and public good, but also a human right.[30] Economic instruments such as water pricing and water trade need to be used very carefully to protect people's basic need for water and not to overlook the need of the poor and disadvantaged.[31] Water development initiative could only be sustainable and successful when it is based on the equitable and efficient management.[32]

Besides, due to the prevalence of a technology mentality, IWRM in China has been given more technical than legal and institutional application. However, based on a theoretical analysis of the three IWRM pillars, what the Chinese water managers need to focus on are as follows:

(1) legislation should be designed properly to allocate and manage water use in a way reflecting its social, economic and environmental values;
(2) institutions should be arranged effectively to facilitate the coordination among central, local governments and basin level organizations, and among different related authorities;
(3) mechanisms should be devised wisely to enable the participation of stakeholders in the decision-making process.[33]

[26]Lenton and Muller (2009, 213).
[27]Mukhtarov (2007).
[28]Cullet (2012, 72–73).
[29]Ibid., 72.
[30]UN Committee on Economic, Social and Cultural Rights (2003).
[31]Pangare et al. (2006, 79).
[32]Rahaman and Varis (2005).
[33]Lenton and Muller (2009, 214).

2.2 China's Legal Framework on the IWRM

As one of the pillars underpinning the IWRM, a well-designed legal framework should clearly define water rights, establish proper instruments to implement these water rights and set up decision-making rules or procedures for water managers. To what extent existing water legislation is well stipulated largely determines the ability of water managers in implementing IWRM and further in addressing emerging climate change challenges. This part will focus on investigating the adequacy and effectiveness of water laws in supporting and implementing IWRM. This task is approached by analyzing related regulations at the national and basin level respectively. Along with this analysis, the capacity of water laws in facilitating sustainable water management will be assessed.

2.2.1 Water Laws at the National Level

The Chinese government realizes that the country has reached a tipping point and that further water exploitation and development without considering the environment will come at the expense of greater aquatic environment degradation and social disturbance. Given that, the government has enacted and implemented a set of laws and regulations on water resource management through a complicated and hierarchical legislative system.[34]

With a centralized and unified administrative and political system, the Chinese government has developed an approach of having policies and laws set centrally but implemented locally.[35] Meanwhile, local legislative departments and administrative authorities conserve certain powers in formulating regulations on local issues. For major river basins, river basin commissions (RBCs) are also entrusted with limited power in formulating regulations on specific issues within a basin area. Under such legislative structures, China has built up a comprehensive legal framework on water resources at the national and local level, which covers majority aspects of water resources, including but not limited to water resources development, utilization and protection, water and soil conservation, flood and drought prevention and control, as well as hydraulic project design and management.

In accordance with to current legal systems in China, water laws and regulations are generally classified into the four categories: (1) laws enacted by the National People's Congress (*jiben fa*) and its Standing Committee (*falv*); (2) State Council decrees (*xingzheng fagui*); (3) ministerial regulations of the water-related ministries (*xingzheng guizhang*); (4) local regulations formulated by the local legislative departments and implemented by local governments (*difang fagui he guizhang*). There is a hierarchical order among those laws and regulations in which the

[34]Lee (2006, 4).

[35]Cosier and Shen (2010).

higher-level ones supersede those of lower level. Category (1) is the highest in terms of its legal validity and applicable around the nation, while category (4) is the lowest and only applied within local jurisdictions. Lower level regulations are usually based on, and developed from, national laws, either at the ministerial level or at the local level. With regard to the content, national and local laws are more general while decrees and ministerial regulations tend to be more specific and technical.[36]

Assessing Water Legal Framework in General

Until now, there has been no legislation addressing water utilization, water pollution control, water disaster prevention and control, and ecological conservation in an integrated way. At the national level, four laws—'*Environmental Protection Law*' (EPL), '*Water Law*', '*Water and Soil Conservation Law*' and '*Water Pollution Prevention and Control Law*' are regarded as four basic laws regulating national water resources management. Although engaged with very different concerns, these laws share the same mission in delivering better water governance in the context of China's rapid economic growth. In addition to national laws, more than 25 State Council decrees, 100 ministerial regulations and 800 local laws and regulations have been in place to provide a legal framework for water management activities.

Compared to past water management practices from 1949 to 1978, especially during the Great Leap Forward and Cultural Revolution periods, which were characterized by government dominance and negligence of natural power, China's current water legal system represents a welcome historical development by its acknowledgement of restraining government power and regulating human behavior. A more sustainable, comprehensive and scientific overview has been embedded in most of the water laws. They have paid more attention to sustainable water resources development and focused more on water quality, wetlands protection, flood management, water allocation, and the impact of water resource projects.

Unfortunately, although China's water legislation is quite impressive due to its broad scopes, it also receives many criticisms of its fragmented legislative mentality, ambiguous legal provisions and weak enforcement capacity. With the aim to resolve water problems, these water laws are, in turn, becoming barriers to good water governance, exacerbating existing water crisis. Furthermore, even though some amendments were subsequently made to reflect the new perceptions of water resources,[37] they do not change the ideology, mentality and regime of understanding and managing water resources. Set mainly in the 1980s, these water laws clearly reflect some inherent characteristics of the first generation environmental laws: segmented management of water as natural resource and environmental elements, utilitarianism and anthropocentrism, dominant command-and-control

[36]Zhang et al. (2012, 12146).

[37]See e.g. Water Law was passed in 1988 and amended in 2002; Water Prevention and Control Law was passed in 1984 and amended in 1996 and 2008.

approach and end-of-pipe treatment.[38] For example, the emphasis of most water laws has been on securing water supply, developing hydropower and maximizing the economic value.[39] Another prominent example is the objectives stipulated in these water laws. Economic growth has been the overriding objective of water resources management both at the national and local level. This is often manipulated by economy-oriented government officials at the local level, which results in prevailing water crises like water overexploitation and water pollution. Understanding that, this part will examine the 2002 *Water Law* (of People's Republic of China) as an example to investigate to what extent existing water laws is a contributor or barrier to good water governance.

Assessing 2002 Water Law for Good Water Governance

With the purpose of establishing a water-saving society, preventing water pollution and achieving the sustainable use of water resources, the 2002 *Water Law* developed from the 1988 Water Law indicates a remarkable progress in China's water management history.[40] It emphasizes the saving, protection and rational allocation of water resources, attempting to balance water's economic and environmental value as well as contributing to a water-saving society.[41] Furthermore, it encourages the adoption and implementation of the IWRM, of which Integrated River Basin Management (IRBM) in conjunction with jurisdictional management is stipulated as a dominate water management regime on seven major rivers.[42] According to this law, the RBCs have been established on rivers and lakes that are of national significance to implement IWRM.[43] It is the first time that RBCs are given formal legal status. The requirement that national strategic water resources planning and river basin (regional) planning (comprehensive planning and specific planning), and water supply and demand planning should be conducted provides water resources planning with a clear legal position and a good start for IWRM.[44]

This law also set up a water right licensing system along with a compensation system, signifying the transition from exclusively focusing on infrastructure development to paying considerable attention to water resources protection and management.[45] Attempting to establish a water trading market, this law has promoted the development of water trading practices. For example, a few water transfers have taken place between municipalities,[46] helping to alleviate pressing water shortages in some cities. Other important mechanisms such as water-function-zone system, total

[38]Cao (2006, 255, 258).
[39]Yang and Griffiths (2010).
[40]Water Law of People's Republic of China (2002, art 1).
[41]Water Law of People's Republic of China (2002, art 2, 8).
[42]Water Law of People's Republic of China (2002, art 12).
[43]Water Law of People's Republic of China (2002, art 12).
[44]Water Law of People's Republic of China (2002, art 14, 15).
[45]Zhou (2008, 31–35).
[46]Moore (2013).

pollutant discharge and combined total-quantity control and quota-based control were also established to promote water quality and sustainable water use. After fifteen years' application, mechanisms like water planning, water rights licensing, total water volume control and water-function-zone have been generally established in China.

Nonetheless, the 2002 *Water Law* is criticized for its low capacity in alleviating water shortage, deteriorating water pollution and delivering good water governance. One of the root causes is the dual management paradigm of water utilization and water pollution control, while both of them should be regarded as an integral part of IWRM. Isolated management between water quantity and water quality, between water protection and water utilization gives rise to endless legal conflicts and institutional confusion. This insufficient consistency and coordination is manifested quite evidently between '*Water Law*' and '*Water Pollution Prevention and Control Law*' in terms of formulating water plans, water quality monitoring and information distribution, drinking water protection, and quantity control of pollution discharge.[47] This situation is further complicated by China's outdated legislative philosophy and technique—it only provides general principles and framework for water management, lacking clear definitions, mechanisms and procedures for implementation. Amphibolous language frequently employed in this law has led to various conflicted explanations and difficulties in implementation. For instance, there has been a failure to define 'water right'. Some interpret it as the right to own and use water while some refer it to the legal acquisition of the right to use or benefit from surface and ground water.[48] The flawed demarcation of the responsibilities among various levels of government, water administrative authorities and RBCs have also created a number of vacuums and overlaps.[49]

In addition, numerous regulations and rules formulated under the old 1988 *Water Law* have not been updated or amended accordingly, resulting in vacuums and conflicts.[50] In practice, with a responsive mentality, certain incidents (especially water pollution incidents) could speed up the legislative process of certain chronic water problems. For example, the enforcement of 'Temporary Regulation on Public Participation in Environmental Impact Assessment' was largely due to the Songhuajiang Pollution Incident and Nujiang Dam Construction Dispute,[51] while Wuxi Water Incident catalyzed the formulation of '*The Tai Lake Basin Management Regulation*'. This sometimes inevitably results in inconsistency with other laws.[52]

Comparing the progress with its deficiencies, it is obvious that the 2002 *Water Law* is the combination of a traditional fragmented management regime and

[47]Wang (2012).
[48]Zhou et al. (2008).
[49]Wouters et al. (2004, 277).
[50]Ibid., 301.
[51]China Water Net (2005).
[52]Yang and Griffiths (2010).

advanced IWRM. Although there have been quite a lot breakthroughs in water management ideology and mechanism, this new law shows a clear sign of compromise with formed ideas, interests and institutions. This is partly because China's water resource management is in its transitional stage, which will be analyzed later. While a transitional period is very common for many developed counties in water management history, China complicates this process by its weak legal traditions and powerful administrative system. It is worth noting that the transition will not be accomplished in a short period, indicating that the old and new regime, their conflicts will coexist for the time being. What water legislation can contribute towards good water governance is to be IWRM-oriented and to be updated continuously with new perceptions on water resources.

2.2.2 *Specific Regulations on River Basin Management*

Due to the significance of certain major river basins in China, some administrative regulations and ministerial regulations have been issued specifically. The '*Yangtze River Channel Sand-mining Regulation*' issued by the State Council is one of such examples.[53] Apart from these, there are also some specific enforcement regulations, rules, methods or standards issued by the river basin commissions (RBCs). Most of these normative documents are on specific issues such as the choice and management of sewage outlet in the Yangtze mouth area, soil and land conservation in specific areas and various water resources investigation or valuation. National laws and regulations have to rely on local governments and organizations to implement. Enforcement regulation is one of the most popular approaches to link national legislation with local realities. For instance, the MWR issued '*The Supervision and Management Methods on Drainage Outlets to Rivers*' (Methods) in 2004. In 2011, the Changjiang Water Resources Commission (CWRC) promulgated its enforcement regulation on 'Methods' to supervise and manage related activities in the Yangtze River Basin (YRB).[54] 'Rules tend to be more administrative and methods more technical, while standards provide numerical bases for compliance.'[55] For the RBCs, which are only entrusted with very limited legislative power on certain issues, rules, methods and standards are common tools for them to manage water resources.

Legislative Progress at the Basin Level

Compared to the development of laws and regulations at the national and local level, legislative progress at the basin level has been far behind. For the seven major river basins in China, only the '*Tarim Basin Water Resources Management*

[53]China's River Channel Sand-mining Regulation (2001).

[54]The CWRC (2011).

[55]Zhou et al. (2012, 12146).

Regulation' could be regarded as a comprehensive legislation on water resources. The absence of comprehensive basin level legislation for most of other river basins has been a barrier for IWRM implementation and for the RBCs to play its role.[56] There has been a strong appeal for a 'river basin law' on Yellow and Yangtze River Basin to improve water-related technical cooperation and bureaucratic efficiency.[57] This idea has been widely advocated by legal scholars and water managers due to its advantage in facilitating basin-wide water management and prevent 'public tragedy'. The CWRC, for example, proposed to establish a macro legal system for the YRB, which was centered with 'Yangtze River Basin Law'.[58] However, also due to the broad and complicated nature of enacting a comprehensive river basin law, after several years of research, formal legislative progress still has not been high on the political agenda. While there is still considerable uncertainty for the destiny of the 'Yangtze River Basin Law', some laws or regulations on a sub-basin level have made substantive progress, such as the Tai Lake Basin (TB).

Legislative Progress at the Sub-basin Level

As a sub-basin of the YRB, TB mainly covers Jiangsu, Zhejiang Province and Shanghai Municipality. Although geographically it is regarded as one of the tributaries of the Yangtze River, its significant physical and economic position has distinguished itself as one of China's seven major rivers. With its 0.4 % land and 4.3 % population, the TB generated 10.8 % of the GDP in 2010.[59] Due to the intensive population and rapid economy development, the pressures of severe water pollution, water scarcity and floods have long overwhelmed.[60] The Wuxi Water Incident in 2007 shocked both the central and local governments, which, as a result, catalyzed the enactment of the first comprehensive administrative regulation with respect to a river basin—the '*Tai Lake Basin Management Regulation*' (TBMR) in 2011, after ten years of research and negotiation.[61]

This regulation marks a significant step that China has made towards IRBM from a legal perspective. Not only because is it the first 'river basin law' in China, but, more importantly, it represents an important shift towards IWRM from the existing water management mentality and paradigm. It requires that water resources protection, water pollution prevention, flooding control and aquatic environment security should be integrated in local economic and social development plans.[62] Compared to the counterpart in the 2002 Water Law, which only requires water

[56]Water Legislation Plan in China's River Basin (2004).
[57]Boxer (2001, 335–336).
[58]Water Legislation Plan in China's River Basin (2004).
[59]Tai Lake Basin Bureau, MWR (2011a).
[60]Ibid.
[61]China Water Resource Newspaper.
[62]Tai Lake Basin Management Regulation (2011, art 6).

infrastructure construction to be enhanced by local government above county level and to be integrated in local economic and social development plan,[63] this new regulation implies a significant development from fragmented management to integrated management and a shift from an engineering mentality to a resource-oriented mentality.

Furthermore, the understanding of water resources has been improved significantly. By stipulating that 'the objective of this regulation is to protect water resources, prevent water pollution, guarantee water security for domestic, industrial and ecological use and improve the ecological environment of the TB', the inherent value of water resources in ecosystem management has been recognized.[64] This is significantly different from the understanding of water resources in the 2002 *Water Law* which regards water as a tool for facilitating economic development. In the 2002 Water Law, water resources are managed to adapt to the requirements of economic and social development,[65] while in the TBRM, economic structure and industry distribution is required to readjust to adapt to water resources.[66] This reflects a shift from water-supply management to water-demand management, an essential transformation towards IWRM. Although this new regulation retains the much criticized IRBM and administrative combination management regime, it clearly recommends building a more collaborative mechanism.[67] For instance, it requires that the plans made by local water authority and those of environmental authority must be the subject of collaboration and consistency.[68] An information sharing mechanism among the Tai Lake Basin Bureau, water authorities, environmental authorities and meteorological authorities has been proposed to establish a basin level monitoring and information exchange system.[69]

In a nutshell, as the first comprehensive 'river basin law', the TBMR has shed light on the implementation of the IWRM. It is able to provide valuable experiences for integrated management of water resources in other basins. While the formulation process of this regulation demonstrates the Chinese government's political will in resolving water crises through law, it also reveals the complicated competing interests among different authorities. If this pilot regulation could be implemented effectively in practice, it could encourage and facilitate the legislative process of the river basin laws in China largely.

[63]Water Law of People's Republic of China (2002, art 5).
[64]Tai Lake Basin Management Regulation (2011, art 1).
[65]Water Law of People's Republic of China (2002, art 1).
[66]Tai Lake Basin Management Regulation (2011, art 6).
[67]Tai Lake Basin Management Regulation (2011, art 4).
[68]Tai Lake Basin Bureau, MWR (2011b).
[69]Tai Lake Basin Management Regulation (2011, art 54).

2.3 Institutional Settings of the IWRM

As the second pillar of the IWRM regime, a well-arranged institutional framework could largely assist with the implementation of IWRM in the context of complicated laws and regulations. More importantly, a resilient institutional structure also enables a quick and effective response to emerging information or unexpected events and surprises.

The 2002 Water Law states that water resources in China are public goods and state-owned. The MWR is the department responsible for water resources management and supervision at the national level. RBCs are dispatched institutions of the MWR to undertake corresponding responsibilities and powers authorized by laws, regulations and the MWR.[70] Combined with various levels of local government and water authorities (provincial, prefecture and county), a complicated multi-level administrative system with a river basin-based approach has been formed in China.[71] From a horizontal perspective, other authorities, such as the MEP and the Ministry of Agriculture (MOA) take their own responsibilities from their sectored interests. As a result, current institutional settings on water management are characterized by being 'vertically fragmented and subject to primarily sectoral management'.

2.3.1 Vertical Institutional Settings

Vertical institutional settings deal with the responsibility distribution among different levels of government and water authorities, from central to regional (basin) and to local level. China has developed a powerful centralized administrative system, where the central government plays a dominate role in managing water resources, especially on river basins and lakes of national significance. At the national level, the MWR reserves the ultimate responsibility of water plan preparation and withdrawal permit to balance water demand and supply. The RBCs are responsible for implementing water plans and laws, and coordinating conflicts at the basin level. They are also empowered with certain power of organizing the planning process and determining key plan elements for trans-provinces tributaries or sub-basins, together with provincial water authorities.[72] Various levels of local water authorities are accountable for water management within their own administrative jurisdictions.

Practices show that the relationship among various levels of government has not been coordinated well to convey sustainable water use. Policies, plans and laws made by the powerful central government are often encountered with resistance or

[70]Water Law of People's Republic of China (2002, art 12).

[71]Shen and Liu (2008).

[72]Water Law of People's Republic of China (2002, art 17).

ignorance of local governments that are responsible for their implementation. Inter-governmental rivalries, corruption and incentives favoring economic development than sustainable resources use have largely undermine China's effort to implement ambitious water management strategies.[73] Additionally, within China's hierarchical administrative structure, most water-related authorities are only responsible for making and implementing water decisions within their own jurisdictions, based on their own interests and priorities rather than considering the interests of the whole basin.[74] RBCs complicate this administrative structure due to their ambiguous legal status. Based on the regime of IRBM in conjunction with jurisdictional management, RBCs and local government play key roles in water management of the basin level.

The Role of the RBC in China's Water Resources Management

A credible river basin commission should have at least three characteristics, namely comprehensive administrative authority related to the economic and social development within the river basin, substantial independence in both river basin management and administrative expenditures, and strong coordinating functions.[75] Using these three lenses to measure the powers and responsibilities entrusted to the RBCs of China, it is evident that they have not yet developed into a mature and credible river basin commission.[76]

According to Article 12 of the 2002 *Water Law*, the RBCs are directed by the MWR to undertake administrative water management responsibility for designated river basins. However, due to the ambiguous language in the Water Law, there are no clear stipulations with respect to the powers and responsibilities given to them.[77] In practice, they have proceeded in accordance with the following missions:[78]

(1) To implement and supervise the enforcement of Water Law and other relevant laws; to exercise the water administrative functions as enacted in the Water Law and authorized by the MWR
(2) To organize the preparation of basin master plan and specialty plans, and oversee their implementation
(3) To deploy preparatory work and technical review for the planned projects
(4) To implement the IWRM in the basin
(5) To provide guidance, coordination and supervision on flood control and drought relief activities in the basin
(6) Water resources protection in the basin

[73]Moore (2013).
[74]Xie (2009, 47).
[75]He and Chen (2001).
[76]Yang and Muller (2009, 148).
[77]Zheng (2005).
[78]Changjiang Water Resources Commission, *The Introduction of CWRC* <http://eng.cjw.gov.cn/eng-introduction-mission.asp>.

(7) The construction and management of central government funded water projects; guidance and supervision for river development projects
(8) Unified management of river sand extraction, including supervision, coordination and guidance
(9) To organize the implementation of soil conservation in priority areas, including soil loss control, dynamic monitoring, supervision and guidance

When observing these missions and responsibilities, verbs like 'organize', 'prepare', 'coordinate' 'supervise' and 'guide' etc. are employed very frequently. It indicates that RBCs have been entrusted with more procedural rather than substantive powers. From a substantive perspective, although they have certain powers such as distributing water among provinces, formulating certain regulations and operating water projects, they only have very limited power in allocating water resources, managing water resources exploration and conservation and making water resource planning at the basin level.[79] Even the duty of water pollution prevention and control, an indispensable part of IWRM, has been assigned to the basin's water resources protection bureaus affiliated to the MWR and the MEP. From a procedural perspective, supervising the implementation of laws and plans, coordinating conflicting interests and providing scientific guidance have been the main responsibilities of RBCs. For example, in the 'Water Pollution Prevention and Control Law', responsibilities of RBCs are limited to monitoring water pollution and reporting the monitoring results to the MWR and MEP. It does not have the authority over pollution control at the source. Being entrusted with procedural power is essential and crucial for RBCs to mediate conflicting interests, but without appropriate substantive power, it is not able to function as a real river basin commission for the interests of the whole basin.

Besides that, the affiliated position to the MWR also restrains RBCs from being effective river basin commissions. As an extension of the MWR, RBCs can only undertake actions within the responsibility scope of the MWR in a very narrow way.[80] For example, they have authority on related water quantity issues, but does not have the same authority for water quality. In addition, being confined by the responsibility scope of the MWR, RBCs have a single focus on water resources, without giving enough consideration to other sectors such as land and forest. Their affiliated status also determines that they will follow the approaches of the MWR in managing water resources. As a result, RBCs are intended to provide technical support, preferring a technology and engineer-oriented approach rather than an integrated technical, economic and legal approach. They are very weak in enforcing laws in terms of investigating and punishing those illegal water activities. In general, RBCs have been mainly functioned as the principal scientifically administrative, advisory and consulting agency within river basins.[81]

[79]Jiang (2009).
[80]Turner (2004).
[81]He and Chen (2001).

Furthermore, although using the term 'commission', the RBCs do not work like those in the U.S., Europe, Australia or Japan, which have wide representatives from various levels of governments, water users and interested public. There is no institutionalized procedure or platform for other related departments (e.g. the MEP) and local governments to participate, which inevitably impairs their ability in managing water resources comprehensively.[82] As a crucial part of a real river basin commission, stakeholder and public participation has also not been in place. No proper mechanism has been designed to bring the voice of related stakeholders, communities and NGOs. Consequently, most of the decision-making on China's water management are administration-driven rather than stakeholder-driven.[83]

Being aware of the problems, some RBCs such as the CWRC are undergoing a systematic reform of their management system to develop themselves to be proper basin commissions.[84] For instance, there has been an increasing role of the CWRC in strategic planning of those significant provincial watersheds or lakes that are used to being predominated by provincial water departments.[85] Nonetheless, its fully-fledged status cannot be established just through RBCs' self-reform. In the above case, the CWRC still lacks power over plan enforcement, which too often leads to incompatibilities between a plan on paper and in practice. To be real RBCs, they need the empowerment from relevant laws to stipulate clearly their substantive responsibilities. More importantly, they require a paradigm shift to include the public participation as an integral part of the RBCs and the decision-making process.

Local Government and Water Authorities

In the 2002 *Water Law*, the RBCs are required to collaborate with local government to implement the IRBM in conjunction with jurisdictional management regime. Local government is required to be responsible for water resource development at local level through its water authority.[86] As part of provincial government, provincial water authority is under the technical and professional guidance of the MWR. There is no administrative and professional hierarchy between the RBCs with provincial water authorities, which is hard for the RBCs to get involved in local water affairs. In that case, the function of the IRBM in conjunction with jurisdictional management regime, largely, depends on the collaborative mechanism among them. While local government prefers to manage water resources from its own local interests,[87] managing water resources on behalf of the whole basin will prove to be very difficult due to the delineation of duties and responsibilities between the RBCs and local (especially provincial) water authorities.

[82]Li and Zhao (2012).

[83]Song et al. (2010, 503).

[84]Cai Q (2005).

[85]Xia and Pahl-Wostl (2012, 71).

[86]Water Law of People's Republic of China (2002, art 23).

[87]He and Chen (2001).

Under China's administrative structure, all ministerial departments at the central level such as the MWR and MEP can find their subordinate agencies at various local levels (province, prefecture, county). These lower level water authorities conduct their duties and responsibilities within their respective jurisdictions. They have technical skills, but their internal incentives are not well matched with current institutional missions.[88] Although they receive technical and professional guidance from upper-level counterparts, upper-level authorities do not have much leverage in ensuring that national regulations and standards are strictly enforced at the local level.[89] Since water authorities are part of the corresponding local governments, they are influenced by government decisions and are required to report to them administratively. In addition, obtaining their financial and personnel resources from local governments, water authorities face significant financial constraints and are frequently undermined by economic pressure while enforcing their policies. On the other hand, local governments are very often sponsors or stakeholders of polluting enterprises, considering environmental regulations incompatible with economic growth.[90] Based on local protectionism, they are very likely to ignore or minimize the pollution problems produced by industrial enterprises. This relationship with local governments makes it difficult for water authorities to enforce their policies and play their role in managing water resources comprehensively and sustainably. In reality, it too often leads to a situation that water resources are managed in ways maximizing local but ignoring basin-level interests.[91]

The Stakeholders and Public Participation in the RBCs

Civil society involvement or more specifically public participation is the third pillar of the IWRM. As Xie argues, 'public participation is helpful to tailor policy to local situations, to maximize the social welfare and utility of resources use, and to protect vulnerable groups.'[92] Whether stakeholders and the public are engaged in the decision-making process is one of the criteria of good water governance. At least two approaches can be employed to facilitate public participation: an institutional setting to include representatives of the stakeholders and the public and; a procedure or mechanism stipulated in legislation to engage the stakeholders and public in the decision-making process. From an institutional perspective, as previously analyzed, most RBCs are not yet developed into fully-fledged river basin commissions where stakeholders and the public are an inherent and integral part of the RBCs. From a legal perspective, current regulations are not effective in enabling them to participate in the water planning and decision-making process.

[88]Varley (2005).
[89]Beyer (2006, 210).
[90]Ibid., 207.
[91]Johnson (1997).
[92]Xie (2009, 55).

Despite the fact that water laws in China have provided a simplified system for public participation,[93] most of these provisions exist only in principle and are very weak in practice.[94] The insufficiency of stakeholder and public participation has resulted from a couple of factors. First, China has a long history of centralized government, making decisions on water resources from the top-down without the involvement of the public. While there has been some development in incorporating public participation in laws and regulations in the past decades (e.g. Regulation on Public Hearings for Administrative Permits in Water Sector),[95] its application in practice is often manipulated by governments. Second, although there are guidelines and principles of public participation in the legal framework, there is no clear procedural regulation for institutionalized participation.[96] This too often leads to distorted implementation. Third, as a crucial precondition of public participation, information disclosure system has not been in place to ensure stakeholders' right to know. Fourth, as planning for water resource management has often been approached from an engineering perspective,[97] public participation in decision-making process is normally replaced by expert consultation, which provide a 'sound' excuse to exclude stakeholders and the public from involvement. The public are tended to be regarded as having a lack of interest and professional knowledge of water resources management, therefore a lack of participation ability. In some cases, independent experts and potential objectors from the public are prevented from joining the planning process because local governments are concerned they may have different views and consequently regard them as 'trouble-makers'.[98]

The absence of public representatives in the RBCs and related decision-making processes not only undermines the legitimacy of water policies and planning due to lack of affected stakeholders, but also generates conflicts and resistance to implementation if the interests of those affected are not considered.

2.3.2 *Horizontal Institutional Settings*

With regard to institutional settings on a horizontal level, it shows a very complicated intersecting picture, which is dubbed as the 'Nine Dragons Governing the Water'.[99] These 'nine dragons' (not literally mean nine authorities) from different sectors and with different interests of water resources, as a result, lead to sectoral

[93]See e.g. Water Pollution Prevention and Control Law of People's Republic of China (2008, art 10).

[94]Wouters et al. (2004, 307).

[95]Regulation on Public Hearings for Administrative Permits in Water Sector (2006).

[96]Geng et al. (2010).

[97]Easter and Dixon (1991).

[98]Geng et al. (2010).

[99]Feng et al. (2006).

and fragmented water management. The original objective of this institutional setting is to improve water management efficiency and effectiveness from different aspects. However, due to unclear responsibility distribution and insufficient coordination mechanisms, this institutional setting has become a barrier for effective water management.

At the central level, several equivalent departments under the State Council share water management responsibility with the MWR from different perspectives. As shown in Fig. 2.2, the main ministries involved in water resources management are the MWR, MEP, MOA, the Ministry of Transportation, the Ministry of Construction, the State Forest Bureau, the State Development and Reform Commission, the Ministry of Health, the State Electric Power Company and the Ministry of Communication. According to sectoral laws and regulations (e.g. 'Water Law', 'Agriculture Law' and 'Environmental Protection Law'), they are entrusted with certain power to engage in water management within their responsibility scopes. For example, the MWR is mainly responsible for surface and ground water management, flood control and water resources planning from the perspective of water quantity; the MEP focuses on formulation and implementation of national water protection plans to prevent and control water pollution; and the MOA has the responsibility to control agricultural non-point source pollution and protect fishery aquatic environment. This institutional division of responsibilities at the central level is roughly reflected in equivalent line agencies at each of the lower levels of governments. Apart from water authorities above county level, which take charge of water management within their jurisdictions, administrative departments of environment protection, land use, agriculture, construction and transportation also conduct their own responsibilities on related water issues.

Given the crosscutting nature of water resources, involving different authorities could provide a balance to different aspects and values of water resources, subjecting to the precondition that their responsibilities must be clearly defined or arranged. As illustrated previously, existing water legislation is developed based on sectors, which too often results in conflicting legal provisions due to the absence of efficient coordination. Furthermore, the lack of clear responsibility allocation in related water laws is likely leading to overlaps and conflicts when undertaking specific water management actions.[100] For example, while the MWR is responsible for monitoring and regulating the water quantity and quality of rivers to examine and improve their capacity in absorbing pollutants, it is also clear that the MEP takes charge of monitoring water quality to prevent water pollution by implementing regulations on water pollution prevention and plans on total pollution discharge control.[101] In addition, both of them are involved in designating and

[100]Cheng and Hu (2012, 253, 267).

[101]Feng et al. (2006).

Main water-related departments	Main water management responsibilities
Ministry of Water Resources	Surface and ground water management, river basin management, flood control, water and soil conservation, designation of water function regionalization, national water planning and policy making; supervision lower level implementation
Ministry of Environmental Protection	Aquatic environmental protection, water environmental function regionalization/zoning, establishing national water quality standards and national pollutant discharge standards, water pollution prevention and control, supervision the implementation
Ministry of Agriculture	Non-point source pollution control, protection of fishery water environment and aquatic environmental conservation, irrigation water protection
Ministry of Transportation	Pollution prevention and control of navigation of ships on rivers
Ministry of Construction	Planning, construction and management of water supply projects, drainage and sewage treatment projects, urban and industrial water use and urban water supply and drainage
State Forest Bureau	Forest protection and management for protecting watershed ecology and water resources
State Electric Power Company	Construction and management of large and mid-scale hydropower projects
Ministry of Health	Supervision and management of the drinking water standard

Fig. 2.2 Main water-related departments and their responsibilities on water management

developing water functional zones; both of them are responsible for managing, protecting and developing urban water resources; both of them have the power to coordinate transboundary water pollution disputes. The undefined responsibilities, the lack of effective coordination and cooperative mechanisms not only result in unnecessary duplicate data collection, and controversial plans and actions, but also impede the effective implementation of water-related decisions.

Another example of fragmented institutional settings is that water-related disasters such as floods and droughts are managed differently from other water issues. Not only is flood prevention planning formulated separately from river basin planning,[102] but institutions are also organized differently. The main agencies involving in flood control and drought relief are China Meteorological Administration (CMA), State Flood Control and Drought Relief Headquarters (SFCDRH), National Disaster Reduction Centre of the Ministry of Civil Affairs (NDRC-MCA), MWR, NDRC and the Ministry of Land and Resources (MLR). As an administrative body of the MWR, SFDH is the main agency to make decisions and mobilize resources to engage in disaster mitigation activities. However, how to coordinate among these authorities that hold equivalent powers has not been clearly defined. At the basin level, there is the Flood Control and Drought Relief Headquarter (FCDRH) for each river basin responsible for the flood control and drought resistance. Although lead by the SFCDRH, they are administrative bodies of the RBCs. At the provincial, prefectural and county levels, the Flood Control and Drought Relief Office (FCDRO) under corresponding local water authorities are in charge of local floods and droughts. A complicated nexus exists among the MWR, MCA, SFCDRH, RBCs, FCDRH and local FCDROs, resulting in conflicts when clear responsibility allocation is absent. For example, the SFCDRH, MCA and other relevant government departments have their own schemes for declaring an emergency status, but with completely different criteria.[103] The inconsistent actions undermine the emergency response and the effectiveness of relief efforts. Therefore, interdepartmental coordination needs to be improved to provide a more consistent response.

From above analysis, it is reasonable to conclude that this institutional structure is controversial at several points and impedes the effective management of China's water resources. They 'are costly due to their complexity, the need for a high level of consistency and the involvement of multiple government agencies, each with their own priorities'.[104] Unless significant progress is made to establish integrated, efficient and effective institutional settings, IWRM could not be implemented in its desirable manner.

[102]Water Law of People's Republic of China (2002, art 17).

[103]Ye (2012, 94).

[104]Cosier and Shen (2010).

2.4 Practices of the IWRM in China

The implementation of IWRM is not isolated, but is often influenced by various economic, social and political factors. The political transition from a totalitarian regime to an authoritarian regime, the economic transition from a command and planned economy to a market economy, and the social transition from administrative dominated management approaches to a combination of administrative, legal and market approaches have the great potential to redefine and shape China's approaches to managing water resources.[105] In line with these transitions, water resources management in China is undergoing a transition from engineering-oriented and a supply management water management regime to a resources-oriented and demand management regime. In many cases, however, water management practices in the river basins still exhibit the coexistence of tradition and modern water management regimes.

2.4.1 The Status of IWRM in China

Given severe water problems, taking into account the state-of-art water management practices and successful international experiences, IWRM is expected to play an increasing and meaningful role in relieving stringent water crisis. Chief engineer of the MWR, Liu Ning, notes that 'without IWRM, China's total annual water supply will reach 800–900 billion m^3 in the next 25 years or hit the limit of the country's total water supply'.[106] Compared to current fragmented, messy and single-objective water management regimes, IWRM is more likely to achieve sustainable water management through its integrated, coherent, collaborative and participatory framework.[107] For instance, while current fragmentation among sectors and jurisdictions has been the main obstacle of achieving sustainable water management, the coordination of cross-sector and cross-jurisdiction in IWRM will greatly facilitate effective and sustainable water management at the basin level.[108] Within the IWRM framework, strategic operational planning and implementation is processed, stakeholder participation is properly integrated, and economic efficiency, social equity and environmental sustainability are fairly balanced.[109] An expert from the GWP commented that:

[105]Economy (2010, 237).
[106]Liang (2005).
[107]Zhang et al. (2010, 123).
[108]Ibid., 125.
[109]Ibid., 123.

> [I]t is a must for China to use IWRM for its future sustainability as it can help all concerned authorities promote the co-ordinated development and management of water, land and related resource.[110]

Along with the evolution of the concept of sustainable development, which has gradually become a national priority in China, the principles of IWRM are being applied with a view to sustainable water resources management.[111] The adoption and implementation of IWRM is particularly facilitated by amendments to the *Water Law* in 2002.[112] Some important features of IWRM can be demonstrated as follows:

(1) the Chinese State Council holds the ownership of water resources on behalf of the Central Government;[113]
(2) IRBM and administrative management are combined to manage the river basins;[114]
(3) the MWR directs unified water resources management and supervision throughout the country, while local water authorities take their responsibilities within their own corresponding jurisdictions;[115]
(4) integrated planning should be undertaken by regarding a river basin as a basic unit of management;[116]
(5) national strategic planning, river basin planning, regional planning, and also the mid-and-long term planning should be developed and managed in line with each other with respect to the demand and supply of water;[117]
(6) the plan for a region within a river basin should be subordinated to the comprehensive river basin plan etc.[118]

The above provisions clearly indicate that some key IWRM elements have been written into current water legislation, laying important foundations for integrated water management at the basin level, from water planning, responsibility allocation to implementation and monitoring. These salient features of IWRM in the 2002 Water Law mark historic progress over the previous water management regime in China.

The status of IWRM has been further reinforced in the national Five Year Plan (FYP), which is the most significant blueprint for China's national economic and social development. The 11th Five-Year Plan (The 11th FYP) (2006–2010) set out a number of policies and priorities for water resources management, including:

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[110]Liang (2005).
[111]Chinese Academy of Science (2007).
[112]Song et al. (2010, 501).
[113]Water Law of People's Republic of China (2002, art 3).
[114]Water Law of People's Republic of China (2002, art 12).
[115]Water Law of People's Republic of China (2002, art 12).
[116]Water Law of People's Republic of China (2002, art 14).
[117]Water Law of People's Republic of China (2002, art 15).
[118]Water Law of People's Republic of China (2002, art 15).

(1) adopting a more unified management system; (2) shifting from supply-side to demand-side management; (3) integrating river basin management with regional management; and (4) establishing a preliminary system of water rights trading.[119] All of these provisions concerning water resources management at a national level signify a requirement of shift in the water management regime and support the implementation of IWRM in China.[120]

Nonetheless, not all of these initiatives cover all what is necessary to properly develop and implement the IWRM regime.[121] First, while China is moving towards an IWRM regime and taking the entire river basin into account when planning and allocating water resources,[122] the use of the IWRM regime is presented in the Chinese literature as more developed than it seems to be in reality.[123] Although cautious and progressive steps on developing legal framework and institutional arrangements have been taken to keep pace with the requirements of the IWRM regime, the traditional water management regime is still very influential among water communities. The provision that 'river basins should be managed by RBCs in conjunction with local governments' and the limited power entrusted to RBCs in the 2002 Water Law is one of the prominent examples to illustrate IWRM's embarrassing status in China's water legislation. Furthermore, as previously mentioned, effective IWRM should be underpinned by well-designed legal framework, cooperative institutions, transparent and participatory decision-making processes. All of them are based on advanced legal, economic, political and social governance systems. At present, China is on an economic, political and social transition stage, having very limited ability to embrace an IWRM regime in a complete manner: the laws are poorly developed, institutions are fragmented and stakeholders' participation is curtailed severely. These impediments are not conducive to widespread and effective implementation of IWRM.

2.4.2 *The Implementation of the IWRM in China*

Implementing the IWRM at the Basin Level

The IRBM is the adoption and implementation of IWRM at a basin level due to the recognition that the river basin is a basic unit suitable for integrated water and land resources management. It shares majority of the common attributes with IWRM, such as the coordination of water, land and biological resources, the integrated management of upper and lower stream, the participatory mechanisms to solve conflicts and compromise among competing water users, and the balance among

[119]The Eleventh National Economic and Social Development Five-Year Plan (2006, Chap. 25).
[120]Jiao (2010).
[121]Zhang et al. (2010, 125–126).
[122]Water Law of People's Republic of China (2002, art 14).
[123]Makkonen (2005).

economic, social and environmental aspirations.[124] The international community has recognized the status and significance of IRBM in various international documents. For instance, the 1992 Earth Summit declared that 'integrated water resources management, including the integration of land- and water-related aspects, should be carried out at the level of the catchment basin or sub-basin';[125] the 2002 World Summit for Sustainable Development also clarified that 'the river (or water) basin should be used as the basic unit for integrating management'.[126]

In China, the IRBM has also been provided with legal status in the 2002 *Water Law* through the provisions about river basin planning and river basin management.[127] It has been recognized by the CCICED (China Council for International Cooperation on Environment and Development, the high-level consultative body providing strategic consultation to the State Council on issues concerning environment and development) as the fundamental platform for pursuing the harmonization between people and nature, urban and rural areas, economic and social development.[128] Nonetheless, the IRBM is by no means a simple combination of the water resources, land and forest management. Rather, based on the ecological system theory and the extensive participation of stakeholders, it is intended to remove departmental, sectoral and administrative barriers in the management of river basin in order to build a systematic and comprehensive management regime to rejuvenate the river. It also requires a transformation in mentality, legislation, institutional arrangements and management approaches. The full understanding and implementation of IRBM takes some time and requires some significant changes in current social and economic perspectives. On many occasions, the concept of IRBM has been used more or less as a synonym for IWRM in China.[129]

There is a considerable political commitment to implement IRBM at the basin level.[130] One of the prominent examples is the formulation of more comprehensive plans in the context of the river basins. As of 2013, integrated river basin planning (2012–2030) for seven river basins have been approved by the State Council.[131] These new plans set aquatic ecosystem health as a key target in order to manage the river basins comprehensively and sustainably through river basin planning, integrated management and balancing different interests. They focus on flood and disaster prevention, river basin management approaches, aquatic environment conservation and the improvement of water use efficiency, reflecting the transformation in both water management mentality and approach.

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[124]CCICED Taskforce on Integrated River Basin Management (2004).

[125]Agenda 21, Report of the United Nations Conference on Environment and Development (1992).

[126]World Summit on Sustainable Development (2002).

[127]Water Law of People's Republic of China (2002, art 12, 14).

[128]CCICED Taskforce on Integrated River Basin Management (2004).

[129]Varis (2011).

[130]WWF (2005).

[131]The Ministry of Water Resources (2013).

Compared to the progress of IRBM at a basin scale, many practical measures at the tributary or local level have been very innovative. For example, at the tributary level, the CCICED has worked with World Wildlife Fund (WWF) on various Yangtze tributaries to implement the IRBM regime. Case studies conducted by them in the YRB mainly include (1) Xianghexi River Basin; (2) Lake Zhangdu River Basin to examine wetland and river basin management; (3) Lake Poyang where WWF has been working with local stakeholders (government, NGOs, and community groups) to devise an IRBM Action Plan; and (4) Danjiangkou Reservoir (upper Han River).[132]

The CCICED has also proposed to introduce IRBM governance in the Chishui River and the Tai Lake Basin (TB), which are important tributaries with natural and cultural values.[133] Chishui is the last free flowing river of the YRB and is the last refuge for many important fish species while the TB is one of the seven river basins with national significance identified by the MWR. These pilot programs will operate through establishing tributary commissions, undertaking tributary planning and engaging stakeholders to implement IRBM.[134] Experiences obtained and capacity built in these pilot programs are expected to provide reference for IRBM in other basins.

Implementing the IWRM at the Local Level

At the local level, since only limited legislative power has been given to cities, most of these reforms and initiates occur from an institutional perspective (either by establishing new institutions or by facilitating institutional cooperation), to improve technical cooperation and bureaucratic efficiency. Two examples will be provided here to illustrate the implementation of the IWRM regime at the local level.

Example 1: Building Collaborative Mechanisms among Local Government and RBCs

Collaboration among RBCs and provinces with various interests is always one of the most challenging tasks for China's water managers. The fragmentation and conflicts among them have created most of the water problems. Current legal and institutional frameworks do not provide a resolution for these conflicts as discussed earlier. In recent years, many innovative measures have been undertaken towards the development of a collaborative mechanism and have acquired some useful experiences. For example, a 'Five plus One' model has been created to protect the water quality in the middle line of the SNWT project.[135] It is a significant innovation over current 'IRBM in conjunction with the jurisdiction management regime'. In 2009, the Yangtze water protection institution affiliated to CWRC—The Yangtze River Water Resource Protection Bureau (WRPB) organized a conference 'The Joint Meeting on Water Protection and Pollution Prevention in Water Source

[132]Turner (2004).

[133]CCICED Taskforce on Integrated River Basin Management (2004).

[134]Ibid.

[135]Changjiang Water Resource Commission (2011).

Areas' with participation from five prefectures: Hanzhong, Ankang and Shangluo of Shaanxi Province, Nanyang of Henan Province and Shiyan of Hubei Province.[136] The document 'Shangluo Declaration' generated at the meeting proposed to establish a joint meeting system which covers multi-department, multi-level river basin consultation mechanism and an information exchange platform to facilitate trans-jurisdictional and trans-departmental water resources management and conservation.[137] This 'Five plus One' model, which means five local governments plus the WRPB, could break the fence existing among jurisdictions and sectors, promoting more coordinated and harmonious water usage, protection and development. The administrative body it set has made remarkable progress in developing law enforcement coordination mechanism through promoting teamwork in water quality monitoring, investigating illegal activities and responding to water pollution incidents.[138]

Example 2: Setting up Institutions to Integrate Water Quantity and Quality Management

In practice, several highly industrialized cities (including Shenzhen, Beijing, Shanghai and Taizhou in Jiangsu province) which are confronting with the pressure of water scarcity and water pollution have begun to implement IWRM by setting up overarching water authorities to integrate water quantity and quality management.[139] The supervisory and planning functions of water conservancy and resource management are integrated into this single institution, which carries the ultimate responsibility for improving information exchange and cooperation and for solving conflicts among various related governmental authorities.[140] Although these water authorities are not recognized strictly as integrated institutions due to their lack of authority over urban water supply and sewage treatment, and water quality control, their experiences provide valuable insights for larger scale IWRM.[141]

To sum up, Chinese water managers have been aware of the necessity of implementing the IWRM and IRBM. However, given the complicated circumstances of the various river basins, most of which involve several provinces with different levels of development, from the impoverished western area to prosperous east, the variety and escalating gaps among them makes IRBM implementation very challenging.[142] Fortunately, considerable progress has been made at the tributary or local levels on a number of different water management fronts. What various levels of water managers need to realize is that no matter at which level IRBM is implemented, a comprehensive mindset and regime must replace the current fragmented and localized thinking and paradigm.

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[136]Changjiang Water (2011).

[137]China's River Water Resources Protection Bureau (2012).

[138]Chen (2014).

[139]Ministry of Water Resources (2003).

[140]Lee (2006, 18).

[141]Ibid.

[142]Varis and Vakkilainen (2001).

2.4.3 The Transition to a Resource-Oriented Mentality

Preference to Engineering Water Management

China has a long history of managing water resources through project construction, river diversion and canalization, mainly due to the requirements of agriculture and floods control. Some famous examples are Dujiangyan and Zhengguo Canal of Warring States, and the Grant Canal of Sui Dynasty. In ancient times, controlling water resources by constructing projects was usually connected to the legitimacy of political control as well as social stability. Both the Republic of China (1911–1949) and the People's Republic of China (1949–) have inherited this preference to large-scale infrastructures. Even today, the Chinese government still focuses its efforts and investment in expanding irrigation systems, conducting trans-regional diversions and building different scales of dams.[143]

In addition to the legacy from China's thousands of years of history, China's deep-seated understanding of nature-human relationship also imposes a profound influence on China's approaches to managing water resources. Water management in China has been dominated by an 'engineering' (*gongcheng shuili*) mentality,[144] which focuses on human economic interests and the capacity to transform nature. Furthermore, the identification of water resources management as a technical problem in China contributes to the widespread adoption of engineering construction. This preference is further enhanced by China's predominate water professionals in various levels of water authorities. The economic visibility and certainty of hydraulic projects also contributes to their priority among various approaches. As a result, both central and local water authorities prefer to respond to water problems by investing in massive new hydraulic infrastructures rather than innovative management approaches.[145] Perhaps the most persuasive supply-augmentation example is the ambitious and gigantic SNWT project that contains eastern, central, and western routes. This project is proposed to meet projected water demand growth of the north, especially the Beijing-Tianjin region, thus redressing China's fundamental geographic disparity in water availability, through transferring some 45 billion m^3 water per year from central and southwest China.

This entrenched philosophy to control water resources and resolve certain water problems has subjected most China's rivers to intensive fragmented construction of dams, reservoirs and other floods protection infrastructure.[146] On the Yangtze River alone, there are an estimated 50,000 dams, including the largest one in the world—the Three Gorges Dam.[147] Due to the great economic benefits of building dams in

[143]Wouters et al. (2004, 247).
[144]Boxer (2001, 335–341).
[145]Ibid.
[146]Wang et al. (2010).
[147]Gleick (2008, 91).

terms of satisfying growing energy needs and rapid economic development, many new dams, especially those small-scale ones, are still under construction, without fully understanding and assessing their environmental and social costs.

In 2001, the former minister of the MWR, Wang Shucheng, proposed that 'the optimized allocation of water resources must rely on four approaches: the hydraulic, administrative, economic and scientific approaches.'[148] Yet, in practice, the hydraulic approach is still attracting most of the attention from the water management community. The social and legal aspects of water management have generally been ignored. The adoption of these hydraulic construction measures could temporarily resolve some water problems, but at the same time, they have resulted in an inappropriate expensive approach that requires evaluation and public acceptance.[149]

In addition, many researchers, both domestic and international, have revealed that the over-reliance on hydraulic projects have caused a number of environmental and ecological problems due to the interruption of water integrity, the alteration of physical habitats and the disruption of longitudinal connections.[150] The deterioration of aquatic ecosystem and land habitat, the loss of biodiversity and the drying up of the river-system are examples of these adverse impacts. Its negative effect has also been confirmed in the recent severe droughts in the YRB—provinces are proud of their abundant water resources and advanced water facilities did not demonstrate their superiority in tackling severe droughts.[151] The over-reliance on structural measures also leads to a tendency of overconfidence in predictions on future water status, neglecting the potential change in future hydrologic variability.[152] This may be challenged by climate change impacts that are with high uncertainty and unpredictability.

Transiting to Resources-Oriented Management Mentality

Given the adverse impacts of an engineering mentality in managing water resources, there has been a move to rethink and revaluate this long-standing water management approach. A debate about the balance between the continuous investment in hydraulic projects and the investment in better water management regime has also been conducted.[153] This debate argues that: first, the benefits and costs of hydraulic projects must be re-evaluated. Not only should the economic cost of a project be assessed, but also its environmental and social cost recalculated; second, other water management choices such as water efficiency improvement, water rights adjudication and water market development should be given equal consideration. Study conducted at the country level reveals that developed countries

[148]Chen and Chen (2005).
[149]Wang et al. (2012, 925).
[150]Qian et al. (2009).
[151]China.com (2011).
[152]Cheng et al. (2009).
[153]Brown and Lall (2006, 308).

typically require improving water management regime while those less developed prefer dam and reservoir construction.[154] Nonetheless, it is important for less developed countries to realize that improving water management regime will benefit the nation's water development in the long run. In terms of China, where an engineering mentality has been embedded for a long time, redefining and reinterpreting water resources and the management regime is necessary in order to implement IWRM.

Also, productive collaboration conducted with western countries like 'EU-China River Basin Management Programme' help Chinese water managers to adopt a new 'resource' concept and ideology which 'integrates engineer intervention, economic assumption and management strategies to achieve interrelated water quality, water supply, and water conservation goals'.[155] In 1999, the MWR introduced a distinctive perspective to Chinese water management—'resource-oriented' concept (*ziyuan shuili*). In line with this new understanding, on the one hand, the role of water resources has been expanded from fulfilling human needs to recognizing its inherent natural, ecological and social values. On the other hand, water management is recognized as not only a technical issue managed by top-down command-and-control measures but also a social, economic, legal and institutional issue managed through comprehensive approaches. While an engineering mentality implies reliance on administrative and technical approach to manage water resources, this 'resource' mentality entails system thinking and an integrated paradigm of market-based, administrative, scientific, legal and institutional solutions. Since China is on a transition stage economically, politically, socially and legally, this 'resource' mentality will take some time to be fully implemented in practice. Contradictory messages may still be manifested in China's water management community in a short time.

2.4.4 The Transition to Water Demand Management

Population growth, urbanization and economic development are considered as the main driving forces of water crises and the increasing gap between water supply and demand in contemporary China.[156] Besides that, climate change as a fundamental driver of the water cycle not only affects hydrologic processes, but also increases the demands for water supply, which makes water problems in China more complicated than ever before.[157]

[154]Ibid., 308, 315.

[155]Boxer (2001, 335–341).

[156]Wang et al. (2012, 924).

[157]Wang et al. (2010).

China's Water Supply Management

As a legacy of planned economy and engineering-centered water management, China's water resources management are largely supply-driven. Wherever there is a water shortage issue, water managers would resort to finding water to meet the increasing water demand. Measures like massive investment in water conservancy projects (such as dams and reservoirs) and various water transfer projects are regarded as best ways to secure China's water supply. Water management strategies developed under this supply-driven paradigm inevitably put intensive efforts on accessing new water resources, capturing a greater percentage of available surface or ground water and increasing total water storage via project building.[158]

With a very narrow focus on maximizing the quantity of water availability for direct use, this management approach has come at expensive, irreversible and delayed ecological, economic and social costs.[159] Extensive water use without considering water utilization efficiency has contributed to water overdraft, increasing water pollution and more intensified contradiction between supply and demand. The unrestraint water resources exploitation and ignorance of water carrying capacity, too often, lead to the deterioration of aquatic environment and vulnerability to emerging pressures. Freshwater resources are finite and cannot be explored endlessly to fulfill the infinite human desire for water. It should be recognized that water transfer through the gigantic SNWT project may alleviate Northern China's thirst for water in a short time, but it will not be able to resolve chronic water shortfall in a sustainable way. Grim water crisis has pushed Chinese water managers to a turning point where water management paradigm should be reflected and transformed.

Transiting to Water Demand Management

Water demand management was born when water scarcity, water pollution and increasing water supply cost was perplexing western countries. As an integral part of the IWRM regime, it is usually approached through implementing a wide range of technical, planning, economic, legal and participatory instruments.[160] Its strong preference to non-structural approaches is also in line with the transition to a resources-oriented mentality discussed previously. Different from supply management, which focuses on finding new water resources, water demand management commits itself to regulating water demand, optimizing water resources allocation and improving water-use efficiency. The regeneration capacity and carrying capacity of water resources is taken as the threshold when balancing the increasing need for water and limited water supplying capacity. More importantly, the turn to water demand management implies a transformation of legal methods in managing water resources. Regulations on water-drawing permit is the center to implement total volume control, the practical way to allocate water resources and the

[158]Cheng et al. (2009).

[159]Wang et al. (2011).

[160]Gumbo et al. (2005).

prerequisite to perform water right trade. Water authorities who grant initial license are required to consider water supply capacity and balance various water use application. Water rights holders are then encouraged to trade in water market based on different water use efficiency. Both administrative powers and market mechanisms are expected to transfer water to sectors with higher value or more productivity. The great advantage of water-demand management paradigm in water conservation, water pollution control and water utilization has made it advocated by countries with very diverse water endowment. Not only water-strapped countries like Israel and Singapore, but also those with abundant water like America and Canada, advance water demand management positively.[161]

China starts to carry out water demand management after 2000 with the advocacy of the MWR. Yet, in practice, both water plan and water management strategies are still lingering on traditional water supply management. This may result from misunderstandings of water managers and researchers on water demand management:

(1) water demand will certainly continue to increase along with economic development, industrialization and urbanization;
(2) water conservation is not related to water pollution prevention;
(3) water distribution should be in line with local economic development plans;
(4) water savings in agriculture only means saving irrigation water.[162]

With regard to the first misunderstanding, Wang et al. illustrated the relationship between socio-economic development, the state of water resources and water management strategies (Fig. 2.3).[163] From this figure, it is clear that, in the short term, water demand will increase with social and economic development, but will decrease after reaching tipping point C. China is presently at the B → C stage where water demand has exceeded water resources and availability but water is still managed by supply-driven approaches. Wang's paper revealed that the transformation from water supply management to water demand management could serve as a turning point for the change in water quantity demand. The gap between declining water demand and comparatively stable water resources (C → D) could only be bridged through this shift.

Water demand management approaches such as water saving technology, water price setting and water rights allocation, if adopted, will benefit our society in the end: the total water demand could even decrease, the harmony between ecology and human activity could attain and the water quality could be improved. More importantly, these water demand management approaches could stabilize total water demand by changing water demand structures and increasing water use

[161]Wang and Wang (2009).
[162]Qian et al. (2009).
[163]Wang et al. (2012, 931).

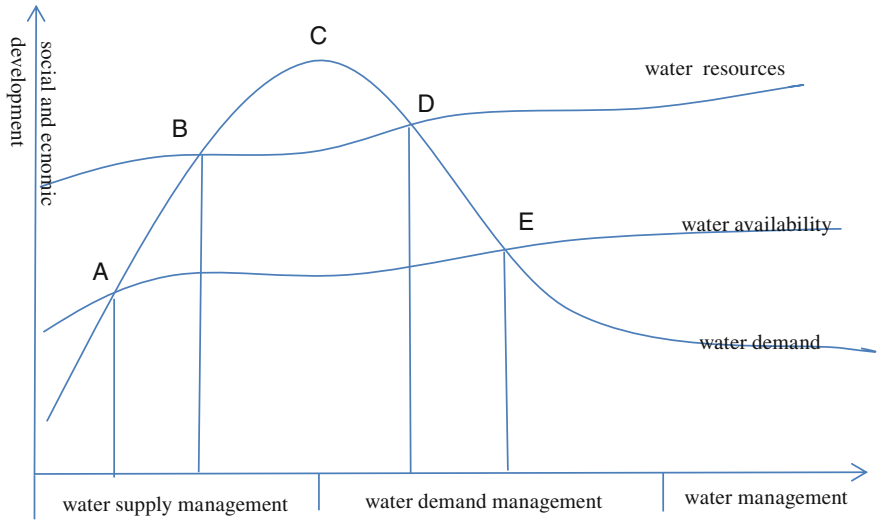

Fig. 2.3 Relationship between social-economic development, water demand and water resource management. *Source* Modified from Wang et al. (2012)

efficiency.[164] The stabilization of water demand on the other hand will also benefit water planning by reducing the difficulty in water utilization forecast in the future.

Along with the new understanding of water resources and water management rules, prevalent misconceptions could be rectified:

(1) the economic development path and model must be adjusted to adapt to the natural availability and variability of water resources rather than the opposite;
(2) water recycling and water pollution prevention is an important way to meet water demand; and
(3) water quality and water quantity should be managed in an integrated way.

As water demand management is a relatively new approach for water managers, how to implement it will remain a very challenging task. Nonetheless, three legal methods could be proposed to control total water demand and improve water efficiency:

(1) setting clear rights to own and use water in order to reduce water conflicts and rivalries;
(2) formulating effective water trade market and rules on the basis of water conservation to improve water use efficiency;
(3) establishing dispute settlement mechanism and promoting regulation enforcement to ensure the commitment to water rights holders.

[164]Qian et al. (2009).

In another research article, Wang et al. presented a framework for implementing water demand management in the middle reaches of the Yellow River. In this framework, tools and techniques to promote water demand management include (1) institutions and laws; (2) market-based measures such as water prices and tariffs; (3) non-market measures such as education and public participation; (4) direct intervention from governments and water authorities.[165] It is apparent that these proposals share much in common, reflecting the trend of the contemporary water world: the combination of marked-based measures and non-market measures such as legal and institutional approaches; and the balance of top-down and bottom-up management approaches. These measures and approaches are expected to improve the capacity of water resources management in responding to changing water demand due to socio-economic development and the emerging climate change.

As mentioned in the previous part, there is a clear requirement in the 11th FYP that water management should shift from supply-driven to demand-driven. In order to achieve that goal, at a central-level government conference about water reform in 2009, a water policy 'implementing the most stringent water resources management system' (SWRM) was proposed to address current water problems and promote sustainable water use.[166] Three objectives (so-called 'three red lines') were announced to establish clear and binding limits on water quantity usage, efficiency, and quality—a water volume control goal which requires to consider the availability of total water volume; a water efficiency improvement goal to improve water use efficiency to save water; and a water-functional-zone pollution control goal which sets aquatic environment as a high priority. According to its content, SWRM actually requires a demand management approach through water availability considerations, water efficiency improvement and water pollution prevention.

At the backdrop of pressing water crisis in China, the requirement to implement the SWRM has been set out in the 12th FYP as an approach to realize a water-saving society.[167] Series of regulations have been enacted to ensure the achievement of stated target. In January 2012, the State Council released the 'Proposal on How to Implement the SWRM'.[168] It not only sets the general principles and goals of water utilization, but also puts forward corresponding measures of managing those 'three red lines'. Safeguarding measures are brought out as a significant part of this proposal, mainly including responsibility distribution and assessment mechanism, water monitoring, water legislation and institutional arrangements as well as the financial support. A year later, the '*Evaluation Methods of Implementing the SWRM*' (Methods) was adopted by the State Council to set the goal of total water volume control, water use efficiency control and water quality

[165]Wang et al. (2011, 562–564).

[166]People Net (2011).

[167]The Twelfth National Economic and Social Development Five-Year Plan (2011, Chap. 22).

[168]Proposals on Implementing the Most Stringent Water Resources Management System (2012).

control of each province by 2030.[169] According to the Methods, the completion of the allocated goals and the implementation of SWRM are regarded as an important index of assessing local economic and social development performance.[170] It implies that water security has been recognized as strategically important to national security as is food security.[171] Yet, this ambitious water management initiatives should be endorsed with three pillars—clarified legal statements on responsibilities to avoid bureaucratic fragmentation and capacity discrepancies threaten; a market mechanism to alleviate administrative cost and optimize water allocation; and most importantly, advancing to an IWRM regime to manage water quantity and quality in a holistic manner in the context of institutional coordination and cooperation.

2.5 Conclusions and Recommendations

2.5.1 Conclusions

The IWRM in China: Still Struggling

The above analysis shows that Chinese water managers have been aware of the importance of managing water in a holistic and proactive way and have started the transition towards the IWRM regime through a series of water-related policies, legislation and institutional settings. Nevertheless, we have to acknowledge that the whole transition is not an easy process. Existing water management framework is influenced strongly by the historical legacy of the planned economy, strong administrative control and weak civil society. As a result, China's water policies, legislation and institutional settings are largely engineering-based, supply-driven, fragmented and usually have limited involvement of stakeholders.[172] Many scholars and water managers reach a consensus that ill-designed legal framework, fragmented institutional arrangements and the ineffectiveness to implement IWRM accumulate to the root causes of current China's water crises.[173]

Implementing the IWRM regime is a long-term, progressive and innovative process for Chinese water managers. It requires an improvement or even a shift in present legal and institutional thinking and arrangements, in order to provide an effective enabling environment. Unfortunately, revising legislation and reforming institutions are subjected to certain social and political context, making it difficult to

[169]The Evaluation Methods of Implementing the Most Stringent Water Resources Management (2013).

[170]The Evaluation Methods of Implementing the Most Stringent Water Resources Management (2013, art 4).

[171]Xu (2012).

[172]Cheng and Hu (2012, 253, 272).

[173]Zhang et al. (2011).

keep pace with the requirement of IWRM. At the basin level, the IWRM regime in China has undergone a different evolutionary path from other countries where enforceable legal and institutional frameworks have been established and where IWRM has a better story.

A prominent example is Murray-Darling Basin (MDB) located in dry Australia continent. To redress rivalrous water use among riparian states, the federal government initiated the IWRM regime by negotiating the 'Murray-Darling Basin Agreement' with relevant state governments. Aiming to 'promote and co-ordinate effective planning and management for the equitable, efficient and sustainable use of the water, land and other environmental resources of the MDB', this agreement established the political (cooperation between federal and state governments), institutional (Murray-Darling Basin Ministerial Council and Murray-Darling Basin Commission), legal (Murray-Darling Basin Act 1993) and financial (annual investment of AUD $8 million) mechanisms for implementing IWRM.[174] In the meantime, the Community Advisory Committee was set up, providing the Murray-Darling Basin Ministerial Council (Council) with advices and perspectives in order to build a two-way communication channel between the decision makers and communities.[175] Firstly framing the water problems and then establishing related policy, legal and institutional frameworks, this path is able to minimize conflicts and inconsistence at a very early stage.

On the contrary, China develops its IWRM regime by integrating the concept of IWRM in the context of existing legal and institutional frameworks that are oriented by a fragmented management mentality. Cautious and prudent steps on legal framework and institutional arrangements have been taken to cater for the requirements of IWRM. However, these tentative steps do not entail unequivocal and systematic support for IWRM. IWRM still struggles to survive within current fragmented and sectoral legal and institutional frameworks. In many cases, the inconsistencies between IWRM requirements and the current legal and institutional frameworks create most of the problems. As a result, the government continues to tinker with water legislation and tweaking institutional system to eliminate conflicts and promote IWRM. Compared to Australia, this path of implementing IWRM is more likely to lead to conflict and contradiction. This can be attributed, in part, to the extraordinary transition in China's politics, economy and social development. Progress will be inhibited undoubtedly, to some extent, during a transition stage. However, if Chinese water managers are able to grasp this opportunity to embrace IWRM through continuously improving legal and institutional frameworks, sustainable water development still could also be achieved at a lower cost. Although political, economic and social scenarios are distinctive between Australia and China, and thus complicate the efforts to draw useful references and lessons, understanding these different evolving paths could help Chinese water managers

[174]Department of Environment and Heritage, Australia Government (2004).

[175]Ibid.

better understand the reasons of the current IWRM dilemma and reorient future focus and development.

Hope of the IWRM in the Future

Research in this chapter reveals that IWRM at the basin level has made some progress, but it is by no means ambitious enough. By contrast, some lower level pilot programs have manifested their effectiveness in resolving local water crises, such as the IRBM cases studies at the tributary level with the help of the WWF and CCICED. Their effective and thriving applications in practice indicate that integrated sub-basin management may be a feasible and promising approach for most river basins. This approach of pilot schemes could also be regarded as a way of exploring uncertainties in the context of economic, social and political transition. Nonetheless, it must be adopted and implemented along with proper coordination with actions taken at the basin level. Only with clarification of responsibilities and effective coordination mechanisms will these pilot programs be able to deliver effective IRBM at a sub-basin or basin scale.

Pilot programs at the tributary level, however, are significantly different from the historical management regime which operated at local level without due consideration of its impacts at the basin level. It has been acknowledged that, based on a basin level vision and planning perspective, decentralizing management responsibilities to local governments is the key to successful IRBM.[176] Focusing on and starting from the interests of the whole basin, implementing IRBM at the local level signifies a paradigm shift compared to historical fragmented management.

2.5.2 Recommendations

To achieve sustainable water management in China, implementing IWRM, improving existing legal framework and reforming institutions are regarded as three fundamental priorities. To be more specific, as previously emphasized, the effective implementation of the IWRM regime is determined by an integrated legal framework, strong institutional capacity, systematic planning and effective coordination as well as institutionalized public participation.[177] Therefore, streamlining the move to an IWRM regime requires a range of policy, legal, institutional and management reforms at national, river basin and local levels. The previous analysis, however, indicates that IWRM reforms have been insufficient, incomplete and largely unsuccessful to this point in time. Recommendations in this part will focus on coordinating existing and conflicting legislation, building collaborative mechanisms and establishing a viable platform for public participation.

[176]CCICED Taskforce on Integrated River Basin Management (2004).

[177]Song et al. (2010, 504).

Improving Water-Related Legislation

While specific legislative provisions are updated continuously to facilitate the new requirements of good water governance, the mindsets underpinning water laws must be updated as well. Majority of Chinese water laws enacted in the last century have been stipulated and implemented with the perception that water resources is a tool to ensure and enhance economic and social development. Decades later, water managers have developed modern water concepts of which the inherent value of water resources in preserving ecosystem has been recognized. Although existing water laws have taken some modern water management approaches, they are still steered by a traditional water management mentality.

Moreover, definitions often have a decisive impact on the quality of legislation. Related water legislation should clarify the definitions of crucial terms, such as water rights, institutions and stakeholders. Obscure language such as 'relevant departments', 'relevant regulations' and 'encourage' should be avoided to prevent misunderstandings and responsibility evasiveness. A strong and cohesive national legislative framework is also very important for the implementation of the IWRM regime. Regulations related to the river basins needs to be overhauled to reduce inter-institutional or inter-jurisdictional contradictions and to provide the RBCs with legal power of formulating plans and enforcing laws. Different functional departments involving different aspects of water resources at various levels (including local government) should take a more coordinative and collaborative approach in drafting water-related laws and regulations, so that any water-related law or regulation is made or amended by relevant authorities on a consensus basis before it is submitted to the legislature for deliberation and approval.[178] This approach could significantly minimize conflicts and improve law enforcement.

Reforming Institutional Settings

An integrated, efficient and coordinated institutional system is at the heart of enforcing IWRM requirements. This can be approached through two different paths: (1) reforming current institutional system to develop a super-ministry for the national water management; or (2) establishing effective cooperation and coordination mechanisms. The former is more of a long-term goal while the latter can be undertaken in the short-term to facilitate cooperation.

For the first approach, there has been some successful example in other countries. For example, a super-ministry system has been effective in delivering sustainable water management in France through the Ministry of Ecology, Energy, Sustainable Development and Sea.[179] By adopting a cross-sectoral and cross-departmental approach, this institutional structure is able to cope with comprehensive and complicated water problems from multiple perspectives. Recently, with the progressive transition to a market-oriented economy, institutional reforms

[178]Xie (2009, 46).

[179]Yang (2013).

to establish a super-ministry system at the central level are in progress in China. The focus of this reform is to amalgamate those departments with overlapping or similar responsibilities in order to simplify and standardize administrative approval procedures and improve management efficiency.[180] Although some positive proposals were discussed in water management area, such as the integration of the Ministry of Land and Resources within the MEP and the combination of the MWR with the MOA,[181] they eventually were not approved by recent institutional reform plan. Nonetheless, it is important to emphasize that the super-ministry reform should not signify a simple consolidation of correlated departments. More importantly, institutional reform in China should be accompanied by the redefinition of the nexus among government, market and society. In line with that, government's role is supposed to transform from 'controlling and administering' to that of 'regulating and serving'. Clear responsibility allocation among various departments should also be taken as an essential part of reform, which could contribute to the coordination, consistency and balance between planning and implementation, as well as between river basin interests and local interests.

Another reasonable option in the short term is to enhance the coordination and collaboration among different departments and with various levels of government. This is necessary even in the context of the aforementioned super-ministry reform. The effective achievement and implementation of certain goals depends on the coordination and collaboration of a variety of actors.[182] While some scholars advocate the establishment of a unified coordination institution or commission for water management of a particular region,[183] this book argues that it is better to take advantage of existing mechanisms or institutions by making some crucial improvements or reforms. At the central level, a 'Joint Inter-ministerial Meeting' is usually introduced to deliberate and review the comprehensive plan of river basins to coordinate interests of different ministries and seek their advices. However, there has not been any statutory framework on how this meeting operates. In practice, the ministry that initiates the action usually dominates the process while the participation of other ministries is often pro forma.

In the future, it should be improved by institutionalizing coordination procedures and mechanisms to deliberate basin-level policies, plans and regulations. Through these procedures and mechanisms, information and knowledge should be shared, coordinative water visions and goals should be discussed and developed, mutual dependence and trust among these ministries should be built and actions should be adjusted to deal with water crises and achieve the joint management of water resources. At the basin level, the RBCs could play a greater role in coordinating central and various levels of local government. Different from the traditional perception on coordination, which is conducted from top-down or among equivalent

[180]Xinhua (2012).

[181]360doc (2012).

[182]Scharpf (1978).

[183]Feng et al. (2006).

entities,[184] the RBCs could be a coordinator or facilitator to bring together the central government who makes policies and plans, and local government who implements them. Developing the RBCs to be fully-fledged river basin commissions is crucial to build an institutional structure to coordinate basin interests and local interests.

The RBCs should be empowered to formulate river basin plans, decide important basin issues, mediate conflicted interests and invite affected public to participate in the decision-making process. They should be comprised of representatives from the MWR, the MEP, local levels of government and their related departments, water users, public representatives, specialists and other social beings.[185] Contrary to the suggestion of establishing a completely new institution like a Water Resources Management Committee,[186] this book argues that RBCs are able to provide a good platform for integrated planning, effective coordination and public engagement if it is authorized to carry out its responsibilities as a real river basin commission.

In addition, some platforms could also contribute to the coordination and collaboration among a variety of parties. The biennial 'Yangtze Forum' and has been established to bring together national and provincial officials and non-experts to discuss coordinated management of the YRB. The 'International Yellow River Forum', however, is not feasible for non-expert due to its strong international and scientific focus. More forums should be developed to bring various interests and voices. Nonetheless, the following aspects should be emphasized to make better use of these forums:[187]

(1) they should establish a coordination mechanism to involve various levels of government in the decision-making process;
(2) they should develop a dialogue and participation mechanisms for stakeholders and the public to participate in decision-making process;
(3) they should regularize its meetings by holding them on an annual basis.

Another quasi-government platform, the CCICED, could also play a greater role in facilitating the IWRM regime. On the one hand, it has the privilege to advise the State Council on water reform, while on the other hand it includes the WWF and International Union for Conservation of Nature and Natural Resources (IUCN) as members. The close relationship between the Chinese government and these international environment-oriented NGOs could contribute significantly to the implementation of IWRM by providing advice and incorporating international

[184]Hanssen et al. (2013).
[185]Yang (2012).
[186]Song et al. (2010, 504).
[187]Changjiang Water Resource Commission (2007).

experiences into the China's context.[188] These mechanisms and platforms should assist related governments, departments and water users to develop a common vision of sustainable water management as well as to formulate a consensus plan of action.[189]

Advancing Stakeholder Participation

Lastly, successful implementation of the IWRM regime relies on participatory water management, which is absent in China's current IWRM practices. Since the development of stakeholder and public participation in the IWRM regime shares much in common with the requirements of climate change adaptation, these issues will be analyzed later in detail in Chap. 6.

The imbalance between human needs for predictable regular flows of water and the variable natural hydraulic patterns determines that water resources management regime and practices should be reflected and improved continuously.[190] It is further argued that only a combination of appropriate hard infrastructure, proper policy and legal instruments, adequate institutional capacity and committed management (including enforcement of policies, laws and regulations) will lead to an effective water management regime.[191] This ultimately will determine the capacity this regime to respond adequately to external challenges, of which climate change is an emerging one.

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[188] China.com (2008).

[189] Changjiang Water Resource Commission (2005).

[190] Gourbesville (2008).

[191] Ibid.

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Chapter 3
The Legal Framework of China's Water-Related Climate Change Adaptation

A healthy and fully functional ecosystem is more robust and resilient to external stressors by reducing related risks, and with greater flexibility in adaptation responses.[1] In contrast, a degrading or poorly managed ecosystem may exacerbate existing vulnerabilities and has a very low capacity in defending against negative climate change impacts. Current water crises in China due to poor water management have been aggravated by evident inconvenient climate change impacts on water. Although Chap. 2 has proposed recommendations on Integrated Water Resource Management (IWRM) improvement from a legal and institutional perspective in order to deliver sustainable outcomes, it does not mean that we can embrace climate change adaptation by these proposals.

Current legal regime on water management no doubt will shape our way of adapting to water-related climate change impacts. Meanwhile, it is equally important to realize that the legal framework on climate change adaptation will challenge and influence that of water management likewise. For example, if current water management regime is dominated by an engineering mentality through constructing water projects, adapting to climate change impacts is likely influenced by the same mentality. Vice versa, if the adaptation framework highlights the need for a holistic approach like proactive planning and information sharing, it will more likely promote the same improvement in the context of water management. Adaptation related policies, regulations and institutions are still evolving and improving in China, and they are very likely to influence the paths and approaches of adapting to climate change impacts in the water sector. In terms of that, a crucial procedure of finding out a legal method of integrating adaptation within water management is to clarify existing adaptation regulations and assess their capacity in managing expected or unexpected climatic impacts.

[1]Munang et al. (2011, 937, 940).

X. He, *Legal Methods of Mainstreaming Climate Change Adaptation in Chinese Water Management*, DOI 10.1007/978-981-10-0404-9_3

3.1 Establishing an Adaptation-Oriented Framework for Water

3.1.1 Understanding the Necessity of Adaptation

Mitigation and adaptation are widely recognized as two related but distinct methods designed to address climate change. The former fixes its efforts on cutting off greenhouse gases to slow down or even curb the process of global warming, whereas the latter talks about preventing and minimizing those unavoidable climate change harms. Much of the international debate about global climate change in 1990s and early 2000s has been overwhelmed by reducing GHG emissions and stabilizing atmospheric GHG concentrations.[2]

For China, the largest GHG emitter since 2007, there is no exception. China's active engagement in the international community has deeply influenced its domestic policy-making circles, primarily through developing climate change policies and restructuring institutions.[3] With concerns focused on energy security and economic development, China has placed considerable efforts into energy production reforms, including things such as GHG emission intensity reduction, renewable energy and low-carbon economy development,[4] which inevitably results in an improved mitigation-preferring legal and institutional system. Prominent examples are the implementation of 'Energy Conservation Law', the 'Renewable Energy Law' and other series of laws to put a premium on the exploitation and utilization of clean energy. Various medium and long-term special plans for energy development, conservation and renewable energy development are also frequently employed by government to achieve the goal of GHG reduction. Not surprisingly, mitigation has a dominant position in China's current climate change discussions and initiatives. Objectives, approaches and focus set in most climate change policies, regulations and institutions show an obvious partiality for mitigation.

On the contrary, adaptation in the Article 2 of the *United Nations Framework Convention on Climate Change* (UNFCCC) is only given secondary consideration and thus is limited to play a role in helping to determine what is 'dangerous'.[5]

[2]McDonald (2010, 1).

[3]Lewis (2007).

[4]Moore (2011, 147–157).

[5]Article 2 of UNFCCC: The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous atmospheric interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. See, United Nations Framework Convention on Climate Change (1994).

According to Burton and May's study, adaptation regime is much less stated in this Convention compared to that of mitigation in terms of its definition, objective, baseline, measures and legal instrument.[6] Consequently, adaptation has long been intentionally kept in the doghouse and talk of adaptation has been long treated as taboo in a quite long period, for fear that it may undermine the need and efforts on mitigation. It is only in the past few years that there is a remarkable increase in the attention paid to adaptation—both theoretically and practically.[7]

In the article 'Lifting the Taboo on Adaptation', Pielke et al. provide three main reasons for adaptation to be put firmly back on the agenda.[8] Firstly, given the physical attributes of GHG, which will remain in the atmosphere long after they were emitted, the warming phenomenon will not be reversed for at least one century even if we stop emitting GHG immediately. Therefore, it is essential to manage climate change induced impacts or risks which have occurred or will occur regardless of mitigation efforts. The second reason is that reducing GHG emission does not directly relate to the reduction of vulnerability to climate change impacts. In many circumstances, severe damage and losses happen where unsustainable development pattern is combined with social and economic inequity. The third reason is that developing countries which suffer the most negative climate change impacts have increasingly turned their attention and focus to climate change adaptation. Adaptation, therefore, should be seen as an inevitable and necessary response for countries affected by adverse climate change impacts.

What's more, the international community has experienced continuous and abject failure to resolve a number of critical issues at the United Nation Framework Convention on Climate Change (UNFCCC) COP meetings. The failure of the Copenhagen summit together with the failure by negotiators at the subsequent COP meetings to reach a binding agreement on the reduction of GHG emissions, has dashed any realistic hope of meeting the target of limiting global warming to a rise in temperature of two degrees centigrade above pre-industrial levels by 2050. In fact, the so-called Copenhagen Accord of 2009 recognizes that a comprehensive program, enhanced action and international cooperation on adaptation is urgently required, especially those developing and least developed countries with vulnerability.[9]

At the same time, extreme and frequent climatic events, such as floods and droughts, compounded with low adaptive capacity force developing countries like China to become increasingly aware of the urgency to adapt to unavoidable obvious climate change impacts without sacrificing other equally important development goals. Mitigation efforts are essential to reduce climate change risks and the urgency of adaptation, but adapting to the climate change impacts that are already

[6]Burton and May (2004, 31).

[7]Adger et al. (2009, 335, 336).

[8]Pielke et al. (2007, 597–598).

[9]Conference of the Parties to the Framework Convention on Climate Change (2010).

'locked in' is also crucial, especially for vulnerable sectors like water resources.[10] Responding to the changing precipitation, distribution and extreme events has been a careladen and imperative assignment confronting Chinese water managers. It should be noted, however, that no specific or concrete law, plan or strategy touching on adaptation has been proposed and put in place in China. Even among extant legal scholarship on adaptation, contestation with developed countries about adaptation assistance (mainly on technology and finance) has been the primary focal point rather than domestic preparedness.

In a nutshell, our society has not been keeping up with the development of climate science and resonating urgent demand of adaptation. In its various climate change policies, government documents and laws, the Chinese government requires that adaptation should be treated equivalently with mitigation.[11] It would be just if this requirement refers to their legal status in climate change initiatives. Yet, in practice, adaptation issues are normally managed with mitigation in the same climate change regulation under the same objective, mentality, principles and responsibility commitment. A crucial question needing to be asked is whether we can adapt to water-related climate change impacts effectively through current mitigation-dominated legal and institutional frameworks.

3.1.2 Adaptation Versus Mitigation as a Legal Problem

We have already go beyond the stage to make an either-or choice between mitigation and adaptation—both of them are essential parts of climate change responses and should be employed in tandem. More room should be left for the discussion of how the two could be mixed or coordinated, especially given their distinctions. Much literature argues that mitigation and adaptation should be integrated with each other in the long-term given their complementarity.[12] This book does agree with this proposal in terms of undertaking concrete measures. Mitigation and adaptation measures may coincide with and reinforce each other. Some measures could contribute to both mitigation and adaptation. For example, the establishment of water markets and the improvement in information exchange could be regarded as both mitigation and adaptation measures. However, when it comes to the legal design and institutional settings, this book argues that adaptation is so different from mitigation that it is better to be managed differently.

[10]Organization for Economic Cooperation and Development (2009, 48).

[11]See, e.g., China's National Climate Change Programme (2007).

[12]See e.g., Mata and Budhooram (2007, 799–807).

Defining Adaptation in a Legal Context

Originated from the field of evolutionary ecology, adaptation in the context of human-induced climate change has not yet resulted in a universally satisfactory definition.[13] Various scholars and institutions provide their own definitions from different perspectives—some focus on systematic adjustment,[14] some on vulnerability reduction,[15] and others on resilience improvement.[16] The Fourth IPCC Assessment Report defines adaptation to climate change as 'the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities'.[17] Adaptation in this book, however, will fix a comparatively narrow focus on how our legal system can absorb and transform in response to those actual, expected or even unexpected climate change impacts.[18] In line with that, the goal of adaptation is not only to minimize and recover from actual and expected harms exclusively, but more importantly, to position us to resume sustainability in the future, even the future is unpredictable.[19] Both public and private actors could contribute to vulnerability reduction and resilience enhancement, through altering the statutory process they make decisions with or modifying the permitted ways they interact with the environment. In some cases, adaptation entails an innovative legal response whereas in some circumstances, it demands a reflective discourse on our extant legal framework and institutions.

Differentiating Adaptation from Mitigation as a Legal Issue

In spite of their relevancy and possible synergy, adaptation distinguishes from mitigation in many aspects, such as the causes and effects, sectors involved, spatial-temporal scales, management approaches and assessment criteria.[20] Mitigation mainly involves economic sectors such as energy, transportation and

[13]Smit and Wandel (2006, 282–292).

[14]For example, Smit et al. (2000, 223–251). (Regarding adaptation as 'adjustments in ecological-socio-economic systems in response to actual or expected climatic stimuli, their effects or impacts'.)

[15]See Pielke (1998, 159–170). (Defining adaptations as the 'adjustments in individual groups and institutional behavior in order to reduce society's vulnerability to climate'.)

[16]See Brooks (2003, 8). (Describing adaptation as 'adjustments in a system's behavior and characteristics that enhance its ability to cope with external stress.')

[17]IPCC (2007a, 6).

[18]According to Ruhl, adaptation is a capital-intensive undertaking, using a broad range of technological, financial, human, social and natural capital. [See, Ruhl (2010, 363, 384)]. This book argues that legal capital can be regarded as an integral part of social capital. Legal capital is at the center of arranging and distributing various capitals through assigning rights and responsibilities, as well as setting regulatory boundaries. This will be given further explain in Sect. 3.2 in Chap. 3.

[19]Ruhl (2010, 363, 393).

[20]Swart and Raes (2007, 288, 291).

domestic building, while adaptation is more likely to be concerned with agriculture, water resources and fisheries vulnerable to changes.[21] The regulatory target of mitigation is comparatively easy to set, which is to substantially cut down GHG emissions, although this does not mean that the achievement of this goal will be easy. On the flip side, adaptation wars against climate harms which are under constant dynamics and thus its goal could not and should not be fixed. To be precise, there cannot be specific and quantified goal for adaptation. In the mitigation realm, regulatory mechanisms like 'common-and-control' regulation for mandatory reduction, cap-and-trade programs, and other economic incentives (such as taxes and subsidies) have a prevailing position, whereas adaptation is usually approached by ecosystem protection, proactive planning, natural disaster prevention and emergency relief. The combination of a command-and-control approach and market mechanisms could contribute greatly to China's mitigation efforts through distributing GHG reduction goals among different jurisdictions and developing viable carbon emission trading mechanism. Efficiency thus is the main concern in achieving the reduction goal. By contrast, administrative measures (such as water planning and administrative assistance), management approaches (such as IWRM) and social cooperation are more applicable in reducing vulnerability and improving adaptive capacity. Conveying directives from the top to bottom and without tailoring measures to local conditions will not be effective for adaptation. Different from mitigation, ecosystem protection, equity and social justice will be the main concerns of adaptation measures.

Different competent departments also manage sectors involved with mitigation and adaptation respectively. Economic development authorities and the departments of energy, transportation and construction will mainly take charge of GHG emission reduction while that of water resources, civil affairs and environmental protection will place more emphasis on adapting and responding to adverse climate change impacts. With respect to institutional responses, mitigation and adaptation is substantially different in how fundamental institutional problems could be identified, framed and resolved. Central government is an important player in allocating mitigation goals through top to down administrative directives, whereas local levels of government have a more crucial role in delivering adaptation measures based on localized climate change impacts and interests. Expenditures and investment for mitigation, as a result, have strong positive externalities, while those of adaptation normally benefit local communities. Additionally, successful mitigation is associated with collective actions coherent, coordinative and cooperative whereas adaptation is a local character and requires no commitment to common solutions.[22] Furthermore, the public could only play a marginal role in influencing mitigation-related decisions and results, while effective participation in the adaptation-related decision-making process could significantly improve the adaptive capacity of decisions.

[21]Ibid., 292.

[22]Heller (1996, 295, 309).

In his article, Ruhl described that a legal system can be defined by its structure (e.g., constitutional division of powers) and processes (e.g., administrative decision procedures), and by the system behavior they produce in the form of actual decisions of executives, legislatures, courts, and agencies.[23] Different configurations of structure and processes of a legal system, not surprisingly, are expected to produce different behavioral outcomes in response to various endogenous and exogenous changes.[24] As a product of legal system, the substantive and procedural content of a specific law could also be interpreted in this way, although by different definitions. Basic elements of a statute could generally include the structure (e.g., the division of powers and the distribution of responsibilities on a specific sector or issue), processes (e.g., the decision-making procedures on that specific sector or issue) and behavioral outcomes (e.g., private and public behavioral changes shaped by specific structure and processes). In this view, the design choices of any regulation on adaptation determine the path and capacity of this regulation in confronting with climate change impacts of various kinds.

According to China's historical legislative practices, the content of climate change-centered laws normally comprise of[25]: (1) general provisions (including aims, principles and guidelines); (2) rights and responsibilities distribution among different levels of institutions; (3) approaches and measures of addressing climate change; (4) guarantee mechanisms and measures (such as technological and financial mechanisms) and; (5) legal liability. Previous analysis on the differences between mitigation and adaptation reveals that their power division, management approaches and institutional settings are apparently distinguished—existing mitigation-preferring legal and institutional frameworks are very unlikely applicable for adaptation issues. Adaptation cannot be simply embraced with current mitigation-oriented climate change legal and institutional frameworks. As Pielke argued, 'new ways of thinking about, talking about and acting on climate change are necessary if a changing society is to adapt to a changing climate.'[26] To adapt to climate change effectively, this book argues that an adaptation-oriented regulations and institutional settings should be established and developed. Nonetheless, it does not necessarily mean a parallel legal system separate from a mitigation-dominated climate change framework and other related laws. Rather, it argues that the differences between adaptation and mitigation must be recognized, identified and reflected in future climate change policies, legislation and institutional arrangements.

This point of view is particularly important for current China that, to this point in time, has joined adaptation and mitigation at the hip in the context of the same climate change policies, laws and with the same institutional arrangements. This

[23]Ruhl (2011, 1373, 1378).

[24]Ibid.

[25]Chang (2012).

[26]Pielke et al. (2007, 597).

approach, due to path dependent, is assumed to continue in a short time. In that case, their differences identified earlier should be factors reshaping future climate change strategies and actions. Otherwise, adaptation is very likely to be overshadowed by the attention and efforts given to mitigation, and unable to deliver resilient outcomes due to entrenched mitigation mentality and approaches.

3.2 China's Legal Responses to Climate Change Adaptation

3.2.1 Adaptation in the Context of Polices and Plans

Adaptation in National Policy and Plan

Given the economic and social implications of climate change, the 12th Five Year Plan (FYP) for national economic and social development for the first time set out climate change as an independent chapter.[27] It requires treating mitigation and adaptation equally through reducing GHG emissions and improving adaptive capacity. In terms of adaptation, climate change factors are required to be taken into consideration when planning economic measures, constructing large-scale infrastructure and projects. The adaptive capacity in responding to extreme climatic events and natural disasters is regarded as a crucial part in minimizing adverse climate change impacts. Integrating climate change adaptation in strategic FYP is more of political implication, but opens the gate of responding to adaptation issues. The UNFCCC entails all the parties to formulate, implement, publish and regularly update national programs to mitigate climate change and facilitate adaptation.[28] As one of the important measures to carry out this obligation, the State Council of China promulgated its first national program on climate change—*China's National Climate Change Program* (the CNCCP) on 30 May 2007. It is supposed to show that the Chinese government has a strong political commitment to respond to climate change and implies that China has made it one of the priorities among its overall environment and development areas.[29] China has commenced to establish a new policy framework on climate change.

The CNCCP sets out the guidelines, principles, objectives and the institutional framework to deal with climate change. With regard to adaptation, it identifies the key areas of adaptation and key measures to enhance adaptive capacity, providing policy guidance and impetus for climate change adaptation.[30] In line with the 12th FYP, it states the equal importance of adaptation and mitigation, as well as the necessity to

[27]The Twelfth Five Year Plan for National Economic and Social Development (2011, ch 21).

[28]United Nations Framework Convention on Climate Change (1994, art 4, 1 (b)).

[29]Cao and Jiang (2010, 195–216).

[30]China's National Climate Change Programme (2007, 23–25).

integrate adaptation with other related policies and programs.[31] The importance of reducing vulnerability and enhancing adaptive capacity has also been recognized. Water resources is identified as one of the vulnerable areas for adaptation, and basin-wide IWRM is proposed as an approach to enhance adaptive capacity. This program provides a comprehensive synthesis of policies and strategies China currently has in place for climate change adaptation.

In 2008, the first White Paper on Climate Change—*China's Policies and Actions for Addressing Climate Change* (CPAACC), was released, to present and assess China's efforts in addressing climate change.[32] Since then, progress reports are released annually to estimate the progress of the CNCCP. Although langue in those reports is descriptive and shallow, evolving contents from setting strategic objective to defining adaptation principles, and to enhance regulations, show a very optimistic trajectory of adaptation progress. More importantly, growing perception of adaptation is normally accompanied with the development in other administrative plans. For instance, compared to that of 2011, one of the highlights in 2012 report on adaptation is the increasing attention to disaster prevention and mitigation. The Ministry of Civil Affairs promulgated the National Disaster Prevention and Mitigation Plan (2011–2015) and other related regulations on disaster relief.[33] The National Emergency Plan on Natural Disaster Relief has also been revised in order to improve early warning and response systems, drought relief and emergency response system.[34] It clearly shows that the Chinese government has been aware of the increasing natural disasters largely driven by climate change and has regarded response systems important for resilience.

In 2013, the nation's first '*National Climate Change Adaptation Strategy*' was published, after two years' compilation by nine ministries including the NDRC, the Ministry of Finance and the Ministry of Agriculture. It clearly sets the goal of increasing adaptive capacity, implementing key adaptation tasks and developing different adaptation pattern in different areas before 2020.[35] At the same time, this strategy requires to develop adaptation-related policies and legal framework, to integrate adaptation consideration in the national planning and the decision-making process.[36] This national adaptation strategy is expected to turn away from scattered and isolated responsive actions to coherent and sustaining proactive adaptation mechanism.

Adaptation in Local Policy and Plan

Due to the localized nature climate change impacts and various vulnerability and adaptive capacities, it is suggested that climate change adaptation be managed at the local level. In June 2008, China initiated to develop provincial level climate change

[31]China's National Climate Change Programme (2007, 23–25).

[32]China's Policies and Actions for Addressing Climate Change (2008).

[33]China's Policies and Actions for Addressing Climate Change (2012, 18–19).

[34]China's Policies and Actions for Addressing Climate Change (2012, 18–19).

[35]National Climate Change Adaptation Strategy (2013).

[36]National Climate Change Adaptation Strategy (2013).

programs. As of November 2011, all of the 31 provinces (this includes autonomous regions and municipalities) have released their climate change programs and have proceeded to implement them.[37] Based on their very diverse climate change impacts, ecosystem vulnerability and natural endowment, these programs identify the key areas and the focal point of adaptation. Corresponding to the CNCCP, water resources have been identified as one of the key areas vulnerable to climate change, and various measures have been proposed to tackle those negative impacts. For example, due to the increasing extreme weather events in the Yangtze River Basin, climate change has worsen the water problems of Hubei Province which has already been distracted by vanishing lakes, aggravating water pollution and constantly disturbing flooding disasters.[38] Thus, in its provincial program, Hubei Province decided to improve its capability in responding to water disasters through improving its water management regime, preventing water pollution and conserving water ecosystems.[39]

Adaptation in Sector Policy and Plan

Under the umbrella of the above national policies, adaptation measures are mainly undertaken by each vulnerable sector. Since 2009, departments concerned with vulnerable areas such as agriculture, water resources, forestry and coastal zones, have initiated some plans and policies to adapt to climate change impacts, such as the 'Climate Change Plan on Agriculture', the 'Comprehensive Plan of National Water Resources'(CPNWR), the 'Climate Change Plan on Forestry' and the 'National Emergency Plan for Meteorological Disaster'.[40] Climate change has been one of the driving forces in promoting their formulation. With the aim of building a resource-saving and environment-friendly society, although most of these plans do not specifically focus on adaptation, they could contribute to reducing vulnerabilities and increasing resilience. For example, the State Council approved the CPNWR in 2010, with the goal of resolving water problems, ensuring the nation's water security and facilitating sustainable water use.[41] By providing strategic guidelines for water utilization, allocation, conservation and management, this plan could largely reduce the vulnerability to changing situations.

3.2.2 Adaptation in the Context of a Legal Framework

Understanding the Role of Law in Dealing with Adaptation

As two different approaches of addressing challenges, policy and law are interactive as well as complementary. On the one hand, policy is a very important precursor for

[37]China's Policies and Actions for Addressing Climate Change (2011).

[38]Climate Change Action Plan in Hubei Province (2010).

[39]Climate Change Action Plan in Hubei Province (2010).

[40]Cao and Jiang (2010, 195–216).

[41]The Ministry of Water Resources (2010).

making related legislation or taking any legal action, especially in those less-developed areas; on the other hand, legislation can provide rules and ensure the enforcement of public policies. Therefore, both policy and legislation should be deemed as necessary to address climate change issues and to facilitate adaptation. To date, however, policy has been the dominant approach to deal with adaptation issues thanks to its flexibility and lower cost. Legislation as an institutionalized mechanism to regulate and rationalize different relationships has not been widely acknowledged and employed by Chinese decision makers.

Much of the literature has reached a consensus that the determinants of adaptive capacity of a society relate to the economic, social, institutional, and technological conditions, which either facilitate or constrain the adoption and development of adaptive measures.[42] These determinants are not independent of each other. Instead, they could influence one another. For example, less effective institutional arrangements could hinder the access to information and create conflicts, reducing the capacity to manage uncertainties and unexpected events around adaptation. As an indispensable determinant of adaptive capacity, the potential of legislation in contributing to adaptation should be recognized by relevant decision makers.

Generally, legislation is important to establish the enabling environment and provide proper incentives for various levels of agencies and practitioners to consider adaptation within their activities.[43] It is also the major vehicle for government decisions to be translated into requirements, prohibitions and procedures through utilizing information from other disciplines.[44] As a crucial element of a society's adaptive capacity, it can have positive or negative impacts on adaptation.[45] Adaptive and responsive legislation is able to contribute to flexible adaptation measures, effective implementation of adaptation policies and quick response to new knowledge and information.[46] In addition, a well-developed legal system, partnered with effective institutional arrangements could promote the integration of climate change adaptation in related policies, plans and activities to minimize climatic harms.[47] Vice versa, if the legal framework does not clarify power divisions on adaptation, ignores climate change factors or encourages activities in vulnerable areas, it could operate as a barrier to effective adaptation.

Although regulation is characterized as rigid, static and slow to update with new information and scenarios, it could 'give expression to institutional rules, shape processes of policy formulation, regulate behaviors, define liabilities and responsibilities, and determine access to decision-making process.'[48]

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[42]See e.g. Smit and Pilifosova (2001, 877, 895–897).

[43]Organization for Economic Cooperation and Development (2009, 74).

[44]Gerrard and Kuh (2012, 4).

[45]McDonald (2010, 11).

[46]IPCC (2007b, 729–730).

[47]National Climate Change Adaptation Research Facility (2010, 29)s.

[48]Ibid., 28.

First, laws and regulations could set power boundaries, distribute responsibilities and stipulate liability for decision makers. Decisions about integrating adaptation in longer-term planning, investment and large-scale infrastructures, as a result, are likely to be more scientific and climate-robust, reducing the risk of policy failure.[49] In a climate change context where natural disasters are becoming more frequent and intense, clear legal stipulations of the duties and powers for emergency managers are not only crucial to protect public safety and citizen's property,[50] but also are able to prevent power-holders from abusing their power under the guise of the public interests.

Second, legislation could create a framework in which the benefits and loss from climate change impacts are distributed impartially in society, conflicts on adaptation are managed and remedies to victims are provided after climatic disturbance.[51] More importantly, clear risk assignment and responsibility distribution could enable problems and conflicts to be managed in a legitimate, rational and peaceful way, minimizing the risk of 'organized irresponsibility' and social conflicts. A just system to allocate future risks is conducive in preventing socially disadvantaged groups from suffering double whammy effect of poverty and vulnerable to adverse climate change.

Third, adaptive laws and regulations are also available to create economic instruments and incentives for adaptation through advocating market activities that promote adaptation and correcting market incentives that could inhibit adaptation or lead to mal-adaptation.[52] They are expected to be very effective in establishing a legal structure where economic incentives or fiscal policies (such as subsides, taxes, bank loans and compensations) are set to promote desirable adaptation behavioral changes.[53]

Fourth, compared to direct climate change polices that are usually produced in an emergent situation for temporary purpose, the legal framework of adaptation is more institutionalized and sustaining.[54] When substantive adaptation goals in climate change policies and strategies are absent, adaptation legislation at least is able to provide flexible legal principles by which adaptation directions are guided. It could also provide a procedural and enforcement framework where adaptation factors are considered. In addition, legislation could be an invaluable educational tool to inform the behavior of both public and private sectors,[55] through creating a public participation mechanism, disseminating information or through direct behavioral encouragement. By setting rules and models for the whole society, laws

[49]McDonald (2010, 12–13).
[50]McDonald (2013, 126, 128).
[51]McDonald (2010, 12–13).
[52]Ibid., 16–19.
[53]McDonald (2013, 126, 128).
[54]Peng (2012, 89–91).
[55]McDonald (2013, 126, 127).

and regulations are credited with raising people's awareness, reshaping their behavior and advancing adaptive capacity.

Recognizing the role of legislation, most developed countries have enacted their climate change laws from different perspectives. For example, the British government promulgated its *Climate Change Act* in 2008 to ensure that the government meets its commitments in addressing climate change.[56] It sets the legal framework for carbon trading and adaptation in UK. In some federal countries like Australia, although national climate change act has not been on political agenda, States like Victoria issued its *Climate Change Act* to deal with pressing climatic challenges within its jurisdiction.[57] On the other hand, America's arduous course in passing a federal climate change law shows a very different story, yet law is still the center of all these climate change discussions.[58]

By drafting a comprehensive Climate Change Law and other provincial regulations, it seems that China is attempting to establish its climate change legal framework, albeit on mitigation primarily. Climate change and its impacts will continue over many years and thus it is necessary to develop climate change strategies and actions underpinned by legislation to provide a strong statutory framework for both public institutions and private actors. Delineating adaptation-related provisions and assessing how they fit in China's climatic picture is beneficial, before new proposals are put forward.

Adaptive Laws

Even though the development of climate change policies shows Chinese government's increasing awareness and determination on adaptation, it is acknowledged that this development is still in its infancy. With regard to adaptation legislation that requires more rigid procedures and profound understanding of adaptation, it is even much less developed. There has been neither 'adaptation law' whose substantive statutory objectives are vulnerability reduction or resilience enhancement, or 'adaptation provision' explicitly state how adaptation should be considered and addressed in the development process. Nonetheless, there are some 'adaptive laws', the implementation of which could accommodate climatic changes and shocks through reducing vulnerability, improving resilience or adaptive capacity. Climate change is framed primarily as an environmental issue by the Chinese government, indicating that the current environmental legal framework (including those on

[56]The Committee of Climate Change (2008).

[57]*Climate Change Act 2010* (Vic).

[58]For example, in 2009, the U.S. House of Representatives passed the American Clean Energy and Security Act of 2009 but this legislation did not get through the US Senate and never became law; in 2010, the American Power Act of 2010 was draft by the Senate and failed to enact again. In 2015, Senators Rob Portman (R-OH) and Jeanne Shaheen (D-NH) have introduced legislation to promote energy efficiency in the past several Congresses only to see it held up for substantive and procedural reasons. Updated data shows that nearly 100 bills focusing specifically on climate change have been introduced in the 114th Congress (2015–2016) and their destiny remains to be seen.

natural resources management) is employed in preference to deal with the need of climate change adaptation.

According to the CNCCP, the most vulnerable areas identified are water resources, agriculture, fisheries and other natural resources, which are mainly located in environmental law's territory. In this case, adapting to climate change risks may be influenced profoundly by the legal mentality, paradigms and approaches of environmental law. In fact, it is widely acknowledged that adaptation could be facilitated through advanced environmental management strategies. For example, in the water sector, IWRM strategies such as the Integrated River Basin Management (IRBM), integrated water planning and water demand management approaches are highly recommended to provide a basis for shaping adaptive strategies to water-related climate change impacts.

China's environmental law can be generally categorized into three types: (1) laws to prevent environmental disruption when utilizing natural resources, e.g. *Water Law*; (2) laws to prevent environmental pollution and other public hazards, e.g. *Water Pollution Prevention and Control Law*; and (3) laws to prevent natural disasters and reduce their adverse effects, e.g. *Flood Control Law*. Theoretically, in the water sector, if these laws are effective in regulating the activities of exploiting, utilizing, and protecting the water resources, they could serve the purpose of water sustainability, which may largely reduce the vulnerability to risks and changes. The better the water system is protected and managed, the more resilience it has when confronted with negative challenges. Furthermore, if the mechanisms and legal institutions in the water management area are well established and implemented, they not only facilitate the management of contemporary climate-related risks but also provide a legal and institutional capacity to deal with risks associated with future climate change.[59] The analysis in Chap. 2 has concluded, unfortunately, that current legal and institutional frameworks of water management have been weak in addressing existing water crises. The deteriorating aquatic environment, the less developed legislation and fragmented institutional arrangements determine that the aquatic system is vulnerable to changes and the related water laws have a very low capacity in managing water-related climate risks.

Besides the inherent legal and institutional deficiencies and weakness of environmental law, these laws have not explicitly put a premium on climate change effects. Adaptation considerations have not been taken into account when making water plans and implementing specific water management approaches. For example, in the *Flood Control Law*, meteorological, hydraulic and oceanic authorities are required to provide relevant information to flood prevention authorities,[60] but it does not explicitly require that related climatic information should be included. Most of these laws were enacted in the 1980s and 1990s, long before climate change became a policy driver in China and they have not been updated to reflect the changing scenario of aquatic ecosystem imposed by climate change.

[59]Smit and Pilifosova (2001, 877, 897).

[60]Flood Control Law of People's Republic of China (1997, art 43).

Furthermore, the less-developed understanding of adaptation and the low capacity of implementing corresponding adaptation measures is another factor resulting in the absence of adaptation consideration. The aforementioned climate change impacts on China's water resources require that climate change and adaptation considerations should be integrated in the forthcoming water management strategies. Yet, unless these laws are revised to provide incentives and clear provisions for adaptation, water managers are very likely reluctant to make changes.

Climate Change Law and Provincial Climate Change Legislation

Central Level: Climate Change Law

In 2009, the National People's Congress (NPC) Standing Committee adopted a 'Resolution of the Standing Committee of the National People's Congress on Making Active Responses to Climate Change' (Hereinafter 'Resolution'),[61] the first statutory policy adopted by China's top legislature to deal with climate change. Although it is not legislation itself, it proposes to strengthen China's legal framework to address climate change and states that climate change-related legislation will be incorporated into the legislative agenda.[62] Amendment and improving of existing laws relevant to climate change over time is also regarded as essential in order to provide legal support for climate change. The legislative progress to date suggests that this 'Resolution' was the turning point for China to begin dealing with climate change issues through legislation.

According to this 'Resolution' and with the aim to build a comprehensive and theoretical statutory framework on climate change, the National Development and Reform Commission (NDRC) initiated a program to draft a new 'Climate Change Law' in China (CCL. Some research institutes translate it to 'Act on Addressing Climate Change').[63] One of its well-acknowledged scholastic draft was published in March 2012, by the Chinese Academy of Social Science (CASS), a think-tank for the State Council and the NPC. Swiss Agency for Development and Cooperation also contributed to the final draft by providing valuable suggestions. If the CCL is promulgated, hopefully in the future, it will be China's first regulation to address climate change. It marks the start of the transition from policy-oriented climate change strategies and actions that are temporary and more of principle to legislation-oriented climate change responses that could provide long-term mechanisms. Although this draft is still impeding and there is no clear schedule for its passage, it is still worthwhile to investigate its pros and cons to identify Chinese government's mentality, methodology and preference of approaching adaptation issues.

[61]The Resolution of the Standing Committee of the National People's Congress on Making Active Responses to Climate Change (2009).

[62]The Resolution of the Standing Committee of the National People's Congress on Making Active Responses to Climate Change (2009).

[63]The National Development and Reform Commission (NDRC) of the PRC (2011).

The regulatory scope of this draft is very broad and comprehensive, including both general principles and concrete measures.[64] According to this draft, the CCL will distribute the responsibilities among related competent agencies, establish legal institutions on mitigating climate change (such as total volume control mechanisms, eco-compensation and emission trading schemes) and adapting China's vulnerable sectors to climate change.[65] With regard to adaptation, it stipulates that both central and local governments shall include climate change adaptation as part of their national and specialized planning for economic and social development with all factors taken into consideration.[66] This legal requirement is very directional for adaptation integration in the development process, even though it does not clarify how this should be undertaken.

There are some meaningful improvements in institutional system. First, it proposes to introduce a targeted responsibility and assessment system, taking into account GHG reductions as an important part of assessing local cadres. Assigning the task of combating climate change to local government just like environmental protection, this evaluation system is expected to produce a serious attitude toward looming but uncertain climatic harms. Second, this draft appreciates an important role environmental authorities could play in preventing air pollution and delegates to them the responsibility of unified supervision and management of GHG prevention and control. Third, by stating the rights and obligations of enterprise, industries, social organizations and citizens, this draft expects to shape the climate change-related behaviors of the whole society.

Unfortunately, this law inherits the entrenched deficiencies of Chinese legal system, such as a lack of clear definitions, ambiguous language and abstract provisions.[67] First, even though adaptation is listed as an independent chapter, it is still very unclear with regard to what adaptation is and how the responsibilities of various levels of government are divided and coordinated.[68] Second, this law has retained a utilitarianism philosophy, by setting addressing climate change, reducing GHG and achieving sustainable development as the objectives. The reality, too often is, when there is a conflict between climate change and development, development will win.[69] Third, attempting to develop climate change law in a very narrow space, this draft does not clarify the overlaps and vacuums with other laws, such as the '*Air Pollution Prevention and Control Law*', the '*Renewable Energy Law*' and the '*Energy Conservation Law*'. The relationship between this law and other international laws has not been delineated either. Fourth, aiming to reduce

[64]China.org (2012).
[65]China.com (2012).
[66]China.org (2012).
[67]ClimaXmi (2012).
[68]Ibid.
[69]China Carbon Forum (2012).

GHG and facilitate sustainable economic and social development, the CCL draft carries on a mitigation paradigm. The distinctions between adaptation and mitigation have not been clearly reflected by this mitigation-preferring framework. For example, the aforementioned progress in institutional setting (the introduction of a targeted responsibility and assessment system, and the empowerment of environmental authorities) does not quite fit adaptation issues. Last, but not least, although labeled as 'practice-oriented' law,[70] it is still very uncertain to what extent this law could be put into practice, especially given the existing gap between laws on paper and their enforcement in China. All of the above shortcomings challenge the effectiveness of this draft, if passed, in responding to negative climate change impacts. It reveals that both legal scholars and legislators have not been fully aware of the attributes of adaptation in terms of its goal, actor, target, approaches, its differences from mitigation and other fundamental issues. Special legislation on adaptation, in that case, is likely to all for naught in practice, before the theoretical and legal aspects of adaptation is clearly identified.

Provincial Level Legislation

Before the CCL draft was released, two provincial regulations on climate change were enacted as pilot projects to explore ways of legislation localization: '*Measures of Responding to Climate Change in Qinghai Province*' in 2010 (the first provincial legislation on climate change in China) and '*Measures of Responding to Climate Change in Shanxi Province*' in 2011 (hereafter the 'Shanxi Measures'). A review of their contents reveals that these two regulations have a good understanding and reflection of the localization of climate change impacts and their different priorities. Shanxi is famous for its abundant coal resources and therefore the 'Shanxi Measures' underscores energy conservation, energy efficiency improvements, carbon sinks and low-carbon development.[71] On the contrary, as part of the sensitive Qinghai-Tibet Plateau, Qinghai Province is one of the most vulnerable provinces due to its fragile ecosystem and less developed economy. Consequently, the focus of its provincial legislation has been on adaptation.[72] One of the common highlights of these two provincial regulations is to assign the responsibility of addressing climate change to local government above county level.[73] In Qinghai's provincial regulation, the provincial government and its various departments are delegated with different adaptation responsibilities within their own scopes.[74]

Although these two regulations lack strict liability provisions and effective market mechanisms, their implementation experience is expected to provide valuable insights for legislative initiatives in other provinces. The project of 'Studies on Provincial Legislation on Climate Change: A Case Study of Jiangsu Province' was

[70]Li (2011).

[71]Measures of Responding to Climate Change in Shanxi Province (2011).

[72]Measures of Responding to Climate Change in Qinghai Province (2010).

[73]Measures of Responding to Climate Change in Qinghai Province (2010, art 4), Measures of Responding to Climate Change in Shanxi Province (2011, art 4).

[74]Measures of Responding to Climate Change in Qinghai Province (2010, art 6-13).

initiated to promote provincial legislation on addressing climate change and gain experience for legislation work throughout the country.[75] These programs signify the progress made by the Chinese government in establishing a legal framework on climate change. More importantly, they denote that addressing climate change (both mitigation and adaptation) is not just the central government's responsibility, but also that of every local government and the population at large.

Where national climate change legislation requiring a particular political environment is absent, initiating regulation from the local level and then extending it to the national level could be very pragmatic and effective, especially when adaptation practices have not been developed. This from-local-to-national approach in promoting climate change legislation has been advocated by some developed countries. When there is no adequate federal legislation, states or provinces have stepped in with their own initiatives,[76] such as the Province of British Columbia in Canada and the State of Victoria in Australia.[77] On the flip side, some other countries have set off climate change legislation from the national level, and then to shape local practices, such as Britain's Climate Change Act 2008 and Mexico's climate change law.[78] It is difficult to say which approach is more effective because every nation has its different climate change priority, political commitment and legislative system. It seems that China tries to establish its climate change legal framework from both the national and local levels at the same time. What really matters for China, however, is to what extent these laws and regulations could be implemented, which is determined by certain political will, well-designed legal stipulations, and more importantly, effective institutional settings.

3.2.3 *Institutional Settings of Climate Change Adaptation*

Institutional Settings of Adaptation at the National Level

Since 1998, the responsibility of dealing with climate change was transferred from scientist-led China Meteorological Administration (CMA) to the NDRC, one of the powerful governmental bodies with a key focus on economic development and energy policy. This transfer signifies that climate change has shifted from a scientific issue to predominantly a development issue that has a strong bearing on economic growth and energy security.[79] In 2008, a new Department of Climate Change within the NDRC was formed to deal specifically with climate change, including mitigation and adaptation. Its responsibility is described as:

[75]Department of Climate Change, NDRC, China (2012).

[76]Fickling (2010).

[77]*Carbon Tax Act*, SBC 2008; *Climate Change Act 2010* (Vic).

[78]*Climate Change Act 2008* (UK); Vance (2012).

[79]Lee (2005, 135, 149).

> analyzing the economic and social impacts of climate change; drawing up strategies to address climate change; updating and implementing national climate change program; participating in international climate change negotiations; launching international cooperation on addressing climate change and capacity-building; administering CDM (clean development mechanism) projects and undertaking related energy saving and emission reduction.[80]

This description of its responsibilities shows very strong focus of its work on international negotiations and GHG reduction. This is mainly driven by both the international regime that centers with economic cooperation and mitigation, and the domestic policy priority on energy issues. In addition, as illustrated in the following schematic diagram (Fig. 3.1), work on climate change adaptation is undertaken by the Division of Foreign Affairs rather than the Division of Domestic Implementation. This arrangement may be because adaptation in China has strong international implications through participating in negotiations and conferences.[81] Much of the emphasis on adaptation in international negotiations has been placed on first, who should contribute money to assist developing countries to adapt, and second, the equality and justice issue associated with adaptation, for example, which country should be funded on adaptation issues.[82] The key point is the availability of

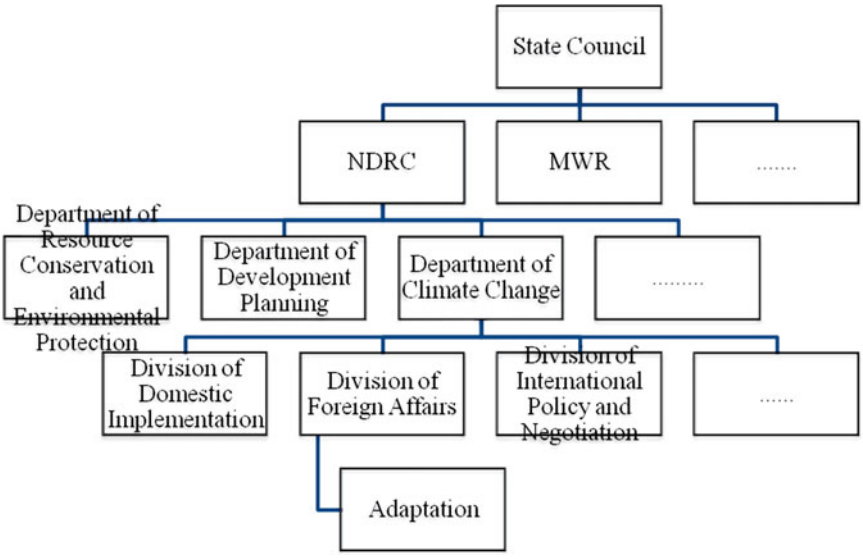

Fig. 3.1 The institutional settings on climate change issues at the central level

[80]发展和改革委员会应对气候变化司 [Department of Climate Change, NDRC, China], 工作职责[*Working Responsibilities*]. http://qhs.ndrc.gov.cn/jgsz/default.htm.

[81]Qi et al. (2007, 8).

[82]Li (2009, 92).

adaptation funds, such as the Kyoto Protocol Adaptation Fund, Global Environment Facility and World Bank Pilot Program on Climate Resilience.[83] National policy and strategy are neither static nor determined in isolation. This international regime or focus will to a large extent influence China's domestic policy priorities and institutional settings.[84] It is not surprising that the first priority for the adaptation department is to secure adaptation funding from the international community rather than developing domestic adaptation strategies and measures.

Given the crosscutting nature of climate change, a multi-agency National Coordination Committee on Climate Change (NCCCC) was established in 1998. With limited independent decision-making powers, it was mainly a government institution coordinating national actions among various ministries to deal with intricate climate change issues. Its main responsibility was to discuss the major issues involved with sector coordination on climate change policy and activities, organizing negotiations, and making decision on those general cross-sector issues relating to climate change.[85] Since its establishment, the NCCCC had done considerable work in the formulation and coordination of China's important climate change-related policies and measures, providing guidance for central and local governments' response to climate change.[86]

In 2007, with the release of the CNCCP, the NCCCC was upgraded to the high-level National Leading Group on Climate Change (NLGCC), mainly in order to strengthen the leadership in addressing climate change. Headed by the Premier, it reports to the State Council and has more than 20 ministries as members, mainly including the NDRC, MWR, Ministry of Environmental Protection (MEP) and the Ministries of Foreign Affairs (MFA) etc. Among them, the NDRC plays the most influential role in the policy-making process.[87] Moreover, due to the strong implication of climate change on foreign affairs, the MFA, which conducts international climate diplomacy, also plays a key role in the NLGCC. Another ministry deserving of attention is the MEP, which only has a subsidiary position in the NLGCC. While climate change is first framed as an environmental issue, the MEP, in charge of environmental issues only plays a very marginal role in tackling climate change.

In this way, in contrast to the majority UNFCCC countries, which manage climate change issues through their environmental agencies or ministries (Fig. 3.2), China administrate climate change issues through its national development authorities. As a result, it produces two different institutional frameworks dealing with climate change issues and environmental issues respectively in China.[88]

[83]McGray (2010).

[84]Wiener (2008, 1805, 1823).

[85]Qi et al. (2007, 8, 9).

[86]China's National Climate Change Programme (2007, 12).

[87]Richerzhagen and Scholz (2008, 308, 318).

[88]Ibid.

Environmental agency or ministry	72%
Foreign affairs ministry or embassy	14%
Meteorological agency or ministry	8%
National development agency and others	6%

Fig. 3.2 Location of UNFCCC national focal points within governments *Source* UNFCCC, National Focal Points http://maindb.unfccc.int/public/nfp.pl

As the leading authority in addressing climate change, the NDRC formulates climate change policies and strategies from a strategic viewpoint, leaving specific work to other competent agencies of various sectors.[89] Vulnerable areas such as agriculture, water resources and forestry have started to learn how to adapt to the negative impacts of climate change. For example, relevant agricultural authorities have cultivated breeds less sensitive to rising temperature and resilient to climatic variation. Water authorities have sped up the hydraulic projects construction process to fulfill increasing water demand. Nonetheless, as analyzed previously, the mandatory requirement to reduce GHG emissions and the focus on economic performance confirms that adaptation is still not given as high priority as mitigation by various levels of government.

Institutional Settings of Adaptation at the Local Level

China is a highly centralized country, where local governments are supposed to implement decisions made by the central government. How local government responds to central government's directives depends on a variety of factors, such as its local needs, the international and domestic market, local officials' motivation, capacity, constraints, and leadership etc.[90] When there is a lack of clear compulsory requirements from central government, the interpretation and implementation of the public policy at the local level are rarely uniform. The phenomenon 'the superior has the policy, but the inferior has countermeasures' is very common to describe the inferior governments' passive response. In terms of the institutional restructure necessary to deal with climate change, paralleled actions are also undertaken generally at a local level, but with different interpretations and implementations.

Following the model of establishing the NLGCC at the central level, local governments at the provincial and prefectural level also create the same leading groups and task forces to coordinate climate change actions among different

[89]Interview with interviewee 1, staff of the Development and Reform Commission of Jiangxi Province (Nanchang, China, 24 October 2011).

[90]Qi et al. (2008, 379, 380).

authorities. Most of these leading groups, however, show a very unabashed favor of mitigation by engaging with energy saving and emission cut off.[91] Qinghai Province is the only exception mainly due to its low level of GHG emissions and high level of vulnerability.

In accordance with the establishment of the Department of Climate Change at the central level, some provincial level Development and Reform Commissions (DRCs) echo by forming new departments to manage climate change issues (including mitigation and adaptation), whereas some provinces integrate climate change issues within established administrative and institutional structures.[92] Different from national and provincial governments, which entrust DRCs to deal with climate change, the prefectural and county governments usually allocate climate change issues to environmental protection authorities.[93] This may be because those lower level governments, so far have shown little interest or awareness of climate change issues, not to mention to set an independent department.[94] In fact, they do not have adequate financial and personnel resources for a new department. A viable approach for them to fulfill the institutional requirements from the central government is to allocate climate change issues to current environmental authorities.

In a nutshell, this mushrooming establishment of leading groups and climate change departments is a general response to the central government's command-and-control administrative mandate. It has little to do with the local governments' awareness, concern or vision of climate change.[95] Nonetheless, the mild flexibility local governments keep in setting up institutions indicates that they are not just the echo of central government—they have to consider their local interests and local needs. Hence, it is expected that if local officials are aware of the local climate change impacts and the implications on local economies and social development, they will have a much greater incentive to adapt to climate change.

3.2.4 Adaptation Responses of China's Water Management

The past decade has witnessed a stunning growth of research articles and outcomes on projecting the climate change effects on China's water resources.[96] By contrast,

[91]Ibid., 382–384.

[92]For instance, Jiangxi, Qinghai and Hubei Province are the former cases while Shandong and Henan Province are the latter cases.

[93]There are four levels of government which set-up the Development and Reform Commission: central, provincial, city, and county level.

[94]Qi et al. (2007, 8, 11).

[95]Interview with Interviewee 2, staff of the Meteorological Bureau, Jiangxi Province (Nanchang, China, 24 October 2011); Qi et al. (2008, 379, 392).

[96]See e.g., Xia et al. (2008, 215).

in-depth study on water-centered adaptation from management, legal and institutional perspectives has been lagging far behind. Both the research literature and field visits to the CWRC have confirmed that no strategic adaptation policy or regulation has been in place for China's water resources management.[97] Adaptation considerations have not been taken into account in China's water plans or decision-making process. Fortunately, from a micro-perspective, some concrete measures have been undertaken in some catchments to reduce the vulnerability of aquatic ecosystem and improve its adaptive capacity.

First, the implementation process of IWRM has been stepped up based on the recognition that IWRM is a crucial tool to improve the adaptive capacity to climate change. Water management strategies such as water conservation, water market establishment and integrating adaptation into water planning are regarded as essential to achieve sustainable water management outcomes.

Second, measures have been undertaken to restore the natural resilience of the aquatic to climatic events by restoring the connectivity between the river and lakes. For example, in 2002, the World Wildlife Fund (WWF) commenced a program to reconnect lakes [Zhangdu (40 km^2), Hong (348 km^2) and Tian Zhou (20 km^2)] in Hubei Province to the Yangtze River through opening the sluice gates and facilitating sustainable lake management.[98] This ecosystem-based adaptation strategy is expected to reduce the vulnerability to flooding and be more climate-resilient.

Third, China's water managers have promoted and initiated technological innovation and engineering projects to cope with the changes in the precipitation patterns induced by climate change. Due to the tough lesson that well-functioned water projects are crucial for regions abundant with water resources to improve the adjustment and storage capacity, Chinese water managers gravitate to put a premium on upgrading under-performing hydraulic projects and investing new ones.[99] Inter-basin water transfer projects, such as the SNWT have been required to accelerate in response to the increasingly intensified conflicts between water demand and supply. Several other large-scale hydropower dams in the upper Yangtze River have been approved for construction.[100] Other water infrastructures, such as reservoirs, dikes and detention zones are frequently proposed to prevent and mitigate natural disasters.

Given the broad territory, complicated ecosystems and various economic and social development levels of most Chinese river basins, the site-specific nature of adaptation cannot be underscored more. Some adaptation practices have been carried out on a sub-basin level or regional level. Up until 2012, the CMA had completed a series of comprehensive assessment reports on climate change for eight regions such as the Three Gorges Dam (TGD) area and Poyang Lake Basin.[101] In

[97]Interview with interviewee 3, staff of the Changjiang Water Resources Commission, Hubei Province (Wuhan, China, 11 October 2011).

[98]Wang et al. (2009).

[99]Xu and Ma (2009, 62).

[100]Gemmer et al. (2013, 79, 90).

[101]China's Policies and Actions for Addressing Climate Change (2012, 18).

the TGD area, where extreme events, soil erosion and geological disasters occur quite often in the context of climate change, measures like improving the predictive ability of extreme events, launching ecosystem protection projects and developing natural disaster response mechanisms have been formulated to enhance adaptive capacity.[102] For Poyang Lake that overlaps parts of Jiangxi province, connects with the Yangtze River and includes areas containing natural wetlands and high biodiversity values, a Mountain-Yangtze River-Poyang Lake Program has been underway to develop a sustainable lake basin.[103] Under this program, adaptation strategies covering water resources, agriculture, ecosystems, transportation and human health are being used to promote adaptive capacity.[104]

Although all the provinces have their own climate change programs, much of the contents on adaptation are largely duplicated from the CNCCP and do not provide effective guidance for decision makers and practitioners. Furthermore, even with these programs, the attitudes and reactions towards adaptation vary depending on the identification of climate change impacts on their own provinces and relevant government official's climatic perception and awareness (see Footnote 89). For example, Qinghai, Hubei and Jiangxi Provinces on the Yangtze River Basin take adaptation more seriously than other riparian provinces (see Footnote 95). This may be because these provinces have more vulnerable ecosystems, but may also because they have a stronger leadership on adaptation issues.

When adaptation research and practices are undertaken at the regional, basin and provincial level, some questions arise. For instance, is it necessary and effective to require every province to formulate and implement its own program regardless of the similarity of climate change impacts among some provinces? Is it more effective to initiate and implement a program on the provincial level or on the regional (basin) level? How to bridge the gap between the facts that climate change impacts are usually assessed at regional or basin level while implementation of programs is based on the provincial level?[105] If the community input is important for making effective adaptation strategies, how could they engage in the decision-making process? As adaptation is better to be integrated and implemented with current water management practices, thus understanding these questions is very crucial for creating synergies and consistency between adaptation and water management.

[102]Xu and Ma (2009, 61–63).

[103]Ibid.

[104]Yin et al. (2011, 162–172).

[105]See, e.g., in the CNCCP, impacts of climate change are identified and classified in different regions; serious reports of climate change impacts funded by China Meteorological Commission are carried out on a regional and basin level.

3.3 An Assessment—Ambitious Progress or Conservative Steps?

According to previous study, the evolution of China's climate change policy, legislation and institutional settings has shown some prominent features of the trend in responding to climate change[106]:

(1) China starts the transition from a climate change policy-oriented response which is temporary and flexible to legislation-oriented response which is long lasting and institutionalized;
(2) local governments, especially those at the provincial level, start to take some responsibilities in responding to climate change;
(3) private actors and the public start to become involved in climate change issues;
(4) adaptation has been required to treat equally with mitigation and has been put on governments' agenda.

These features are not only in line with the development in international negotiations, but also share much in common with those empirical experiences in some developed countries, such as the UK and the US.[107] Nevertheless, coupling with the transition taking place in economic, social, political and legal areas, these features make the development and implementation of adaptation framework in China very complicated and uncertain. This transition nature also determines that the adaptation framework will be much influenced by the traditional mentality and paradigms entrenched in related sectors or areas, such as water management. Thus, it is very essential to assess the capacity of adaptation-related legal and institutional frameworks to identify to what extent they facilitate or impede effective adaptation initiatives.

There is no consensus on how to assess the capacity of adaptation-related legal framework, but a number of indicators could be put forward. Literature review shows that adaptive capacity is captured by six generic determinants: knowledge and awareness, technology, infrastructure, institutions, economic resources and equity.[108] This book proposes that the capacity assessment of adaptation legal framework could be approached by the following parameters: knowledge and awareness of decision-makers, the diversity of adaptation approaches and the horizontal and vertical institutional settings.

[106]Peng (2012, 89–91).
[107]Ibid.
[108]Juhola and Kruse (2015, 99, 102).

3.3.1 Low Awareness of Adaptation

Generally, both the central and local governments have approached climate change issues through conflating energy issues, environmental protection and climate change.[109] Among them, energy issues have been afforded most of the attention due to its significance to economic development, overshadowing environmental protection and climate change. Take the iconic CNCCP as an example. Although claimed to be a climate change program, the CNCCP per se does not articulate climate change policy, but delivers policies implemented throughout economic development and transformation, especially in the energy sector.[110] In other words, policies and strategies on climate change are tools to help the country meet its broader economic development goals. Besides, even though the equal treatment of mitigation and adaptation is stated as a principle in the CNCCP, mitigation is still under the spotlight, through the lens of energy efficiency, renewable energy and industrial policy. This economy-oriented and mitigation-centered program determines that climate change adaptation has thus far been less developed.

At the central level, compared to mitigation where a cadre responsibility has been introduced through setting specific mandatory energy intensity or GHG reduction goals to instrumentally motivate local governmental officials to act on climate change,[111] there has been no well-defined goal set for adaptation. Neither have clear responsibilities or procedures on adaptation been set for decision-makers. Adaptation is regarded as merely a nebulous concept with no tangible policy specifications and implications. Most of the statements, identification and attitudes of adaptation could only be found in speeches, forums, public interviews or even the research articles of government officials.[112] To date, adaptation considerations are merely limited to moral encouragement, lacking in legally binding requirements. This way of approaching adaptation inevitably influences local governments' perceptions, attitudes and reaction towards adaptation.

A lack of attention to climate change adaptation at the national level may lead to worse treatment at the local level. Before the establishment of the NLGCC in 2007, climate change was regarded as an international issue beyond the interest, purview and responsibility of local governments. As a turning point, the requirements of formulating local climate change action plans and setting up their own climate change leading groups motivate local governments to treat climate change adaptation seriously. However, this sudden about-face in a short time implies that local governments just implement actions defined or directed by the central governments. They have not developed parallel awareness, incentive and ability to handle adaptation issues. Their actions on climate change adaptation are usually very

[109]Lin (2012, 300, 314).

[110]Lewis (2007).

[111]The Comprehensive Work Plan for Energy Conservation and Emission Reduction During the 12th Five Year Plan Period (2011).

[112]Qi et al. (2007, 8).

sluggish, mainly in response to policy directions issued by the central government.[113] The misalignment between central directives and local government incentives could also undermine the implementation of relevant policies. Interviews conducted for this book show that local governments from province to township and village so far have shown little interest or incentive to deal with climate change adaptation issues, not to mention taking proactive adaptive plans or strategies. Some local decision makers even confuse climate change with normal climate variability or air pollution.[114]

3.3.2 *Over-Reliance on Engineering and Technological Approaches*

Pan et al. proposed three different types of tools for adaptation to climate change:

(1) engineering measures: strengthening engineering constructions, such as water conservancy facilities, environmental infrastructures, inter-basin water transfer project, disease-monitoring networks, meteorological monitoring stations, and so on;
(2) technological measures: enhancing scientific research and technological innovation, such as climate risks assessment, exploitation of new stress resistant varieties, development of bio-technologies, disease prevention and control technology, risk monitoring and early-warning technology;
(3) institutional measures: setting up and improving policy, legislation and institutional framework, such as the reform of administration and governance systems, exploration of financing resources, making the best use of taxation, supervision and management, and so on.[115]

How could these three modes are combined normally depends on the attributes of a specific sector and the climate risk zone where it locates. In order to reduce the impacts of climate stress on human and natural systems, effective adaptation demands a combination of them. However, research and empirical studies reveal that the first two categories are employed more frequently than the third one.[116] In the CNCCP, the White Paper and other local level climate change action plans, most recommendations for adaptation in the water sector, for instance, mainly comprise technology innovation, infrastructure construction and the use of economic instruments.[117] By

[113]Lin (2012, 300).

[114]Interview with a village committee leader, Dangyang City, Hubei Province (Dangyang, China, 13 October 2011).

[115]Pan et al. (2011, 99, 104).

[116]Gemmer et al. (2013, 79, 90).

[117]China's National Climate Change Program (2007), Climate Change Action Plan in Hubei Province (2011).

contrast, those 'soft' adaptation methods (such as enhancing knowledge, providing information, clarifying institutional responsibilities and developing legislation) which could provide greater benefits to nature and human livelihoods and long-term flexibility in addressing negative impacts from anthropogenic climate change, are taken lightly.[118] According to the data collected by Gemmer et al., only 13 % of the recommendations are related to legal instruments in the White Paper, compared to 32 % of technology and infrastructure.[119] At the local level, it is even worse. In Hubei Province's climate change plan, for example, legal tools are not even mentioned, while the ratio of technology and infrastructure increases to 44 %.[120]

Based on the analysis in Sect. 3.1 of this chapter, due to lack of profound adaptation understanding, adaptation approaches and preference in the water sector are influenced, to a great extent, by both the current water management regime and mitigation framework where an engineering and technical mentality is pervasive. In China, the failure of effectively responding to extreme events is usually attributed to 'insufficient infrastructure', without investigating the ecosystem vulnerability and the root cause of this vulnerability.[121] That is why the Chinese government accelerates the progress of the SNWT project given the climate change impacts on water quantity and distribution, without investigating its continued feasibility under a different climate change scenario.[122] Recently, the government has decided to increase its national investment in water conservancy projects to 4 trillion Yuan ($612 billon) by 2020.[123] One of the interviewees from a provincial climate change department also acknowledged that:

> For us who were trained as engineers, the first choice to deal with water problem is to build a dam. This approach is very simple. There is no exception to manage water resources in the context of climate change (see Footnote 95).

The investment in infrastructure and technology is crucial to reduce 'adaptation deficit' through managing uneven water distribution and improving flood and drought management capacity.[124] However, water conservancy is not a panacea for Chinese water resources with such a fragile ecosystem. Building more and more

[118]China's National Climate Change Program and Report of Experimental Provinces' Advice on Dealing with Climate Change (2007).

[119]Gemmer et al. (2011, 1, 9).

[120]Ibid.

[121]See, e.g., Yang (2010).

[122]国务院南水北调工程建设委员会办公室 [Office of the South-to-North Water Division Commission of the State Council], 荣耀与尊严[*Glory and Dignity*]. http://www.nsbd.gov.cn/zx/zj/2005gqt/5/4/201205/t20120523_221667.html.

[123]The Resolution on Promoting Water Conservancy Development (2010).

[124]Many scholars have articles on 'adaptation deficit'. An adaptation deficit usually arises when the current infrastructure or fundamental facilities is inadequate to cope with the present climatic variations due to low level of development. See, Pan et al. (2011, 99, 102), Burton and May (2004, 31).

infrastructures, in turn, may disturb the delicate balance upon which the ecosystem depends and may consequently lead to increasing vulnerability to changes. Consequently, a vicious circle may be formed in China's adaptation area if water managers fail to go beyond an entrenched impacts-driven approach.

Different from Chinese water managers who have proposed to build more hydraulic projects to adapt to climate change, many international scholars have agreed that large-scale dams are not the right choice for climate resilience.[125] They argue that the high reliance on hydraulic projects creates significant vulnerability to climate change due to the uncertainty of precipitation patterns and the high environmental, economic and social cost of building such massive infrastructures.[126]

As discussed in the previous Chap. 2, China's water management is transitioning from an engineering mentality to a resource mentality, indicating that science and technology will still play a leading role over the next few years. This book suggests that more research on adaptation should be conducted from a legal, social and cultural perspective to reduce the underlying vulnerability to climate change rather than placing an over-emphasis on its impacts.

3.3.3 Marginal Role of Environmental Authorities in Adaptation

Previous analysis illustrates that climate change issues and environmental issues are managed by two different sets of legal and institutional framework. The nation's environmental agencies—the MEP and lower environmental authorities, have been given a very marginal role in dealing with climate change issues. Most climate change related policies and laws do not refer to their responsibilities. With regard to the institutional setting from the central to local level, although they are incorporated as group members of the NLGCC and local level inter-agency coordination committees, their roles are still very passive and they are not entrusted with bargaining power to inform climate change-related decision-making process.

Climate change in China is closely interrelated with national energy security, industrial development, environmental and natural conservation, which determines that it is reasonable for the NDRC and lower level of NDRs to play an overarching role in addressing climate change. Nevertheless, this does justify that climate change should be separated from traditional environmental problems, or that environmental authorities should be marginalized on climate change discourses. Although climate change is ultimately framed as a development issue, it is primarily an environmental issue. Overemphasizing climate change's economic implication could only result in the ignorance of environmental protection, which already has a disadvantaged position in China. Furthermore, both energy and industrial issues

[125]Hurwitz (2012).

[126]Ibid.

have strong implications on environment and natural resources protection. Thus, effective responses to climate change will rely heavily on effective environmental policies, laws and institutional structure. Decoupling climate change issues from environmental problems and restraining environmental authorities from participating in the climate change discourse have limited them in accessing climate change knowledge and information, and also confined their capacity in adapting to adverse climate change impacts. As a result, it has lost some of its best opportunities to formulate and implement climate-friendly and climate-proofing policies through environmental policies and laws.

First, environmental authorities are the source of environmental-friendly policies which, if consider climate change factors, could contribute to the formulation of climate-friendly or climate proofing environmental policies. Otherwise, environmental management measures undertaken by them may lead to the increase of GHG emissions or vulnerability. Vice versa, if there is not enough collaboration between environmental authorities and development authorities, measures to tackle climate change may unconsciously cause environmental problems. For example, the NDRC's proposal to develop hydraulic power by building large-scale dams may help to develop green energy but may also deteriorate aquatic system and degrade water quality. Second, environmental impacts assessment (EIA) is another important decision-making tool for environmental agencies to assess proposed plan/project's impacts on environment. If environmental agencies could approach climate change impacts through EIA, both GHG reduction and adaptation could be facilitated.[127] Third, environmental authorities (especially the MEP) have been the most enthusiastic authority attempting to slow down global warming by promoting alternative energies and reduce vulnerability by improving environmental quality.[128] It is also the only agency within the NLGCC that cares about environment and attempts to achieve a balance between economic development and environment protection.

The published draft of the CCL stipulates that the MEP and local environmental authorities shall take the responsibility of unified supervision and management on the prevention and control of GHG classified as air pollutants. On the one hand, different from the United States where GHG is integrated and regulated by the Clean Air Act,[129] CO_2 as a key GHG element is not regarded as an 'air pollutant' in China. Therefore, this proposal is merely a restatement of the environmental authorities' present purview on pollution prevention and control, without reaching the core of climate change issues. On the other hand, it does not clarify whether environmental authorities could influence decisions related to vulnerability reduction and adaptive capacity improvement. Again, this excludes environmental authorities from engaging in key climate change decisions, losing the best chance

[127]As a tool to address climate change, mainstreaming climate change adaptation in EIA will be analyzed in Sect. 6.2 in Chap. 6.

[128]Marks (2010, 971, 977).

[129]Day (2010).

for climate change adaptation. At the central level, although the MEP has been given full ministerial status, it continues with a lack of political influence, as well as financial and personnel resources to manage environmental issues, let alone more complicated climate change issues. At the local level, the affiliated position to economy-oriented local governments constrains their influence in climate-friendly and climate-proofing decisions.

3.3.4 *Lack of Institutionalized Governance at the Local Level*

The new Environmental Law amended in 2014 restates that government at various local level shall be responsible for environmental quality within their own jurisdiction, with a political support of a target-oriented responsibility system and a cadre evaluation system.[130] Yet, long before this new evaluation system in place, more than thirty years' environmental responsibility paradigm has lead to a variant environmental performance and quality among different administrative jurisdictions.

This disparity in environmental performance is further amplified and intensified by weak environmental enforcement and the absence of institutionalized governance. Environmental protection, then, is highly dependent on local officials' attitudes, visions and leadership toward environmental interests, rather than legal requirement. In those provinces/cities where their officials perceive their personal advancement or reputation as linked to an improved environment, environmental protection is decidedly more vigorous.[131] Prominent examples are Dalian, Shanghai and Xiamen. These cities have been recognized for their physically beautiful environment mainly due to their environmentally enlightened mayors. The significant percentage of local revenues on environmental investment, the reach out to the international community and the equipment of well-staffed, well-funded and well-supported local environmental protection bureaus which contribute to their environmental achievements are all mainly thanks to mayoral support.[132] Vice versa, where the officials are economic oriented and closefisted to environmental investment, local environmental interest is likely to be less well considered and cared.

As an issue closely associated with environmental conservation, regime of climate change adaptation is inevitably affected by this paradigm. In the absence of clear responsibility allocation on adaptation issues, field visits and interviews about climate change adaptation reveal the same characteristics as environmental management—whether climate change adaptation is put on decision-making agenda depends on related officials' awareness and understanding of adaptation. In

[130]Environmental Protection Law of the People's Republic of China (2014, art 6, 26).

[131]Economy (2010, 278).

[132]Ibid.

addition, whether adaptation is responded in a holistic and integrated approach depends on related officials' background and predisposition. As previously illustrated in this chapter, climate change issues are left to local governments, mainly provincial governments. Thus whether adaptation is given a reasonable position is determined by provincial governments' perceptions concerning adaptation. Some provinces take climate change adaptation very seriously and devote sufficient efforts to it while others do not. For instance, thanks to the commitment of the Dean of the Climate Centre in the Meteorological Bureau, Jiangxi Province has undertaken very proactive strategies and measures to adapt to climate change on various levels (see Footnote 95), in order to increase the resilience of vulnerable sectors such as water resources and agriculture (see Footnote 89).

The different attitudes towards adaptation, to some extent, are consistent with the nature of adaptation, which is better to be viewed and addressed in a local context. However, its negative impacts are also apparent. This high reliance on personal leadership rather than institutionalized governance not only result in policy inconsistency on climate change adaptation when next officer charges the office, but also add uncertainty to adaptation-related investment or action. Sometimes, a strong leadership may be very effective and efficient in initiating and promoting changes to a considerable degree, but it is also difficult to sustain these changes.[133]

3.4 Conclusion

Climate change has great potential to affect China's water security in various means, for example, through changing water supply and demand, and the intensity and frequency of floods. Being aware of the urgency and importance to combat climate change and its adverse impacts, Chinese government and water managers have made a great deal of efforts by developing climate change-related policies, enacting climate change laws and rearranging institutions. However, due to the economic concerns associated with mitigation, most of these policies, laws and institutional settings are oriented by, and centered with, mitigation. After analyzing the differences between mitigation and adaptation, this chapter concludes that they are fundamentally different in terms of power division, responsibility distribution, legal requirement, management approaches and institutional settings. Existing mitigation-oriented legal and institutional frameworks are very unlikely to embrace manage adaptation issues with its paradigms.

Although there is no 'adaptation law' in China, this book finds that 'adaptive laws' helpful for vulnerability reduction could be portrayed after examining relevant laws and regulations on climate change and environmental management. Nonetheless, this book also discovers that these 'adaptive laws' have a very low

[133]Xia and Pahl-Wostl (2012, 60, 73).

capacity in delivering effective adaptation strategies due to lack of purpose-built and explicit statutory requirements and instruments.

Adaptation does not take place in vacuum—it needs to consider current political landscape, environmental status and development trajectory. In-depth research in this chapter reveals that China's adaptation-related legal and institutional frameworks are entrenched in China's traditional mentality, paradigm and approach in dealing with economic development and environmental protection: less developed legislation, over-reliance on 'hard' approaches, marginalized environmental authorities and lack of institutionalized governance. Although the urgency of adaptation has been self-evident and is required to be treated equally as mitigation officially, it is still not the priority of both central and local government. In the water sector, Chinese water managers still perceive other water problems more urgent without giving sufficient attention and support to adaptation. Both the awareness and the ability of government in adapting to climate change are relatively very low. Apart from that, clear guidelines, recommendations, procedures and financial support have not yet been put in place for climate change adaptation. This adaptation framework will influence the paradigms and approaches undertaken by Chinese water managers in managing water-related climate change impacts.

More importantly, it is crucial to realize that the substantial challenges from climate change impacts bring significant challenges to the legal values, perceptions and institutions of China's water management. In that case, not only should the awareness of adaptation be improved, water-related laws, regulations and institutional settings should also be shifted or upgraded to respond to these challenges. The next chapter will analyze how the requirements of adaptation challenge current legal and institutional frameworks regarding China's water resources management, and then discuss the possibility and path of integrating adaptation issues in China's water laws.

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Chapter 4
Mainstreaming Climate Change Adaptation in China's Integrated Water Resources Management (IWRM)

Chapter 2 has illustrated the challenges to Chinese water managers because of ill-designed legislation and fragmented institutional settings. These challenges are further aggravated because of uncertain and complicated climate change impacts. After analyzing and assessing the effectiveness of related adaptation-related legal and institutional framework, Chap. 3 concludes that this framework is not adequate to deliver proactive and resilient decision-making. To manage these dual challenges, this book proposes that mainstreaming climate change adaptation by improving IWRM regime and related legal framework to include adaptation factors will be a promising approach to deal with the challenges from water crises and climate change impacts in China. To rationalize this proposal, two crucial questions must be answered: (1) why should the legal and institutional framework of IWRM mainstream climate change adaptation? Alternatively, why should climate change adaptation be mainstreamed in IWRM framework? (2) Is IWRM able to mainstream climate change adaptation? In other words, can adaptation be mainstreamed in IWRM?

The first question will be examined in Sect. 4.1. This part will conduct a theoretical analysis of the mainstreaming process through understanding the relationship between climate change adaptation and sustainable development, as well as through providing definitions and justification for mainstreaming adaptation. Section 4.1.3 will investigate the status of mainstreaming in China by examining its political and legal environment. Question (2) implies that a thorough comparison between IWRM and adaptation from a legal perspective is essential to identify their synergies and trade-offs. Therefore, Sect. 4.2 will mainly demonstrate their differences through identifying and scrutinizing the challenges to water-related legislation, institutional arrangements and the IWRM per se presented by climate change adaptation. Based on those challenges, Sect. 4.3 will provide an in-depth study on the possibilities and rationales of integrating IWRM with adaptation.

X. He, *Legal Methods of Mainstreaming Climate Change Adaptation in Chinese Water Management*, DOI 10.1007/978-981-10-0404-9_4

4.1 A Theoretical Analysis of Mainstreaming Adaptation in the Development Process

4.1.1 Aligning Climate Change Adaptation with Sustainable Development

The Birth of Sustainable Development

The concept Sustainable Development (SD) was first endorsed by the Brundtland Commission in 1987 and further adopted by the Rio Summit in 1992 and the United Nations 2005 World Summit Outcome document. While recognizing the importance of illustrating the origin and development of the concept, this book will not dwell on it.[1] The 'classic' definition of SD is found in 'Our Common Future': 'SD is development that meets the need of present without compromising the ability of future generations to meet their own needs'.[2] Far too many legal professionals have provided very diverse understandings of this concept by delving into key terms 'sustainable' and 'development'. Just as the National Research Council of the U.S. noted, there are 'differing views about what should be developed, what should be sustained, and over what time period.'[3] In spite of this contestation on exactly what it means, this definition remains at the core of sustainable development theory. Much literature reaches a consensus that SD is more like a principle to 'integrate the social, economic and ecological aspects of the use and development of natural resources for present and future generations in making decisions about these resources and undertaking operations in relation to them'. [4]As three integrated facets of development, economic development, social equity and environmental protection are supposed to converge within a SD framework.[5]

Key components of SD comprise of both the substantive and procedural dimensions,[6] mainly including a sustainable utilization of natural resources to develop economy without bending the goal of environmental protection, the pursuit of both intra-generational and inter-generational equity, and the environmental consideration in policies, plans and actions.[7] Some underlying principles and procedural mechanisms widely acknowledged in environmental law field are derived from the principles of SD, such as public participation, access to information and justice, good governance and environmental impact assessment.[8] By

[1]For those who are interested in the development of sustainable development, this paper could be very helpful: Drexhage and Murphy (2012).

[2]World Commission on Environment and Development (1987, 45).

[3]National Research Council (1999).

[4]Fisher (2009, 26–29).

[5]Drexhage and Murphy (2012, 2).

[6]Segger (2005)

[7]Alan and Freestone (2009).

[8]Fisher (2009, 26, 28–29).

seeking to reconcile the developmental aspirations with the need for environmental protection, this concept has been embraced by the international community, national governments, business and the civil society after it was proposed.[9]

Sustainable Development in China

At the domestic level, SD has become the goal and principle of managing natural resources, developing economy and protecting environment in China. Ever since the 9th National Five-year Plan (FYP) (1996–2000), it has been the basic goal and guiding principle for the socio-economic development. The central government has placed a high priority on working towards a sustainable economic, social and environmental development. In the water sector, one of the objectives or management principles of Chinese water policy and legislation are to achieve sustainable water management. The 10th FYP regarded the sustainable water use as a strategic issue in China's development.[10] China's landmark 2002 Water Law stipulates that 'this law is enacted for the purpose of…bringing sustainable utilization of water resources'.[11] In 2005, being aware of the negative impacts of environmental pollution, the 'Scientific Outlook of Development' was adopted as the rubric of Hu Jintao's official principle for economic, social and environmental development.[12] Policies like 'building an energy-conserving and environmental-friendly society' are also brought out to achieve SD.

However, current environmental crises and water crises at international and national level show that the visionary concept of SD has failed to deliver desirable outcomes.[13] National governments have not effectively harnessed it as an instrument for implementation. The advent of climate change, on the one hand, definitely imposes series of unprecedented challenges to sustainable development; on the flip side, some scholars argue that sustainable development has found a de facto 'home' in climate change.[14] The implication of climate change as an opportunity clarified in Chap. 1 denotes that: first, the current concern for climate change could be used to stimulate more work on the larger envelope of challenges to SD;[15] secondly, many other development concerns and challenges need to be addressed in order to cope with climate change effectively.

With regard to China's water resources, SD requires that current water crises must be resolved to reduce the vulnerability to climate change and the impediment of adaptation. Briefly, climate change provides a arena to gather the national and local attention to address chronic development problems. Yet climate change per se is a challenge to SD too. To stimulate various levels of government to implement

[9]Fisher (2009 26, 27).

[10]The Tenth Five Year Plan for National Economic and Social Development (2001, Chap. 14).

[11]Water Law of People's Republic of China (2002, art 1).

[12]Wiener (2008).

[13]Drexhage and Murphy (2012, 15).

[14]Ibid.

[15]Wilbanks (2003).

the principles of SD through the lens of climate change, the relationship between climate change (and adaptation) and SD should be identified first.

The Association between Sustainable Development and Adaptation

There is a close association between SD and responses to climate change in general and adaptation in particular. The Fourth Assessment of Intergovernmental Panel on Climate Change (IPCC) pointed out the iterative relationship between them, and stated that the two could be mutually reinforcing if properly managed.[16] SD can reduce the vulnerability to climate change, while responses to climate change are very likely to increase nation's ability of achieving SD outcomes. With regard to adaptation, its concept is too often intertwined and confused with development in many studies. Professor Pan classifies adaptation into developmental-oriented and incremental adaptation, both of which claim that adaptation issues should and could only be successfully managed in the development process, no matter in developed countries or those developing ones.[17]

While recognizing their intimacy, this book argues that the alliance between adaptation and development is better to be identified and delineated to make adaptation mainstreaming in development process clearer and deeper. In general, SD could reduce the vulnerability to climate change impacts, which in turn eventually reduce the difficulty and cost of adaptation. Climate change adaptation, on the other hand, could absorb or minimize adverse climate change impacts, which denotes a reduction of threats to SD. Their relationship could be further explained in the following two aspects:

First, the development choices made and pathways chosen will largely determine the vulnerability, adaptive capacity and adaptation choices of a country or region to the forthcoming climate change harms.[18]

The SD level of a country or region is central to its vulnerability, since technology and resources increase its ability to adapt while poverty and social injustice restrains it.[19] Thus, it is important to set actions on climate change in a SD framework, balancing social, environmental and economic dimensions. A sustainable path, the one improving energy efficiency and exploring renewable energy, for example, will not only cut off the greenhouse gases (GHG) emissions but will also enable adaptation much easier.[20] Vice versa, any development strategy or action resulting in vulnerability increase or maladaptation should be prevented. In the water sector, the enhancement of present water management outcomes through implementing IWRM is necessary to prepare for potential climate change disasters. Moreover, whether risks associated with climate change and variability are considered in development decisions, actions and programs play a significant role in determining adaptive capacity. In addition, the capacity to adapt depends

[16]Drexhage and Murphy (2012, 9).

[17]Pan et al. (2011).

[18]OECD (2009, 28).

[19]IOM (2010, 8).

[20]Bizikova et al. (2007, 271).

clearly on the state of development.[21] Underdevelopment and unsustainable development fundamentally constrain the adaptive capacity of a society, especially when lack of resources to hedge climate change impacts.[22] It is also true that the adaptation options in the future will inevitably be affected by the development activities chosen today.[23] For example, the relocation of people in flood-prone zones will largely determine affected people's adaptation measures when confronting with floods.

Second, climate change has posed serious challenges to the sustainable social, economic and environmental development throughout the world; appropriate adaptation measures and adaptive capacity improvement could facilitate and promote SD.

Climate change impacts are very likely to compromise development objectives, jeopardize development outcomes and affect the efficiency with which development resources are invested. The Organization for Economic Co-operation and Development (OECD) identifies the potential climate change effects on the achievement of Millennium Development of Goals (MDGs), such as altering economic development rate and path through affecting natural resources, system, infrastructures and labor productivity.[24] This is true especially for developing countries with vulnerable socioeconomic systems and low adaptive capacity.

As the IPCC has observed, 'while physical exposure can significantly influence vulnerability for human populations and natural systems, a lack of adaptive capacity is often the most important factor that creates a hotspot of human vulnerability'.[25] Therefore, in order to achieve the goal of SD, adaptation must be defined and institutionalized in the development process and adaptation policies can only be successfully implemented within a sustainable development framework. For water sector, adaptation to climate change-induced hazards should be integrated as part of the ongoing water resource management. Those effective adaptation actions will ensure that less is lost each time when climate related hazards take place, which in turn reduces the barriers and threads to the SD. It is important to note that adaptation measures undertaken in one certain region today should consider their effects on other regions or on future generations.[26] Furthermore, reduction of vulnerability and enhancement of adaptive capacity will largely promote the SD. In many cases, the enhancement of adaptive capacity involves similar requirements as promotion of SD, such as improved access to resources, reduction of poverty and inequity.[27] In

[21]Berke (1995, 370–82).

[22]Schipper (2007, 7).

[23]Agrawala and Aalst (2008, 183, 184).

[24]OECD (2009, 28–29).

[25]IPCC (2007, 317).

[26]Adger et al. (2009, 335, 340).

[27]Smit and Pilifosova (2001, 877–912).

this sense, adaptation to climate change can be regarded as part of broader sense of the SD.[28]

From the above discussion on the relationship between SD and adaptation, this book concludes that effective adaptive measures must be undertaken to facilitate the SD and eliminate barriers. Meanwhile, the SD paradigm must be implemented to reduce vulnerability and increase adaptive capacity. The Chinese government has steadfastly stated that addressing climate change should be undertaken within the framework of national strategy for SD.[29] It is one of the six principles guiding China's responses to climate change both domestically and internationally (see Footnote 29). By setting climate change issues within the framework of SD, Chinese government expects to facilitate adaptation through economic development, poverty reduction and environmental conservation.

4.1.2 *Justifying the Legal Method of Adaptation Mainstreaming*

A Vulnerability Reduction Approach toward Adaptation

There are two different approaches or responses identified towards adaptation: impact-oriented approach and vulnerability reduction approach (Fig. 4.1). The former targets specific adverse impacts associated with climate change through creating responsive mechanisms while the latter focuses on underlying factors causing vulnerability.[30] The United Nations Framework Convention on Climate Change (UNFCCC) and most national governments around the globe have adopted an impact-oriented approach to undertake adaptation research and policy discussion in the past decades.[31] Prominent examples are sea wall building to defend coastal cities under the threat of sea level rise and crop cultivation for a warming climate. Adapting to climate change impacts in China has also been dominated by an impact-oriented approach. For example, in order to resist and address the severe droughts and floods, responsive measures have been undertaken to keep water and food security at all costs, while the vulnerable factors contributing to the entry of these disasters have not been examined. Although this approach is essential to buffer and defend communities and households against specific climate change impacts, it is very costly for most developing countries that are facing resource and financial constraints.

Recently, much of the literature has revealed that the primary cause for the growing damage of climate change impacts is the vulnerability of human systems to

[28]Zhang and Zhang (2008, 57, 57–63).

[29]China's National Climate Change Program (2007).

[30]Schipper (2007, 8, Ford (2008, 9).

[31]Tan (2010, 135–136).

Impact-oriented approach	Adaptation to climate change impacts → loss reduction and climate change impacts reduction → sustainable development
Vulnerability reduction approach	Sustainable development →vulnerability reduction → impacts reduction → adaptation

Fig. 4.1 Two different approaches towards adaptation in the context of sustainable development

climate variability and change, not the changes in climate per se.[32] On the other hand, a study conducted by some Chinese scholars reveal that measures to reduce vulnerability and increase resilience could help affected communities to adapt to climate change-induced droughts in a cost-effective way.[33] In view of this, the vulnerability reduction approach, which put a premium on reducing climate sensitivity and human vulnerability, should be widely advocated by the Chinese government.[34]

Mainstreaming Adaptation: A Method of Vulnerability Reduction

Theoretically, the vulnerability reduction for adaptation could be achieved in two ways: (1) integrating adaptation factors within present development process and activities; and (2) developing activities that do not specifically target climate change impacts but indirectly contribute to climate risk reduction or adaptive capacity enhancement, such as initiatives to alleviate poverty, promote gender equity and literacy.[35] With regard to the second method, it assumes that the vulnerability to climate change could be reduced when the barriers to develop are removed or the capacity of SD is improved. Nonetheless, due to the pre-set objectives and priorities that do not consider climate change, it has a very limited role in addressing climate change impacts proactively. In light of that, this book argues that decision makers in China need to integrate adaptation with development policy and planning through a transformation of mentality, objective setting, decision-making process and implementation. In the water sector, this transformation requires that adaptation factors should be mainstreamed in the ecosystem-based IWRM regime.

The mainstreaming approach, actually, is not new. With the idea that cross-cutting issues should be resolved in the 'mainstream' development activities, mainstreaming has been predominately used as a means to tackle disturbing development issues such as gender inequality, environmental degradation and HIV/AIDS in developing countries since 1990s.[36] It believes that compared to

[32]Pielke and Sarewitz (2005, 255, 256).
[33]Ye (2012, 84, 94).
[34]Ford (2008, 5–16).
[35]McGray et al. (2007, 20).
[36]Oates et al. (2011).

separate initiatives, this holistic approach will be more viable, cost-effective for countries lack of due political will, finance and resources. However, as a development-oriented adaptation approach, mainstreaming is still in its early stage, and there is not much discussion about its definition. In many contexts, mainstreaming is often used interchangeably with synonyms such as integrating, which could lead to confusion, manipulation or inaction. Furthermore, there has not been any widely accepted doctrine on how this mainstreaming method could be processed. Both researchers and practitioners have not developed in-depth discussion with regard to the strategic level mainstreaming which addresses the setting environment of mainstreaming approach, and the operational level mainstreaming which talks about specific mainstreaming process and climate-proofing measures.

Realizing that climate change risks should inform and be informed by ongoing development process, the method of mainstreaming is highly advocated, although without clarified conception. According to the IPCC, the term 'mainstreaming' in a climate change context originally

> has emerged to describe the integration of policies and measures that address climate change into development planning and ongoing sectoral decision-making. The benefit of mainstreaming would be to ensure the long-term sustainability of investments as well as to reduce the sensitivity of development activities to both today's and tomorrow's climate.[37]

The original intention of 'mainstreaming' assumes that climate change issues could largely influence core development processes, and thus should be factored in routine development strategies, activities and approaches. Different from separate initiatives which are generally responsive and short dated, mainstreaming climate change is more proactive and longer by focusing on the root causes of vulnerability.

Justifying Adaptation Mainstreaming

In general, 'mainstreaming' adaptation in the climate change area could be approached from different paths: (1) mainstreaming mitigation and adaptation within the development process; (2) mainstreaming adaptation within a mitigation framework; (3) mainstreaming adaptation in the development process. Some scholars argue that climate change issues could be generally integrated with SD, without distinguishing mitigation and adaptation.[38] Conversely, there are also opposing opinions. For example, after analyzing the distinctions between mitigation and adaptation, Klein et al. question the effectiveness of the current focus on the optimal portfolio of integrating mitigation and adaptation with climate and development policy.[39] Being aware of the interplay between climate change and development, they suggest that the links between adaptation, mitigation and development are better developed separately.[40] As demonstrated in the previous

[37]Klein et al. (2007, 745, 768).

[38]See e.g. Bizikova et al. (2007, 271–277), Danga et al. (2003, S81–S96).

[39]Klein et al. (2005, 579, 586); Kane and Shogren (2000, 75–102).

[40]Klein et al. (2005, 579, 586).

chapter, current mitigation-oriented framework is unable to manage adaptation issues due to their fundamental distinctions of legal and institutional requirement. Therefore, this book will only advocate the third type of mainstreaming approach—mainstreaming adaptation in the development process.

Based on the perception of 'mainstreaming', mainstreaming adaptation refers to the iterative process of integrating or incorporating adaptation considerations in the development process, mainly national (local) and sectoral policies, plans and activities, policy-making, budgeting, implementation and monitoring process at national, sector and sub-national levels.[41] Compared to the widely used 'integrating', the term 'mainstreaming' recognizes the marginal status of adaptation in current policy and planning, and emphasizes the priority and importance of adaptation. It is supposed to help adaptation capture more political, legal and social concerns. By accounting for adaptation factors in the development policies or planning, adaptation mainstreaming could provide a solution to the dilemma between the tasks of development and addressing climate change for most developing countries.[42] It is expected to minimize policy conflicts and trade-offs, maximize the benefits of policies and activities and develop climate-proofing development pathways.

Both the 'demand pull' from the development community and a much more visible 'supply push' coming from the climate change community contribute to the adoption of a mainstreaming approach.[43] From the development side, if the development policies and practices do not give adequate attention to climate change, their effectiveness may be significantly challenged due to the negative climate change impacts. Meanwhile, a clear point is that although climate change is a source of significant stressors for societies, it has always been only one factor among many (see Footnote 27). Climate change should not be overemphasized and should be better considered equally with other issues in the development process.

From the climate change side, first, it is widely acknowledged that climate change is largely induced by human development which is characterized by economic growth, population growth and technology development, thus it is better to be resolved in the development process.[44] Second, it is clear that climate change policies cannot and will not be implemented in isolation with other environmental or economic policies.[45] In the water sector particularly, adapting to water-related climate change impacts should not be isolated with other water management policies or activities such as water pollution prevention and water demand management.[46] Third, given the uncertainties surrounding climate change risks and impacts, adaptation, in most cases, has to be and will be implemented within

[41]Huq et al. (2004, 25, 35); UNDP-UNEP Poverty-Environment Facility (2011, 3).
[42]Kok and Coninck (2007, 587–599).
[43]Agrawala and Aalst (2005, 142).
[44]OECD (2009, 4).
[45]Klein et al. (2005, 579, 582).
[46]Tan (2010, 135, 137–138).

present development strategies and process. The water management community has always needed to address climate variability and factored climate information into their plans and practices. This experience could provide valuable insights for addressing climate change uncertainties. Fourth, the difficulties and barriers adaptation confronts determine that mainstreaming will be an optimal choice. Different from GHG mitigation that could resort to quantitative criteria like setting specific reduction goal, there is no single metric to measure adaptation and compare different adaptive strategies.[47] All these factors contribute to the advocacy of a mainstreaming approach.

4.1.3 *Examining the Status of Adaptation Mainstreaming in China's Water Management*

The international community highlighted the urgency and significance to mainstream climate change risks and adaptation in the conferences of parties (COP) 17 of the UNFCCC. It urged to formulate and implement National Adaptation Plans to enable both developing and developed parties to assess their vulnerabilities, to mainstream climate change risks and to address adaptation.[48] The United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) have also developed an 'Adaptation Policy Framework' to provide strategies, policies and measures for integrating climate change into the policy-making process.[49]

Thanks to the help of international organizations (such as the World Bank, and Food and Agriculture Organization of the United Nations), China is conducting a couple of case studies and project initiatives centered on vulnerable sectors such as agriculture, water resources and coastal zone. For instance, aiming to increase the adaptive capacity of agriculture and farmers, the World Bank sponsored a five-year project to mainstream climate change adaptation in water resources management and rural development in the Huang-Huai-Hai Basin of Northern China.[50] By mainstreaming climate change adaptation within national Comprehensive Agricultural Development Programs and strengthening institutions, this project is supposed to provide valuable insights for China's forthcoming mainstreaming practices.

At the national level, the Chinese government politically requires to addressing climate change within the broader framework of the country's national sustainable

[47]Klein et al. (2005, 579, 581).

[48]Munang et al. (2013, 67).

[49]United Nations Framework Convention on Climate Change, *UNDP Adaptation Policy Framework* http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5501.php.

[50]World Resources Institute (2007).

development strategy, which could be interpreted in two very different ways. On the one hand, sustainable development should serve as a framework, guidance, principle or objective for adaptation and climate change. On the other side, Chinese government implies that climate change mitigation and adaptation should not take priority over national development objectives, especially economic development—the government will only act forthrightly when adaptation contributes to development (especially economic development) or at least is consistent with development goals.[51] This has been proved through the analysis and assessment of current policies and legislation on adaptation in Chap. 3. In this case, it is better to integrate adaptation with policies and practices that address other development issues or promote China's core interests. Mainstreaming will be an effective approach to putting adaptation into practice. Although the term 'mainstreaming' has not been widely used in official documents, its synonyms 'integrating' has been used to deliver a similar message. The China's National Climate Change Program (CNCCP) has identified 'integrating climate change policies with other interrelated policies' as a principle to tackle climate change (see Footnote 29). China's 12th FYP also requires that climate change factors be fully considered in the productivity distribution, infrastructure construction and major project planning and implementation. The 'integration' requirement is also incorporated in the newly drafted Climate Change Law in China for the first time.

Compared to infrastructure and project construction, policies and planning could reduce vulnerability at a higher level, from a larger scale and at an earlier stage. Nonetheless, those requirements regarding 'integrating climate change' analyzed above do not reach the level of national policy and planning which have more influence on mainstreaming adaptation. In practice, most core development activities which are related to vulnerable sectors—from long-term national development policies and plans to short-term projects—generally give little, if any, explicit attention to climate change adaptation. Even if there are finite considerations on adaptation, most of them are limited to conceptual guidance and encouragement, lacking of detailed analysis on operational practices. To date, how to change and structure existing legal and institutional frameworks in order to support effective implementation of mainstreaming measures have not yet been researched. Having realized this gap, the following chapter of this book will provide recommendations on how to develop and set legal and institutional frameworks so that they could facilitate water-related adaptation. Following that, it will explore how to mainstream adaptation considerations in the IWRM of water resources through identifying some feasible entry points.

The Asian Development Bank (ADB) has found that it is possible to avoid most of the damage costs attributable to climate change if climate-proofing measures are undertaken at the design stage of related policies, plans or projects.[52] Climate-proofing strategies will be delivered if climate change impacts and

[51]Harris (2010, 10858, 10859).

[52]Asian Development Bank (2005, 18).

adaptation factors are mainstreamed in routine development process and methods, such as the IWRM. Through linking adaptation, water resources management and sustainable development, adaptation mainstreaming not only avoids the deficiency of impact-oriented approach in disproportionately focusing on specific climate change impacts, but also pinpoints the core of sustainable water development in the context of climate change—reducing the vulnerability to climate change impacts. To this point, the crucial question here is whether IWRM and adaptation are compatible with each other and how adaptation could be mainstreamed in the IWRM regime. This question will be approached by analyzing the barriers of implementing mainstreaming adaptation in the IWRM regime—that is, to understand the challenges of adaptation to those established water-related legal and institutional frameworks.

4.2 Identifying Legal Challenges of Mainstreaming Adaptation in the IWRM

Climate change adaptation could be regarded as a continuous stream of attitudes, decisions and actions that could inform existing legal procedures and decisions.[53] Extant water-related legislation and institutional settings should be examined and updated to identify and address the challenges presented by adaptation in the mainstreaming process. In fact, adapting to climate variability is not new in water management history, either as a theoretical framework or as an empirical reality. Many human instruments have been formed and invented in order to adapt our social practices to variable climates, such as our irrigation system and insurance mechanism.[54] Furthermore, water management practices show that demographic trends, economic development patterns and social resilience have always been the main drivers to develop water management regimes. In a nutshell, adapting to the changing natural, economic and social situation in water availability and demand has always been at the core of water management.[55] That is to say that our water management regime has developed certain capacities to responding to these changes.

In terms of dealing with climate change impacts and risks, some researchers and water managers argue that it is only one of, but not the most challenging, water problems they face, and it will not dramatically influence their traditional and fundamental approach of managing water resources.[56] The adaptation mainstreaming approach, as a consequence, is not something new and still located in the spectrum of our environmental law. On the contrary, others claim that our

[53]Adger (2005, 77, 78).

[54]Adger et al. (2009, 335, 336).

[55]IPCC (2007, 196).

[56]Beek (2009, 51).

business-as-usual water management regime framed by conventional environmental law is challenged fundamentally by climate change adaptation and is not able to effectively respond to water-related climate change risks. A mainstreaming approach, according to this understanding, deserves careful study and thorough examination. Thus an inescapable question here is: does adaptation mainstreaming approach challenge our established legislation, institutional settings and regime on water resources management.

In addition, a clear point has been repetitively made in this book is that the water management framework will interact with that of adaptation to shape the mechanisms and approaches of water-related adaptation. The previous chapter elaborated China's adaptation-related legal and institutional framework where water-related adaptation takes place. To what extent this framework delivers effective adaptation strategies for water management not only depends on the design and implementation of this framework but also relies on how much synergy there is between the framework on adaptation and that of water management. Therefore, this part will investigate the distinguishing features of adaptation and its incremental or exceptional challenges to existing water-related legal and institutional framework, which are often designed and implemented without considering the emerging climate change impacts.

4.2.1 Challenges to Water Laws

Climate Change Requires a Reflective Discourse on Water Laws

As previously illustrated, water is the first vital natural resource deeply affected by climate change, thus it is no wonder that water law scholars were the first vigilant movers to climate change adaptation.[57] Past twenty decades witness a burgeoning body of research in western countries, illuminating the viability of old water legal regime or its capacity of transforming to new requirements. Much literature reveals that hydro-climatic changes, to a very large extent, challenge the predefined ways water is managed based on our elaborated statutory and regulatory framework.

Research of this issue, from both Chinese water experts and legal scholars, unfortunately, is surprisingly lagging behind. Chinese water law scholars have been insensitive in observing and analyzing the internal legal crisis imposed by external climatic harms.[58] Nonetheless, thriving but exclusive research on these challenges to water laws may be significant to alter our water management paradigm, but it would be too superficial and not contribute to sustainable water law development without digging deeper to the assumption of legal regimes. Therefore, this book

[57]According to Juhl, as early as 1990, water law scholars, Professor Dan Tarlock in particular, were the first to focus attention on international and domestic legal regimes for allocation of water resources in order to adapt to climate change.

[58]By far, there is only one doctoral dissertation on the adaptability of water law, see Tao (2012).

argues that the assumption of water regime taken as given by lawmakers should be first understood and reviewed in a Chinese context, before we go further into specific legal challenges of water laws.

Reflecting and re-evaluating current management regime of water resources is also desirable when transitioning from the first modernity to the second modernity society.[59] While the fundamental idea of controllability, certainty or security of the first modernity collapses,[60] a paradigm-shift is needed to reconstruct and redefine relationships emerging in the second modernity. Not being calculated and covered by the dominant regimes designed in the first modernity, climate change requires a reflective discourse due to its complexity and uncertainty.

From a cultural perspective, there are two different cultures that could shape and determine the paradigm a society adopts: centripetal culture and centrifugal culture.[61] According to Bosiot:

> Underlying the harmony model of social process in a centripetal culture is a request for equilibrium, for a stable, unchanging social order that eliminates painful and divisive uncertainties. Centrifugal cultures, by contrast, aim to exploit conflict and uncertainty constructively, making use of them as drivers of adaptive change. For conflict to play a constructive role in social evolution it has to be contained within certain bounds but not eliminated. The governance challenge then becomes to devise structures that can operate flexibility within those bounds.[62]

Different cultural patterns not only influence decision makers' strategies but also have an effect on the behaviors of those who are affected by those decisions. Chinese government and society are entrenched with a centripetal culture, where conflicts, differences and uncertainty are regarded as 'evil' and incongruent with socialism. For example, when facing conflicts and uncertainties, the government prefers to repress, ignore or conceal. Another prominent example is the 'harmonious society' slogan taken as the patter by both central and local government, due to its cognitive orientation and objective in facilitating a secure and stable society.[63] On the flip side, however, a centrifugal culture which is not afraid of confronting with conflicts and challenges, will contribute to a paradigm shift to adapt to new changes, especially given the uncertainty and conflicts induced by climate change.

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[59]In the first modernity, people live in an industrial society, trying to overcome their material needs. There is secured borders among classes. Decisions are based on scientific knowledge and uncertainty is neglected. Differently, in the second modernity, there is the pluralization of boundaries and decision-making. We have a huge growth of scientific but contradictory and inconsistent knowledge. Uncertainty and risks are acknowledged. The borders between classes in society are less fixed. See more at http://sociologicaldiagnoses.wordpress.com/.

[60]Ulrich (1999, 2).

[61]Boisot (1995, 345–346).

[62]Ibid., 346.

[63]People Net (2007)

Stationarity is 'Dead' as an Assumption of Water Laws

The less than half-century development of modern environmental laws shows a very close association with ecological science. To be precise, it is on the scientific and perceptual understanding that our environmental law is firmed, no matter in a western or non-western setting. Up until now, the premise underpinning environmental law (including those on natural resources management) is an equilibrium-based understanding of ecosystems,[64] which assumes the natural stability model of ecosystems. Relying on the predictability of future changes, it prefers to resort to a return to equilibrium following disturbance.[65] It reflects a homeostatic view which attempts to pervert or restore (if necessary and possible) the ecosystem to some previous state through various approaches.[66] Based on this ecological theory, 'stationarity', which means 'natural systems fluctuate within an unchanging envelope of variability', prevails in current water resources management theory and practice.[67] Both natural (mainly refers to the internal variability of the ecosystem and the externally forced climate change) and anthropogenic factors (such as human intervention of watercourses through hydraulic projects) could influence this envelope size,[68] and decision-makers generally deem this disturbance as manageable.

For water sector, this assumption has assumed that the best basis for water management should be and can be captured through the historical record of that basin's hydrological variability and weather behavior.[69] It implies that any variability (e.g., annual stream flow or annual flood peak) has a time-invariant (or 1-year–periodic) probability density function, whose properties can be estimated from the instrument record (see Footnote 67). Justifiably or not and not surprisingly, the concept of stationarity has underpinned the water-related legislation, water management regime and approaches.[70]

Based on stationarity, the hydraulic rules and the adaptability (coping range) of current water systems are set up and designed according to current climate conditions and historical information.[71] This is tantamount to the principle that the past is the key to the future.[72] It influences the preference of water management approaches profoundly—water managers tend to favor structures such as dams, diversions and dikes over non-structure measures. Structure measures are also the

[64]Tarlock (1994, 1122–1123), Profeta (1996, 72).

[65]Godden and Peel (2010, 26–27).

[66]Fischman and Rountree (2012, 19, 20).

[67]Milly et al. (2008, 573).

[68]Ibid.

[69]Matthews and Wickel (2009, 269, 272).

[70]McDonald (2010, 1, 28).

[71]Aerts and Droogers (2009, 87, 88).

[72]Kundzewicz et al. (2007, 196).

priority choice for water managers to respond to emerging pressures of climate change. This argument has been adequately discussed in Chap. 2. In addition, based on historical information, water-related legislation prefers long-term planning and strict procedures.

In a long period, the basic assumption that the ongoing changes can be predicted and recent knowledge can be served as an effective guide to the future, has worked well in most cases and not been widely questioned (see Footnote 69). However, after 1970s, the equilibrium theory was questioned and the so-called non-equilibrium theory is introduced to understand and explain how ecosystem functions (see Footnote 65). The climate change impacts speed up the reflection of current management paradigms.

Marked by Milly's proclamation on the demise of the defaulted assumption of water resource management (see Footnote 67), a growing number of legal scholars work on finding out how the premise of our water legal regime is challenged and how it could be refreshed. It is believed that preserving and returning to previous conditions would not be possible due to the irreversible large-scale climate change impacts. Water-related laws need to be upgraded to provide frameworks, guides, rules and even procedures for the inevitable transformations of the environment. Furthermore, by altering the means and the extremes of precipitation, evapotranspiration and the resulting river discharge, climate change has posed a major conceptual challenge to water managers.[73] Thus, many scholars assert that stationarity 'should no longer serve as a central and default assumption in water resources management'.[74] The past has lost its power to determine the present and indicate the future.[75] It is no longer appropriate to assume that the past hydrological conditions will continue into the future (the traditional assumption) and the historical records will indicate future actions. Predetermined objectives, long-term plans and strict procedure that fit with stationarity may limit the ability of water laws in responding to climatic impacts to which flexibility is desirable. The procedures, factors and standards considered in water-related policies, plans and infrastructures must be revised in order to ensure them to perform properly in the changing situations.[76]

Uncertainty is Pervasive

If ecological stationarity is proclaimed obsolete, finding a suitable and valid successor is crucial for water laws to deal with adaptation issues. Based on the observation and investigation of the ecological baseline alteration, almost all of the researchers agree that uncertainty pervades the whole process of adaptation—from decision-making to

[73]Beek (2009, 51, 76).

[74]Milly et al. (2008, 573–574).

[75]Ulrich (1999, 137).

[76]Kundzewicz et al. (2008, 3, 6).

implementation—and we will live with it for a long time.[77] Our environmental regulations will, sooner or later, find themselves in an 'increasingly uncomfortable world of changing complex systems and complex adaptive management—a world of unpredictability, poorly understood and changing feedback mechanisms, nonlinear changes, and ecological thresholds.'[78] Those 'cascading', 'exploding' and 'pervasive' uncertainties presented by climate change risks could still bring unprecedented challenges to the current water statutory framework which has developed certain capacity to deal with water, related variability.[79] They must be acknowledged and managed because they have great tendency to cause the paralysis of legal and institutional framework.[80] In many cases, climate uncertainties are not reasons to delay but should be incorporated into water strategies. Thus, a more crucial topic is how to communicate appropriate and viable legal tools and approaches for dealing with uncertainties to water managers and other related decision makers.

Climate change uncertainty, first of all, means our human systems cannot predict and make thorough preparation for future climate change impacts due to the imperfect and inadequate knowledge of the probability, magnitude, timing and location of climate change impacts.[81] The assessment of the climate change risks is generally based on a number of insights, such as the understanding of the physical laws governing the climate, historic trends, scenario analysis and model calculations.[82] Yet, our state of knowledge still knows quite a little about them and the complicated feedback loops of the system. Thus, there are pervasive or even irreducible scientific uncertainties associated with climate change, in terms of climate change itself, its associated extremes, their effects, the vulnerability of systems and regions, conditions that influence vulnerability.[83] For example, General Circulation Models (GCMs) is a powerful tool accounting for the complex set of processes which will produce future climate change.[84] However, GCMs projections are subject to significant uncertainties with regard to the magnitude and probability of potential effects,[85] particularly in the process of model downscaling to regional and local levels. Regulators have increasing impediments in confidently understanding and defining the ecosystem states and functions, especially given its diverse uncertainties at the national, regional and local level.

Not only do these scientific uncertainties exist, but also *epistemological uncertainty* (who should be involved in decision-making and whose values count),

[77]McDonald (2010, 27–30), O'Brien and Sculpher (2000, 460); Matthews and Wickel (2009, 269–79); Reilly and Schimmelpenning (2000, 253–278),Xia et al. (2011, 1–12).

[78]Craig (2010a, 10, 15).

[79]McDonald (2010, 27).

[80]Ibid.

[81]Leitch et al. (2010, 68–9).

[82]Sluijs and Turkenburg (2006, 247).

[83]Handmer et al. (1999, 267–281).

[84]Karl and Trenberth (2003, 1719–1722).

[85]Allen and Ingram (2002, 224–232).

ethical uncertainty (who affects and is affected by climate change impacts and responses) and *scale uncertainty* (at which level should actions be taken) are also very important and should be managed.[86] The epistemological, ethical and scale (EES) uncertainties are involved with the adaptation decision-making process and behavioral rules that try to describe and respond to the dynamic uncertain socio-economic system.[87] Put in another way, we are not clear about who and how to take adaptation actions and what actions could be taken when scientific uncertainties are normalized. Deriving from them is the uncertainty of the cost, implementability and effectiveness of any anticipatory adaptation responses, which is also an important aspect of uncertainty and should be counted.[88] What's more, not enough attention has been put to those secondary environmental effects presented by adaptation strategies and actions. That is we know quite little about the interference or interaction between human adaptation and ecosystem's adaptation.

Uncertainty is Challenging Water Legal Framework

These uncertainties associated with adaptation have brought a series of challenges for water managers to approach adaptation from a legal dimension, from legislative objectives to responsibility distribution and from the decision-making structure to management approaches. Translating uncertain scientific information and socio-economic context to legal requirements, prohibitions and procedures would be very difficult and challenging for both lawmakers and decision makers.

Environmental laws enacted over the past 30 years value certainty, which believes that legislation could and should stipulate clearly the distribution of adaptation-related duties and liabilities among various levels of decision makers and development practitioners. However, climate change uncertainty challenges this entrenched perception and mentality. Climate change-related risks, losses and damages are so diverse and complicated that they are unlikely to be managed with a 'one-size-fits-all' legal solution. The pervasive EES uncertainties also imply that questions like 'who takes adaptation measures?' and 'who pay the costs of adaptation initiatives?' should be flexible rather than being 'locked in'. Water managers in China need to learn how to respond to these series of new issues in a constantly changing context.

Moreover, legal provisions on water allocation, water supply, water rights and water conservation may not work the way as always under a different scenario. The public interest and private property tug-of-war in Chinese water management is no surprisingly also under constant rebalance as a result of uncertainty. Therefore, they may impede effective climate change adaptation by making water use re-distribution and water priorities rearrangement expensive and legally difficult.[89]

On another side, intensified controversies between various levels of government, between rival water uses, as well as between rural and urban areas are expected to

[86]Leitch et al. (2010, 69–71).
[87]Rotmans (1994, 20).
[88]Barnett (2001, 977, 981).
[89]Craig (2010b).

increase. This not only rises a strong demand to examine our settled administrative or judiciary pattern of resolving water use disputes, but also challenges the role of government and river basin commissions especially in dealing with water sharing issues. Further, any adaptive actions under a changing context may produce accumulative environmental impacts which should be integrated as part of water decision-making process to secure a sustainable future.

Most water planning and policy-making framed by static environmental regulations are underpinned by certain degree of scientific certainty to provide the best information, knowledge and predictability of the future. Unfortunately, uncertainty implies that there is great information gap where the demands of law exceed the supply of science.[90] A legal reform is necessary but also challenging to reduce the information sensitivity or knowledge demand of the decision-making process,[91] so that water managers is able to make decisions in the context of unmet information. It may require a significant shift in the legal philosophy, instruments and mechanisms of adaptation-related legislation in order to provide resilience and adaptive capacity for the changing climate.

Furthermore, to bridge this information gap, improving our capability of scientific research and prediction is absolutely essential and viable. Yet, it is naïve to expect a significant reduction in scientific uncertainty within climate projections in a short period. Many researchers argue that more can be done to facilitate communication and cooperation between scientific community and policy makers.[92] For China, this implies a reflection on the role of science and the relationship between scientists and decision makers.

Science in China is understood quite differently from that in Western countries. Scientific research has been employed to support decision-making rather than to shape decision-making—'decision-making supporting research' named by Dr. Yu, a Chinese scientist and environmentalist.[93] That means 'government has already made the decision. You do research to support the decision. You never do something that changes the decision.'[94] Other independent research that is more reliable, unfortunately, is excluded from input into the decision-making process and ultimately influencing final decisions. For example, some independent scientists have questioned the feasibility of the western line of the South-to-North Water Transfer (SNWT) project based on their investigation of water flow in upper Yangtze River. Their research outcome of seven billion m^3 annual average water flow in upper Yangtze indicates that the government's plan to transfer eight to nine billion m^3 to the North will not work.[95] If the impacts on water resources due to climate change induced glaciers melt are counted in, the adverse impacts of this colossal project

[90]Fischman and Rountree (2012, 19, 25).
[91]Ibid.
[92]Agrawala and Aalst (2008, 183, 190).
[93]Larson (2009).
[94]Ibid.
[95]Ibid.

will be much greater. Unfortunately, due to the lack of institutionalized mechanism to communicate with decision makers, their investigation is unable to influence the project development progress. The absence of real scientific research in decision-making process could bring disastrous consequences, especially given the irreversible large-scale climate change impacts.

4.2.2 Challenges to Water Institutional Framework

Responses to climate change adaptation are being constructed at the intersection of several areas of law and policy, including environmental law, natural resources law, administrative law and international law. Any effort to adaptation raises issues about the proper role of national and various levels of local government, about the relationship among different competent agencies, as well as the public and private partnerships. This fact demands substantial debate and research about how best to organize our institutions of governance to deliver a better adaptation decision.

Institutional Challenges from Adaptation Mainstreaming

Institutional challenges from adaptation mainstreaming in Chinese water management could be generally elaborated both from vertical and horizontal dimensions. A vertical institutional challenge comes from the fact that climate change risks could occur on various spatial scales and thus a very different administrative structure from current one on water management is needed. The second chapter of this book discussed the implementation of Integrated River Basin Management (IRBM) in China and concluded that sub-basin or tributary level will be more applicable for Chinese water management. However, climate change impacts could occur at several spatial scales, which not only means the most appropriate adaptation responses will often be on multiple levels, but also implies that localized actions for specific scale of identified risks are desirable. Moreover, localized adaptation demands interaction between institutions across scales, and calls for more initiatives and powers to be delegated to local levels of government, which challenges current power relationships on water management between the national and local governing bodies. Therefore, effective adaptation mainstreaming is not only dependent on the coordination of various levels of regulation, but also on a central-local (upper-lower) cooperation framework to arrive management strategies acceptable at the local, regional and national levels.[96]

As illustrated earlier, adaptation policies and strategies for water sector are generally isolated from those of agriculture and land. This fragmented regulatory regime for different sectors and regulatory objects created in our pollution prevention realm may bring obstacles for adaptation mainstreaming from a horizontal perspective. It may interfere with institutional coordination efforts on achieving a

[96]Jäger and Moll (2011, 213–214).

common goal of reducing vulnerability and increasing resilience and adaptive capacity. For example, adaptation actions in water sector may increase vulnerability or undermine adaptive capacity of another sector, if effective coordination among different competent agencies is absent. Accommodating conflicts and trade-offs generated from these vertical and horizontal institutional challenges will be not an easy task for Chinese regulators and water managers while adopting a mainstreaming method.

Understanding the Context Specific Nature of Adaptation

Climate change impacts and vulnerability usually do not follow sectoral and political boundaries, but most adaptation responses often do.[97] They are often developed and employed at a regional, local and community level.[98] While there are no panaceas or one-size-fits-all methods for climate change adaptation, effective adaptation measures are highly dependent on specific, geographical and climate risk factors as well as institutional, political, legal and financial indicators. Local realities, from climatic characters and physical landscapes to cultural traditions and local knowledge should be thoroughly examined to take local level adaptation responses.[99]

The OECD provides three reasons about why adaptation actions should be based at a specific local level.[100] First, climate change impacts are manifested locally, affecting local livelihood activities. Although climate change is most often discussed and understood as a global issue, its various impacts are felt differently due to different topography and meteorology. Some places experience more rain and frequent floods while some experience short rainy seasons. The impacts on the upper Yangtze River, which is prevalent with glacial melting, are distinct to those impacts of middle stream of the Yangtze that are characterized by frequent floods. Its highly localized nature implies that adaptation actions must be tailored to specific local conditions.[101]

Second, vulnerability and adaptive capacity are defined and determined by local conditions. Ecological factors of local level like the sensitivity and exposure to climate change impacts and local socio-economic factors like institutions, education and technology, infrastructures, health and income are crucial to assess the vulnerability and adaptive capacity at that level.[102] For example, communities living in the downstream of the Huai River have a comparatively higher adaptive capacity than those in the middle and upper stream, mainly due to their high economic and social development level. A developed economy and society enables individuals and communities in this area to dilute adverse impacts through insurance, diverse incomes and resources. Thus, measures to reduce vulnerability and advance adaptive capacity are best conducted according to current local conditions.

[97]Agrawala and Aalst (2005, 40).
[98]Macintosh (2010, 41).
[99]Wilk and Wittgren (2009, 18–19).
[100]OECD (2009, 140–141).
[101]McDonald (2010, 23).
[102]Tan (2010, 135, 138).

Third, adaptation activities are often best observed at the local level. The adaptive capacity (or lack thereof) of government in various regions frequently confirm that response actions would be better left to appropriate local government which is closest to people's daily life and activity and closest to where impacts are experienced.[103] Local government is best positioned for its role in the context of delivering local government functions, conducting the responsibilities conferred by laws and regulations, and lastly demonstrating leadership and innovative solutions in its own jurisdiction.[104] It is also convenient and forthright for local government to collect experiences, voices and interests from affected people as well as get firsthand feedback on policy and planning implementation.

Challenges to Current Hierarchical Central-Local Power Relation

Localized responses on adaptation needs do not mean the exclusion of the role of higher level government or national government. On the contrary, local actors will increasingly need external support because the large, covariate and undefined climate change risks may overwhelm local adaptive capacity and cause irreversible damages.[105] How to coordinate local initiatives and external support from a higher institutional level under current or reformed Chinese legal framework deserves in-depth discussion.

China's constitution has established its central-local governance system by stating that

> The division of functions and powers between the central and local levels of government and their departments is guided by the principle of giving full scope to the initiative and enthusiasm of the local authorities under the unified leadership of the central authorities.[106]

In practice, based on this model, central government has superiority over local government by allocating goals, introducing a cadre responsibility system and providing mandatory requirement. As a result, a hierarchical system which favors command-and-control regulations has been established among various levels of government (from the top down, it is mainly central-provincial-prefectural-county). In this statutory structure of governance, authority tends to be split between central and local government for much of the work. Cooperation among different levels of government has been far less focused and developed. There is poor communication among them on certain issues (especially those central policies that do not benefit local government) and too often, it leads to conflicts and local government's perfunctoriness.[107] This hierarchical system has been the main paradigm to deal with problems confronting China, from developing local economies and regulating production security to preventing coalmine disasters and environmental

[103]OECD (2009, 141–142).

[104]Durban Local Government Convention (2011).

[105]Craig (2010a, 10, 54).

[106]Constitution of the People's Republic of China (2004, art 3).

[107]Guttman and Song (2007, 418–433).

pollution.[108] For example, top-down command-and-control instruments such as the performance standards established for polluters, permitting system and the uniform environmental criteria have been adopted widely by environmental authorities to control pollution.

Chapter 2 pictured a top-down institutional system in most Chinese river basins where the MWR and its dispatched RBCs make key decisions. Local levels of government have predominant power on implementation within their jurisdictions, but often do not give full consideration of the whole basins' interests. This paradigm may be very effective and efficient in addressing issues such as natural disaster prevention and land and resources management which are better undertaken within a common national framework from top to down.[109] However, it may not deliver the best outcome for adaptation which prefers localized responses.

The Chinese government has supported localized adaptation responses through requiring provincial governments to formulate their own climate change action plans and promoting provincial legislation. At first sight, it would seem that provincial governments are well placed to create and implement adaptation strategies based on their own specific vulnerability and adaptive capacity. Unfortunately, in reality, analytical examination of the contents in their action plans and legislation reveals heavy influences from the central government's CNCCP and the White Paper, lacking adequate understanding and thorough consideration of local contexts.

For the EU and some of its member states where subsidiarity principle (SP) is widely accepted and implemented, the localized nature of adaptation does not raise additional institutional conflicts. Primarily applied as an effective guidance to allocate environmental responsibilities between higher and lower government,[110] SP argues that national government should occupy a subsidiary function, taking action only on those tasks which could not be conducted or performed effectively by a lower level of government.[111] Although it does not clearly explain how responsibilities on climate change adaptation are distributed among various levels of government, the paradigm and model created in managing environmental issues could provide off the peg experience for adaptation. For some federal states where local governments have great autonomous power, it is not hard to take local adaptation actions either. For example, in Australia, the federal government has promulgated 'Climate Change Adaptation Actions for Local Government' to delegate state government greater flexibility in responding to climate change based on its local needs.[112] Many local councils and state government have undertaken progressive steps to facilitate adaptation as well.[113] However, for China, which has

[108]Korppoo and Luta (2009, 43–44).

[109]Shi (2013).

[110]Richardson (2012, 3, 6).

[111]Ibid.

[112]Department of Climate Change and Energy Efficiency, Australia Government (2010, 13).

[113]The Office of Environment and Heritage, New South Wales, *Adapting to Climate Change*. http://www.environment.nsw.gov.au/climatechange/adaptation.htm.

a unitary system and where SP has not been accepted formally,[114] empowering local governments to take adaptation initiatives will encounter several difficulties.

For China, adaptation implies that the powerful central government is better to cede its control of local governments, in order to devolve more discretion and flexibility for them to develop their local adaptation strategies. This demands a significant power shift from central level to local level. At the same time, central or upper level government should provide policy, technological or financial support to establish a cooperative framework with local (lower) government. Mechanisms should be established to enable local knowledge and experience of adaptation to be integrated into upper-level decision-making process. Reforming current central-local (upper-lower) governance patterns, decision-making paradigms and the direction of information flow to accommodate adaptation requirements will be very challenging,[115] especially when considering certain political and institutional path dependence. This dependence recognizes that once duties and liabilities are allocated, it is difficult to alter these allocation rules.[116] Furthermore, given that the current mitigation-dominant climate change framework is pervasive with top-down directives and objectives, enabling local governments certain competent power to respond to adaptation needs will require a significant shift in climate regime and thus it will not be easy.

4.2.3 Challenges to Extant Public Participation Mechanism

The UNDP articulates that governance should 'comprise the mechanisms, processes and institutions, through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences.'[117] Accordingly, good governance is able to 'ensure that political, social and economic priorities are based on broad consensus in society and that the voices of the poorest and the most vulnerable are heard in decision-making over the allocation of development resources.'[118] By underscoring the value of equity, transparency, accountability, participation and responsiveness, good governance requires broader and effective civil society engagement to build consensus, mediate different interests and to reach a broad consensus on policies and procedures.[119]

The risks associated with climate change and the uncertainties inherent in adaptation pose an urgent requirement for consensus-oriented governance paradigm which builds on exchanging, sharing, and integrating knowledge about

[114]On the Principle of Subsidiarity and the Reform of Chinese Administrative System (2006).
[115]Ibid.
[116]Comley (2012).
[117]UNDP (1997)
[118]Ibid.
[119]Ibid.

climate-related risks among all stakeholder groups.[120] In addition, adaptation also needs adequate and effective input from civil society who has its own perceptions, knowledge and experiences on addressing adaptation associated risks.[121] IPCC also acknowledges the importance of citizens by stating that responses to climate change should include 'actions at all levels from the individual citizen through to national governments and international organizations'.[122] This part will begin with an in-depth investigation and assessment of the legal framework and practices of the public participation in Chinese water management. The challenges for a wider and more effective public participation in adaptation will be expounded after that.

Analyzing and Assessing the Legal Provisions on Public Participation

Civil society in China is a relatively very weak actor whose political space is restricted and has a very limited ability in influencing decision-making process and results.[123] According to the UNDP, civil society is defined as: 'individuals and groups, organized or unorganized, who interact in the social, political and economic domains and who are regulated by formal and informal rules and laws.'[124] It is not limited to traditional non-governmental organizations (NGOs) and the stakeholders, but includes various social groups. It offers a dynamic, multi-layered wealth of perspectives and values, seeking expression in the public sphere.[125] Strictly speaking, civil society engagement is much broader than 'public participation' that mainly focuses on the participation of stakeholders and interested public. However, for China, the first and down-to-earth step would be to promote public (mainly those stakeholders and affected public) participation. Without effective and institutionalized public participation mechanism, any progress toward civil society engagement would be futile. Here the public participation in environmental protection area will be analyzed and assessed to provide the backdrop of its role in water management.

The Development of Public Participation in Chinese Laws

China has established an 'authoritarian environmentalism' in environment management—a non-participatory decision-making approach which is dominated by the government and affording little or no role for social actors.[126] Under this model, 'public participation is limited to a narrow cadre of scientific and technocratic elites while others are expected to participate only in a state-led mobilization for the

[120]Allen et al. (2012, 15).

[121]Amaru and Chhetri (2013, 128–39).

[122]Klein et al. (2007, 20).

[123]Richerzhagen and Scholz (2008, 308, 319).

[124]UNDP, *Governance for Sustainable Human Development: A UNDP Policy Document—Glossary of Key Terms*. http://mirror.undp.org/magnet/policy/glossary.htm.

[125]Ibid.

[126]Gilley (2012, 287, 288).

purposes of implementation.'[127] After realizing that environment protection cannot be completely entrusted to the government and is best handled with the participation of all concerned citizens, the Chinese government stipulated public participation as a principle for environmental protection in early 1989 *Environmental Protection Law* (EPL).

With increasing mass disturbance on environmental pollution and growing public awareness for participation, new EPL in 2014 develops public participation with much-detailed clauses on information disclosure and whistle blowing of those violators and malfeasant officers. Environmental public interest litigation by environmental NGOs, for the first time, is clearly stipulated by a comprehensive national law, and is praised as a landmark of public participation in the way of environmental justice.[128] These stipulations, however, if given serious investigation, are fundamentally different from 'public participation' in the international discourse which is based on the environmental rights of citizens.[129] It is mainly about relying on the public to protect the environment rather than engaging them to participate in the decision-making process. The rights to be consulted and heard in the decision-making process in order to shape polices and strategies on environment protection have been absent.

As the core of social public policy, rights justify the qualification of possessing certain resources or interests, influencing and shaping actors' behavior.[130] More than 20 years after the 1989 EPL enforcement, the real perception about public participation has not made substantive progress. In '*The People's Republic of China National Report on Sustainable Development*', which was published before 'Rio +20-United Nations Conference on Sustainable Development', public participation is still about arising people's awareness in protecting environment.[131] As a result, the public, especially the stakeholders, have generally been excluded from the environmental planning and decision-making process.[132]

Although new development in 2014 EPL will largely improve the legal condition of public participation, current stipulations on public engagement stated in relevant regulations are still shaping the level and effectiveness of public participation in practice. After the 1989 EPL, alleged significant progress in legal provision starts from the release of the *Environmental Impact Assessment* (*EIA*) *Law* in 2003, which ostensibly encourages public participation in environmental decision-making for the first time. This law requires certain plans and all major construction projects to undertake an impact assessment to prevent adverse environmental impacts. It states that 'the government encourages relevant units, experts

[127]Ibid.

[128]Environmental Protection Law of the People's Republic of China (2014).

[129]Zhao (2010, 89, 92).

[130]Lu (2004, 59–60).

[131]The People's Republic of China National Report on Sustainable Development (2012, 70).

[132]Wang et al. (2006, 579–588).

and the public to participate in the EIA process in appropriate ways'.[133] In addition, it requires that 'the institutions should seriously consider the opinions of the relevant units, experts and the public' and 'should attach explanations for adopting or not adopting the opinions.'[134] As the first procedural legislation on public participation, the EIA Law marks significant progress towards public participation. Nonetheless, it is merely a guideline with blurry and brief stipulations. The public are not entrusted with veto power on the approval of environmental assessment, largely restraining their role in influencing decision-making outcomes.

In addition, the Chinese government has promulgated several other laws or regulations to promote public participation. For example, in 2006, *The Provisional Measures on Public Participation in Environmental Impact Assessment* was promulgated to establish the procedure of public participation in the EIA. The 2004 *Law on Administrative Licenses* which introduce principles of transparency, fairness and justice and the 2008 *Environmental Information Disclosure Measures* (EIDM) which aims to establish information disclosure mechanism are also important laws providing foundation for more effective public participation.[135]

Assessing the Effectiveness of Public Participation as a Legal Institution

Nonetheless, due to the limited extent of the public who are able to participate, limited impacts of the public in decision-making and limited access to judicial redress, most of these laws do not set up effective institutionalized mechanisms and supporting systems for public participation.[136] Moreover, they inherit the legacy of Chinese legislation mentality—more akin to policy statements and propositions of ideals than laws.[137] Most of these laws and regulations prefer to state general principles without many details about implementation or who will be held accountable when non-disclosure occurs in violation of the law.[138] For example, Article 12 of the EIDM stipulates that 'environmental authorities should not disclose information involved with state secrets, business secrets or personal privacy', but it does not list what information belongs to these three 'secrets'.[139] This general provision provides excuses for environmental authorities to deny applicants' information disclosure application in the name of protecting state secrets, business secrets and personal privacy.

Influenced by this attribute, vague languages are frequently employed in provisions.[140] What are frequently used are exhortation terms such as 'encourage'

[133]Environmental Impact Assessment Law of People's Republic of China (2002, art 5).

[134]Environmental Impact Assessment Law of People's Republic of China (2002, art 11, 21).

[135]Law on Administrative Licenses of People's Republic of China (2012, art 5).

[136]Zhao (2010, 89, 118–22).

[137]Alford and Shen (1997, 125, 135).

[138]Wu (2005, 288, 307).

[139]Measures for the Disclosure of Environmental Information (for Trial Implementation) (2007, art 12).

[140]Beyer (2006, 185, 205).

(*guli*) and 'should' (*yinggai*) rather than stronger ones like 'require' (*yaoqiu*), 'shall' (*dei*) or 'must' (*bixu*).[141] Flexible terms may present discretion for local government to tailor appropriate adoptions to its local circumstances, but they also provide local officials considerable leeway for interpretation.[142] As a result, their implementation is often distorted on a case-by-case basis. Both literature and empirical studies show that the enforcement of public participation in reality remains weak.[143] Many scholars characterized it as 'imposed, involuntary, manipulative, unsustainable or unaccountable practices'.[144]

The absence of institutionalized participation system has resulted in an increasing number of environmental protests, such as Dalian and Xiamen PX (P Xylene) protests.[145] Although these environmental protests successfully forced local governments to alter their decisions, they are not public participation in its true sense. In-depth investigation of these cases reveals that most of them were post participation—the public only got a chance to express or protest after the decision has been made or the project has been started.[146] Related authorities were very passive in providing chances for those affected to participate. They only initiated the hearing procedure after the environmental protest became a serious social stability issue.

Both research and observation reveal that there are three stages of public participation in general:

(1) local interest groups and local governments get a polluting project underway in violation of environmental regulations;
(2) local affected people spontaneously organize the mass to protest against the project in question, an activity neither supported law nor policy;
(3) being afraid of affecting social stability, local government halt the project—again, breaching laws.

At every stage, existing legal rules are ignored by all participants in the 'public participation' process (see Footnote 145). This so called 'interaction without rules' has been a very common path of responding to environmental issues, reflecting the absence of a strong rule of law and institutionalized procedures for public participation in China.[147]

(b) *Reviewing the Public Participation Practices in the Water Management*

[141]Ibid.
[142]Wu (2005, 288, 317).
[143]Eng and Ma (2006, 155, 179).
[144]Plummer and Taylor (2004, 52–53).
[145]Tang (2009).
[146]Zhange (2011).
[147]Ibid.

Public Participation Practices in Water Management

In the water sector, issues involving various stakeholders mainly include: initial allocation of water rights, water price, decision-making about water resource projects and environmental protection, etc.[148] All of them involve various interest groups that are of high interest and relevance.[149] Stakeholders and the interested public could participate in the water management process mainly through the following ways:[150]

(1) public opinion collection and solicitation, where public opinions on certain water management issues are collected through questionnaires, surveys and forums;
(2) public hearings, where formal public hearings are organized by government agencies and representatives of various stakeholders can express their viewpoints, interests and raise questions on certain water-related issues or decisions. For example, to make decisions on raising water price, relevant authorities organize public hearings to consult stakeholders from industry, agriculture and household water users;[151]
(3) experts' reviews of development policies and plans, where professionals with expertise are involved in water management;
(4) stakeholder coordination, where representatives of various stakeholders communicate and negotiate over water-related issues relevant to their interests.

These four types of public participation are expected to significantly influence the decision-making on water issues from various perspectives and for different levels of public. Unfortunately, in practice, the affected groups and the public are treated as recipients of inconsequential information or information about decisions that have been made.[152] They are consulted and allowed to comment only on pre-determined issues. Their opinions, comments and suggestions are not able to influence or shape final decisions (see Footnote 143).

Assessing Public Participation Practices in Water Management

This dominant top-down decision-making approach with engaging the public has advantages in producing rapid, centralized responses to address severe water threats, and to mobilize state and social factors to take collective actions.[153] It has been efficient in addressing water conflicts and large-scale urgent crises such as floods and droughts,[154] due to its merits in mobilizing resources, directing performances and keeping social stability.[155] For example, during the 2009 spring and

[148]Pu (2007, 16).
[149]Ibid., 21.
[150]Xie (2009, 56).
[151]Dayoo (2012).
[152]Wang (2009).
[153]Gilley (2012, 287, 300).
[154]Qiu (2005, 116–120).
[155]Ye (2012, 84).

summer drought, a temporary drinking water supply was made available in a timely manner, large areas of crops were saved and public social order in the drought stricken provinces were maintained due to the powerful centralized system.[156] In those severe droughts, the centralized approach has shown its advantages in mobilizing people and the army, deploying resources and allocating funds.[157]

Nonetheless, it is not always the case in managing other water issues. The visible benefits of authoritarianism should not cover the invisible disadvantage it brings to society in the long run. This approach does not provide a system of checks and balances, making it difficult to change course and avert disastrous consequences if decisions are wrong (see Footnote 93). Furthermore, it suppresses and creates obstacles to the development of other civil society groups. The absence of public participation has resulted in a low and inadequate public awareness, understanding and knowledge of water crisis and water-related climate change problems.[158]

First, water users have no understanding of current water crises such as water scarcity and water pollution due to inadequate information dissemination and ineffective public participation. This, as a result, is not conductive to raising water-saving awareness and is likely to lead to public tragedy. For example, according to a survey carried out by Social Survey Institute of China (SSIC), more than 80 % of the respondents never consider saving water resources; and only 14.3 % of the respondents feel panic with current water scarcity problems.[159]

Second, the exclusion of the public from public polices and strategies could nurture a social atmosphere—the indifference of public water affairs. With this atmosphere, the public tend to regard water resources management as the government's business and show no interest in being involved. They will only be compelled to participate when their quality of life has been seriously affected. Their behaviors in that case are likely to be aggressive and irrational,[160] increasing risks of conflict and social unrest.

In addition, due to the decision-making process conducted behind 'closed doors', the public's trust in the government has been in crisis in many circumstances. An empirical study shows that where there is a lack of trust in decision makers, or where individuals feel powerless to influence the final decisions made by the government, their attitudes towards participation are very negative.[161] If this indifference to public affairs and distrust in government has been formed, they are not easily reversed and their consequences will be disastrous for the society in the long run.

In a nutshell, while most of the provisions show some progress in facilitating public participation, there is also a large gap when translating them into practices.

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[156]Ibid., 90.

[157]Ibid., 89–90.

[158]Richerzhagen and Scholz (2008, 308, 317).

[159]Zheng (2005, 15–21).

[160]Xie (2009, 57).

[161]Li (2005, 67–70).

Effective and institutionalized public participation has been absent in arena of water management. This status quo is not able to address crosscutting and complicated adaptation issues, which demands more effective and broad-based public participation.

Challenges to Public Participation by Risk-pervasive Adaptation

Given the intrinsic uncertainty and complexity of climate change, the whole human socio-economic system is at risk. Decisions made and actions undertaken on climate change are inevitably haunted with various risks. In fact, risks are not new to a modern society: risks of nuclear power and genetically modified food (GMF) serve as examples of what humans need to resolve alongside development. Sharing much in common with them, however, risks associated with climate change challenge current socio-economic system due to their larger scale, unpredictability and the irreversibility of the consequences.[162] One could avoid the risk of nuclear power and GMF, but he/she could not escape from the risks presented by climate change. As stakeholders of climate change, all of us are entitled and expected to be engaged in the adaptation actions.[163]

In his book 'World Risk Society', Beck stated that 'so far, risk has seemed a purely negative phenomenon, to be avoided or minimized. But it may be seen at the same time as a positive phenomenon too, when it involves the sharing of risks without borders.'[164] Not only will the risk-sharing cross the physical borders of nations and jurisdictions, but also cross the invisible borders of different genders, occupations, ethnicity, educational attainment, classes (both economic and social classes) and even generations. However, this does not mean that people have the same understanding and response when confronting with risks. On the contrary, their perceptions, attitudes and reaction towards risks may be very diverse. This is because risk is not only a factual statement with technical understanding, but also a value statement—a combination of 'knowledge' and 'awareness'. Embedded cultural and societal norms and values could largely shape both individual and collective behaviors. Thus, rules, strategies and institutions to manage risks and social change are highly dependent on people's perception, belief and knowledge of risks.[165] As O'Riordan and Jordan have proven, it is difficult to have agreement among egalitarians, individualists, fatalists and hierarchists on how to respond to risks due to their profound differences in attitudes and worldviews.[166] Therefore, this perceptual and cultural plurality of risk implies that the question of how society ought to deal with (climate change) risks 'can only be answered in public debate—a debate in which people will necessarily discuss their perception of risks and risk

[162]Craig (2010a, 10, 35).

[163]United Nations Educational, Scientific and Cultural Organization (2011, 14–15).

[164]Ulrich (1999, 16).

[165]Adger et al. (2009, 335, 338).

[166]O'Riordan and Jordan (1999, 81–93).

management from different points of view and different conceptual and ethical frameworks'.[167]

As Beck explained, 'risks are related directly and indirectly to cultural definitions and standards of a tolerable or intolerable life'.[168] First, the goals or objectives set when managing risks are obviously defined by related social and cultural factors.[169] Although in the context of climate change adaptation, the general goal is to reduce vulnerability and enhance resilience to climate change and its impacts,[170] specific goals should be made, such as land use optimization, flood prevention and control and insurance renovation. All these sub-goals will be influenced or shaped by the underlying social and cultural factors of one region or group.

Second, when facing with risks, people will behave 'culturally' in ways reflecting their own understanding of risks and response priorities.[171] Some of them tend to be risk-seeking while others are risk averse, based on their traditionally cultural understanding of the robustness or resilience of the nature. In many cases, their priority list of risks that should be managed does not necessarily match with the factual level of these risks. For example, individuals and communities, out of their personal risk experience or prediction, tend to respond to risks and concerns immediately or personally.[172] In that case, any risk reduction strategy that is not in tune with people's understanding of risks and priorities are unlikely to succeed.[173]

Even among a certain group of people, on the one hand, different people have different values in judging what is valuable and important in life.[174] On the other hand, their perceptions of the risks they are facing are also different. People filter the information they receive about a risk through pre-existing mental models.[175] These diverse values and perceptions of stakeholders involved in the decision-making process of risk management could lead to confliction or even failure if there is no effective communication (see Footnote 165). In addition, different groups with different needs, perceptions and values in a society should be given equitable participation in order to reduce and manage risks.

In a nutshell, an appropriate mechanism responding to risks not only rests with a just identification and distribution of risks among people who produce them and who benefit from them, but is also highly dependent on affected groups' perception, awareness, identification and experience of risks.

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[167]Sluijs and Turkenburg (2006, 253).
[168]Ulrich (1999, 138).
[169]Adger et al. (2009, 335, 341).
[170]Smit and Pilifosova (2001, 877, 891).
[171]Cannon (2008, 350–357).
[172]Adger et al. (2009, 335, 347).
[173]Cannon and Detlef (2010, 621, 628).
[174]Jäger and Moll (2011, 213).
[175]Ibid.

Based on above analysis, the risks confronting with our society

> demand an opening up of the decision-making process, not only of the state but of private corporations and sciences as well. It calls for institutional reform … could encourage environmental innovations and help to construct a better developed public sphere in which the crucial questions of value that underpin risk conflicts can be debated and judged.[176]

For adaptation, a more open decision-making process requires effective civil society engagement, which can meaningfully acknowledge, identify and negotiate the complexity arising from the diverse values of various groups,[177] particularly those marginalized vulnerable groups. More importantly, the values and knowledge developed by non-mainstreaming groups should be perceived and recognized politically, socially and legally.[178] For China, where even institutionalized public participation is absent, this requirement will be not so easy to achieve.

4.2.4 Challenges to the Capacity of IWRM in Managing Adaptation Issues

Mainstreaming adaptation in Chinese water management will mainly be realized in the process of IWRM which is the advocated as a promising approach by Chinese water managers. Challenges to the IWRM regime presented by climate change and adaptation can be interpreted from two dimensions. First, while IWRM aims to achieve sustainable development, climate change may compromise the outcomes due to its adverse impacts. This aspect can be understood as the general physical effects of climate change which have been discussed earlier and will not be duplicated here. Another dimension is that climate change will challenge IWRM's capacity in managing emerging climate change impacts. As illustrated earlier in this chapter, although IWRM has developed certain capacity in dealing with climate variability and changing socio-economic situation, the larger-scale, cascading uncertainty and complexity brought by climate change has raised questions about its capacity in dealing with these new challenges. Furthermore, whether the theory and practice of IWRM developed decades ago are ready and robust enough for a climate change era is under debate. However, to what extent and from what aspects IWRM is challenged has not been given in-depth investigation in China.

The emphasis of most work on IWRM is, as its name suggests, managing water and related resources in an integrated way to maximize economic and social welfare,[179] without considering responding to exogenous pressures like climate change. First, the adaptability of the current water system was set up, designed according to

[176] Ulrich (1999,5).

[177] Adger et al. (2009, 335, 350).

[178] Ulrich (1999, 119–120).

[179] Aerts and Droogers (2009, 87, 92).

historical information and current climate conditions, which may be unable to adapt to future uncertain climatic projections.[180] Second, the IWRM was adopted and developed before climate change became an internationally hot issue and a domestic policy driver, and thus does not explicitly require to integrate climate change considerations. Most water management instruments do not explain how to address the increasing levels of variability, uncertainty and irreversibility presented by climate change.[181] It is also true that neither the vulnerability of water system nor the vulnerability of the current water management regime is investigated and considered by the IWRM. Third, originally advocated as a politically pragmatic approach to mediate conflicts among different water users, IWRM does not invite much science in its concept and practice.[182] The scientific basis of IWRM concept and practice has not been well established.[183] For example, monitoring is often limited and passive, making periodically scientific assessment and review very difficult. Water-related climate change adaptation, on the contrary, needs to base future projections and dynamic assessment on scientific understanding. In addition, some scholars argue that IWRM as an attractive water management approach could not enhance the flexibility and adaptability required by climate change adaptation.[184]

Another possible challenge that could be easily ignored comes from the gap between water-related disaster risk reduction (DRR) and IWRM. According to the United Nations International Strategy for Disaster Reduction (UNISDR), DRR is 'the broad development and application of policies, strategies and practices to minimize vulnerabilities and disaster risks throughout society, through prevention, mitigation and preparedness.'[185] Aiming to avoid, lessen and transfer hazards, it offers cost-benefit approaches to reduce the negative effects of natural disasters. In the water sector, floods and droughts are the most important examples of disaster risks needing reduction and management. Nevertheless, until recently, DRR has not been considered as a component of IWRM in both developed and developing countries.[186] As aforementioned, in China, water resources and natural disasters (especially floods and droughts) are managed by different authorities. Different policies, laws, regulations and institutional arrangements have been established and developed to manage them respectively.

The negative effects resulting from the gap between DRR and IWRM can be exacerbated by climate change, where water-related disasters provoked by climate change have been becoming more intensive and frequent. Therefore, it is necessary that DRR strategies be well integrated with IWRM to build resilience to cope with

[180]Ibid., 88.

[181]Bruch and Troell (2011, 828, 830), Medema and Jeffery (2005, 5).

[182]Pahl-Wostl and Sendzimir (2005, 5).

[183]Ibid.

[184]Gain et al. (2013, 11, 17).

[185]UNISDR (2007).

[186]Pangare et al. (2006, 79).

floods, droughts and other climate change induced disasters. This integration, however, complicates the process of adaptation mainstreaming where both adaptation and DRR are significant input of the IWRM regime. Despite the considerable overlaps between DRR and adaptation in terms of reducing climatic disasters, they are distinguished in their origins, scopes and institutional requirements.[187] Mainstreaming adaptation in China's IWRM implementation is calling for serious and thorough analysis of exceptional and incremental challenges presented by climate change.

4.3 Analyzing the Potential to Mainstream Climate Change Adaptation in the IWRM

Unlike the vigorous comparative studies between IWRM and adaptive water management, both of which are approaches of managing water resources, there are not much research to compare IWRM with water-centered climate change adaptation. Theoretically, IWRM is widely regarded as an approach to manage water and related resources among different users with a holistic perspective, while water-centered climate change adaptation is challenged to enable related water management regime to adapt to expected or unexpected climate change impacts. Nonetheless, if IWRM is regarded as an ongoing development approach due to the endogenous challenge of fragmented management, water-centered adaptation can be deemed as a response to an emerging exogenous challenge—climate change. While the endogenous and exogenous challenges are currently recognized and addressed separately because of their different concerns, they are associated in many aspects and are compatible with each other to some extent. To what extent and how they compatible with each other, and how to bridge their differences have so far not been thoroughly investigated. This part will conduct a comparison between IWRM and water-centered adaptation from various perspectives to detect their distinctions, overlaps and the likelihood of integration for synergy (Fig. 4.2).

As shown in Fig. 4.2, it is clear that IWRM and adaptation share much in common:

(1) IWRM and water-centered adaptation share the same goal of reducing the ecosystem vulnerability and achieving sustainable water management;
(2) Both of them are crosscutting issues, which determines that IWRM and adaptation need a comprehensive, coordinative and collaborative framework;
(3) Both of them are better regarded as a process which provides an ability to integrate new information and knowledge into future practices;

[187]Phukan and Tomar (2012, 137, 144–146).

Distinctions	IWRM	Water-centered adaptation	Possible synergies
Driving forces	An approach to address internal fragmented water management	A response to the external climate change challenges of water management	Combining the internal and external factors in one process
Objectives	Delivering sustainable water management by integrating competing and conflicting water uses	Reducing the threats to water security posed by climate change-induced risks and impacts	Aiming to achieve sustainable water management, promote sustainability and ensure water security
General approaches	Preferring an integrated approach; thinking at basin level and implementing at local level; from top to down	Preferring approaches based on specific site; acting at local level while thinking at a higher or basin level; from bottom to top	A balance between a holistic thinking and local actions; a balance between basin and local interests
Institutions involved	The MWR, MEP, MOA and other competent agencies; their sub-level counterparts; RBCs	The NDRC and DRCs, meteorological agencies (MA), MWR and lower water authorities	Collaborating among the NDRC, MWR, MA and MEP; empowering RBCs and the MEP

Fig. 4.2 Distinctions and commons between the IWRM regime and water-centered adaptation

Legislation assumptions	Assuming that the aquatic ecosystem is stationary, and the future can be predicted based on historical data and observation	Assuming that the water system is non-stationary and inherent with uncertainty; understanding the future could not fully relies on the past	Bridging the assumption gap by reflecting IWRM and reducing uncertainties; allow principled flexibility to achieve the same regulatory goals
Social status	Water problems are recognized as a core and urgent issue by various levels of Chinese government	Climate change is not a priority issue and is a long-term issue; its uncertainty is also a reason for delayed action	Climate change is very likely to aggravate water problems and threaten water security, thus must be taken seriously
Common points	Both of them are crosscutting issues; Both of them have close link with sustainable development; Both of them share the same ultimate goal to improve sustainability; Both of them are regarded as a process rather than a one-shot approach; Both of them strongly require information sharing and dissemination, participatory process and stakeholder involvement; Both of them need structural and non-structural approaches, good governance, social justice consideration and the engagement of woman; …		

Fig. 4.2 (continued)

(4) Some identical key elements are required for their successful implementation, such as public participation, information disclosure and the social justice concern.

Overlapping in areas such as objective, institutional framework and key elements, these common areas provide great potential for synergies while mainstreaming adaptation in IWRM. However, in addition to the great challenges to legal assumptions and institutional settings demonstrated in the previous part, they are also distinct in many aspects. Hence, it is vital to analyze whether and how these differences could be bridged or resolved.

4.3.1 Bridging the Gap Between Stationarity and Uncertainty

Since stationarity has dominated IWRM and related legislation for decades, it is impossible to change the legal assumption from stationarity to uncertainty immediately. However, related laws and regulations should be amended or developed in a reflective discourse in order to adapt to the changing baseline conditions. In the past ten years, a series of intensive droughts in southern and southwest China where water resources are regarded as abundant not only have made the challenge to this assumption self-evident, but also made the reflection and development of this assumption more urgent. Some leading Chinese water professionals have acknowledged the limitation of stationarity which is based on historical records and not considering climate change.[188] They gravitate to accept that uncertainty is one of the most challenging topics for water-related research and decision-making process. Nevertheless, problem realized does not mean problem solved. This scientific understanding needs some time to be understood by regulators of the water sector and to be translated into policy-making circles.

Before the repudiation of stationarity assumption is widely accepted by water managers, and before uncertainty is fully recognized and integrated in IWRM, the gap between them should be reduced to minimize the possibility of policy failure. According to some scholars, both a 'filling' and a 'bridging' strategy could be employed to address this gap in the context of adaptation (see Footnote 93).

To 'fill' the gap, more research information and data should be input in the decision-making process. Earlier in Sect. 4.2 of this chapter, it was pointed out that IWRM does not invite too much science, which does not help water managers to manage the dynamic hydraulic system and complicated water-related climate change impacts. Thus, to effectively implement IWRM in the context of climate change, the communication between water scientists, climate change scientists and water managers must be improved. On the one hand, scientists need to think out of the box to re-evaluate the social aspects of their scientific research. That means their research outcomes and outputs should be refined and translated properly to inform the decision-making process. On the other hand, water managers should recognize

[188]Xia et al. (2011, 9).

the need for a better interaction with the scientific community to an extent that platforms are being developed for frequent interaction between these two parties.

Although some uncertainties could be reduced along with the development of science, some residual uncertainties will always remain. In this circumstance, a 'bridging' strategy is demanded, especially for those epistemological and ethnic uncertainties. The information and knowledge gap could be bridged by recognizing the information limits and decreasing the demand for information in decision-making process.[189] Methods like legal principles, legal institutions and mechanisms are conducive for decision makers to move forward with less information. Flexible procedures and mechanisms which allow change and input of new information could also encourage decision makers to take action with inadequate information or knowledge. This book proposes that at least the following principles and approaches could be employed to guide decision-making process in the context of uncertainties:

(1) A precautionary principle which implies that uncertainties should not be an excuse to postpone cost-effective decisions;
(2) A public participation mechanism which requires that affected people should be identified and integrated in the decision-making process to supplement the inadequate knowledge of decision makers;
(3) An adaptive management approach which could provide an iterative and experimental process to monitor and evaluate, learn from experience, respond to emerging knowledge and continually refine policies and management decisions;[190] it is a promising approach to reduce the demand for information, input continuous information and create flexibility which is desirable for climate change adaptation;[191]
(4) A risk management approach which is able to reduce risks, provide alternatives, distribute risks among societies and prepare for negative risks;[192]
(5) A vulnerability-based approach which focuses on reducing climate exposure and human sensitivity as well as increasing adaptive capacity;[193]
(6) 'No-regret' or 'low-regret' strategy which requires that adaptation measures should have the capacity to deliver and resolve other economic, social or environmental concerns rather than depending primarily on climate change projections.[194] They will increase resilience to particular climate change harms if those harms are actual, but will still enhance social welfare even if they do not happen.[195]

[189]Fischman and Rountree (2012, 19, 27).
[190]Pahl-Wostl et al. (2007, 30, 34).
[191]Fischman and Rountree (2012, 19, 30).
[192]Aerts and Droogers (2009, 87, 93).
[193]Ford (2008, 5, 11).
[194]Abramovitz et al. (2001, 10).
[195]Craig (2010a, 10, 67).

(7) Increasing regulatory principled flexibility to reflect the changing baseline condition that beyond human control is also desirable for water laws to achieve adaptation goals, even with great uncertainties. Differentiating climate change causes from anthropogenic stressors on water crisis is necessary for water manager to tailor pertinent actions.

These principles and approaches could facilitate the adoption of climate-proofing water management measures, reducing climate change vulnerability and promoting sustainable water development. Since most of them have been applied or is being applied by both the water community and adaptation community, they provide great potentiality for the mainstreaming strategy.

4.3.2 *Integrating an Integrated Thinking with Locality-Based Actions*

Section 4.2 of this chapter presented the institutional challenges posed by adaptation that favors localized initiatives to IWRM which prefers an integrated management approach at the basin (or sub-basin) level. Mainstreaming adaptation in the IWRM requires an intersection to take action at an appropriate level.

Although preferring an integrated approach, IWRM is not a one-size-fits-all prescription or strategy that can be applied as a fixed model in all contexts and situations.[196] More importantly, it is by no means a simple combination of different sectors, water users and jurisdictions. It signifies a significant shift in the management mentality and paradigm, which has a holistic thinking but also gives full consideration of local realities. In reality, the effectiveness of IWRM, to a large extent, relies on the recognition of different hydro-geological, demographic and socio-economic-cultural reality in different regions.[197] Therefore, successful application of IWRM must tailor measures or initiatives to fit with local situations and priorities with a view to the basin interests. This is especially necessary for most river basins (since they run from the less developed west to the developed east) which have very diverse natural, economic and social circumstances among different regions and provinces. Research in Chap. 2 revealed that some successful reforms have been undertaken on the sub-basin, regional or city level to reflect their different basin realities and local conditions. Furthermore, various climate change impacts on different reaches of rivers require that water management strategies and measures must be based on certain contexts. At the same time, water-related decisions made at local levels should be in-line with national frameworks and plans to achieve the broader river basin objectives.[198]

[196]Pangare et al. (2006, 48).

[197]Shah et al. (2000, 89, 94).

[198]Slootweg (2009).

In terms of adaptation, it not only needs to be locally based but also requires that adaptation strategy or planning should be conducted in a holistic way to achieve coherence and avoid maladaptations and conflicts.[199] For instance, a program or project conducted on the upper reach must consider its effects on other reaches or regions, so as not to increase vulnerability to them. In China, the primary responsibility for adaptation has been delegated to the provincial level government. To date, all provinces have formulated their own provincial climate change policy framework to guide adaptation actions within their jurisdictions. At the same time, the Chinese government is developing its national climate change policy and legislation to provide consistent guidance for local adaptation actions.

So far it has been very apparent that IWRM needs to consider local water realities while localized adaptation measures should think holistically. A crucial question here is at which level adaptation planning (not implementation) is ideal to be mainstreamed with IWRM in the river basin. This book suggests that adaptation mainstreaming at the sub-basin level or regional level has a huge potential to coordinate central and local interests.

This argument can be supported from both theoretical and empirical studies. Theoretically, climate change affects such as flooding, changing precipitation and temperature are often regional, cutting across administrative borders. Furthermore, it is water authority that manage adaptation to water-related climate change impacts through existing water management regime and legal framework. As concluded in Chap. 2, water resources in most major basin are apt to be managed at the basin level (both basin and sub-basin level). In that case, water-centered adaptation should keep pace with the same trend.

In practice, in *China's National Climate Change Program* (*CNCCP*), climate change impacts are mainly observed and assessed on the scale of regions and river basins. For example, the Hai-Luan River basin is identified as the most vulnerable region to climate change, followed by Huai River basin and Yellow River basin (see Footnote 29). Some scientific research and empirical studies on climate change are undertaken on a regional, basin or tributary level. Just name a few examples: the scientific research on climate change impacts organized by China Meteorological Administration is based on regions;[200] some scholars also have studied the climate change impacts on water resources in the Han River basin (the largest tributary of Yangtze River);[201] the Yangtze River Basin (basin level) and Poyang Lake Basin (sub-basin level) have generated their own reports on climate change vulnerability and adaptive capacity. The CNCCP also encourages establishing a regional administration system for coordinating responses to climate change (see Footnote 29). Mainstreaming adaptation factors in the sub-basin level IWRM will not only be more effective to ally provinces which have similar climate change impacts to work

[199]Ranger and Garbett-Shiels (2011, 12).

[200]Interview with interviewee 4, staff of the National Climate Centre (Beijing, 22 September 2011)..

[201]Zhu and Zhang (2005, 16–23).

together but also will be able to minimize the risks of maladaptation and externalities.

To put it briefly, although evolving from different paths, IWRM and adaptation reach the same destination. IWRM is developing from a whole-basin level to a sub-basin level while adaptation is developing from local to sub-basin level. With the same goal to deliver sustainable and robust water management, both of them need to integrate a holistic thinking and local reality considerations.

4.3.3 Developing Collaborative Mechanisms Between Various Levels of Government

Section 4.2 discussed that the cooperation among Chinese central and local governments along the same river basin is very weak in terms of resolving complicated water problems and minimizing conflicted interests. In order to implement IWRM, current cooperative mechanisms between central and local governments must be strengthened to set up a common goal and action plan. Chapter 2 proposes that the River Basin Commissions (RBCs) could play a significant role in bringing together various levels of government to discuss coordinated management of relevant river basins. The same requirement to establish an effective central-local collaboration mechanism could also be found in adaptation, which provides another opportunity for synergizing with IWRM.

Climate change and adaptation are characterized by highly specialized scientific knowledge as well as a high reliance on local experience and knowledge, which brings about challenges to the aforementioned central-local power relations dominating current water management regime. On the one hand, national level government has the most advanced scientific information and technology but does not have a good proximity to the specific local challenges, knowledge and stakeholders. On the other hand, local governments have abundant local experience and knowledge on adaptation but have very limited competence and capacity in predicting and interpreting technical and scientific information. Therefore, adaptation measures implemented at the local level require some level of cooperation from the national government to provide scientific support, policy guidance and enabling environment. Vice versa, adaptation policy and planning at the national level should consult local governments to gain better understanding of local vulnerability, adaptive capacity and local knowledge.

To date, two different paths have been discussed as to the effectiveness of the institutional approaches to adaptation: (1) developing proactive national adaptation policy or legislation to guide local adaptation activities—a top-down approach; (2) developing local adaptation policy or legislation to provide insights to national adaptation strategies—a bottom-up approach. Most countries have adopted a mixed approach where both the national government and local governments have worked towards adaptation from different aspects and scales. China first promulgated its

national climate change policy in 2007, which becomes a guiding document for provincial governments' response to climate change. Meanwhile, China started its adaptive legislation from a provincial level pilot program.

So far, not enough research has been done on which approach should be undertaken on which occasion. Nonetheless, it is certain that neither central nor local government could handle the challenges of climate change alone—governments at all levels have important, complementary and differentiated roles in adapting to climate change. No matter which approach is adopted, a central-local coordination is always essential to formulate common goals and to build a more consistent and coherent framework on adaptation. A national partnership based on various levels of government efforts to adapt to climate change would help reduce institutional inefficiencies, avoid duplication and promote information sharing.[202]

4.3.4 Understanding the Climate Change Threats to Water Security

Another concern of mainstreaming adaptation is how adaptation, which is not the priority of Chinese water managers, could be integrated with water management issues of high importance. This question mainly resolves the political barriers to adaptation mainstreaming. Due to the pressure of population growth, economic development and urbanization, water problems such as water shortage, water pollution and uneven water distribution have been one of the urgent core issues of the Chinese water managers. Their importance has also been widely recognized by various levels of local government due to their potential to impact local water security, food security and economic development. Although slow in taking innovative water management approaches, Chinese water managers never stop promoting sustainable water development. Adopting and implementing IWRM is one of their strategies and efforts in the context of China's specific political, legal and institutional environment.

Different from water crises that require immediate attention, climate change is often perceived as a long-term issue. Economy-oriented government and water managers at the central and local levels have not considered climate change adaptation adequately and seriously. Their awareness and understanding of climate change and adaptation is comparatively very low. While climate change has been associated with peace and security issues at the international level, the Chinese government has not recognized it as a security issue.[203] Although some policies and plans related to climate change adaptation (such as the CNCCP and the White

[202]Australia Government (2010).

[203]Moore (2009, 25, 30).

Paper) have been promulgated in the past few years, adaptation practices have not progressed. As revealed in Chap. 3, various levels of government are generally lacking internal incentives to take innovative and proactive adaptation strategies.

To achieve sustainable water management in a climate change context, Chinese water managers need to realize that climate change has great potential to directly threaten China's water security. As Zhang et al. point out, climate change affects water security through impacting floods, water supply, aquatic ecological environment and hydraulic engineering projects.[204] In addition, Chinese water managers need to understand that climate change may pose severe implications on food security, ecosystem security and even social stability through the impacts on Chinese water resources.[205] These potential challenges to the socio-economic stability and development must be integrated in water management regime and strategies through embracing uncertainty, thinking and acting in a positive way.

Mainstreaming adaptation concerns in the IWRM is expected to effectively reduce these negative water-related climate change impacts, assuage vulnerability and enhance resilience of water ecosystem. For China which is suffering severe and urgent water crises, the climate change challenges to water resources indicate that mainstreaming adaptation will be the only way to ensure the basin's water security.

In addition, international factors have largely stimulated the development of adaptation in some areas of China. For example, the commitment and support of the Asian Development Bank (ADB) in helping China integrate adaptation considerations through policy and institutional development has promoted adaptation to the frontline.[206] The international support has, to a large extent, contributed to raising awareness, garnering political will, and assessing the financial and capacity needs for adaptation implementation.[207] Nonetheless, these are external factors and inadequate to deliver effective adaptation outcomes. Adapting to water-related climate change impacts will only be effective if there are strong internal incentives from water managers.

4.3.5 *Identifying the Potential of IWRM in Mainstreaming Adaptation*

Water resource management has been traditionally about understanding and assessing risks and uncertainties that hydrological cycles brings and designing robust responses to them.[208] The constant change in economic circumstances and social priorities also catalyze approaches of water resources management to evolve

[204]Zhang et al. (2009, 34, 35).

[205]Moore (2009, 25, 31–32).

[206]Asian Development Bank (2009, 22–27).

[207]Bruch and Troell (2011, 828, 835).

[208]Lenton and Muller (2009, 215).

to meet these challenges.[209] Derived from these requirements, IWRM has been developed on the concepts of flexibility and adaptability, which fits with adaptation to some extent. The aforementioned three pillars of IWRM allow water managers to make judgments about which set of suggestions, reform measures, management approaches and institutional settings are most appropriate according to their cultural, social, political, economic or environmental context. Furthermore, the identification of IWRM as an ongoing process also enables IWRM regime and practices to evolve for adapting to changing situations.

From an empirical perspective, the experiences of IWRM could help to develop adaptation strategies in the water sector. First, compared to traditional water management which focuses on economic efficiency, IWRM incorporates societal (social equity) and environmental (environmental sustainability) concerns, aiming to achieve a strategic balance among them. The environmental criteria and the participatory process it values could contribute to adaptation through reducing vulnerability and inputting valuable information and experiences. Second, the central position of risk management in IWRM enables alternatives and certain flexibility to be provided to deal with uncertainties (see Footnote 198). Third, many of the principles or ideas underlying the process of IWRM planning and implementation lend themselves to effective adaptation planning and implementation.[210] For example, the inter-sector and inter-institutional cooperation based on IRBM is important for adaptation in terms of reducing maladaptation from other sectors. By considering the river basin as a unit, it encourages an ecosystem-based approach for adaptation where resilience enhancing and adaptive capacity building are preferred.

As a result, IWRM is assumed and believed by many organizations to be able to cope with the complexity and uncertainty added by climate change. In 2001, the IPCC advocated IWRM as a framework for adapting to climate change across socioeconomic, environmental and administrative systems.[211] It recognized the potential of IWRM to be used as a means of reconciling varied and changing water uses and demands under climate change because of its greater flexibility and adaptive capacity than the conventional water resource management regime.[212] The Global Water Partnership (GWP) suggests that IWRM provides the best approach to manage water-related climate change impacts.[213] Some other water-focused organizations also identified IWRM as one of the mechanisms to mainstream climate change adaptation within water resources planning.[214] In China, by underscoring the implementation of the most stringent water resources management

[209]Global Water Partnership (GWP) (2009, 1).

[210]Bruch and Troell (2011, 828, 831).

[211]Mileham (2010).

[212]Giang et al. (2012, 28, 30).

[213]Ibid., GWP (2007, 6).

[214]Co-operative Programme on Water and Climate and the Netherlands Commission for Environmental Assessment (2009, 1).

(SWRM), Chinese water managers have the tendency to acknowledge the importance of IWRM for addressing climate change impacts.

As a holistic approach to manage water and related resources, IWRM provides an integrated and practical framework to manage water-related climate change impacts. It has immense potential to help water managers and practitioners to deliver sustainable water management by reducing vulnerability and building resilience to climate change impacts.[215] Thus, it is necessary to retain many of the elements that have been developed as part of IWRM. Nonetheless, the incremental challenges from adaptation indicate that it is also very essential to develop or extend IWRM's focus to include adaptation. IWRM will 'need to evolve in ways that place a much greater emphasis on risk, uncertainty and the ability to respond to change and inevitable surprises' (see Footnote 185).

There is no mechanism or approach designed to manage all the future challenges, but an effective approach would have the flexibility to evolve constantly to adapt to the changing environment. Born and developed to manage climate variability and changing socio-economic conditions, IWRM has an inherent capacity to develop continuously to be more adaptive and robust to the changing climate. The following chapters will analyze how IWRM-related legal and institutional frameworks could be developed to integrate adaptation considerations in order to adapt to the changing climate.

The challenges from incorporating DRR and adaptation in the process of IWRM identified previously could be responded by exploring their regulatory associations and synergies. First of all, IWRM and DRR are intertwined with each other. IWRM is generally centered on water quality and water quantity issues. 'Too much' (floods), 'too little' (droughts) and 'too dirty' (pollution) are the three main water problems confronting various levels of water managers when implementing IWRM.[216] While floods, droughts and other water disasters are partly induced by natural factors, water management strategies could, to a large extent, increase or reduce their probability, severity and impacts. For example, some water management activities such as water infrastructure construction and water diversion projects could reduce the consequence of water hazards, but may also cause more floods and droughts. In this circumstance, the risks of causing water disasters must be considered, assessed and minimized when taking water management strategies. On the other hand, DRR in the water sector is able to reduce vulnerabilities, mitigate risks and prepare for inevitable negative impacts, facilitating the IWRM implementation.

Furthermore, adaptation and DRR share mutual mission and approaches when facing climate change harms. On the one hand, climate change impacts on precipitation patterns and distribution determine that they must be considered and integrated in future DRR policies and strategies. On the other hand, aiming to reduce exposure, vulnerability and build resilience, DRR shares the same goal with

[215]Phukan and Tomar (2012, 137).

[216]Beek (2009, 51, 52).

climate change adaptation and thus should be regarded as a crucial aspect of climate change adaptation. More importantly, DRR has been viewed as the first line of defense in adapting to climate change and a no-regret climate change adaptation strategy.[217]

The international community has recognized the necessity of integrating DRR and climate change adaptation by identifying the need to 'promote the integration of risk reduction associated with existing climate variability and future climate change into strategies for the reduction of disaster risk and adaptation to climate change…'.[218] By building linkages among IWRM, adaptation and DRR, a triple win is expected to be achieved in the water sector.

Meanwhile, DRR is on its way of transformation from a 'response and relief' paradigm to a 'prevention, mitigation and preparedness' paradigm.[219] Along with this paradigm transition is an approach evolution from 'engineering-based solutions' to an 'ecosystem approach' and 'community-based DRR'. Not only are these transformations corresponding to the requirements of adaptation (such as vulnerability-reduction approach adoption),[220] but also they coincide with IWRM (such as an integrated approach). It is expected that the integration of DRR (which is part of climate change adaptation) with IWRM (that provides the framework for water adaptation to be mainstreamed) could generate synergic effects.

4.4 Conclusion

Against the increasing climate change impacts on China's water resources, it will be imperative to speed up the integration of climatic risks into water-related policies and plans in order to ensure water management activities resilient to climate change. As climate change is an emerging external challenge and water management issues have already been a challenge for quite a long time, adaptation is best mainstreamed within the IWRM regime and its legal and institutional framework. It will be a very promising and cost-effective approach for Chinese water managers to achieve the dual objectives of resolving current water problems and tackling climate change impacts.

After comparing IWRM with adaptation thoroughly, this chapter concludes that they have various distinctions as a legal issue, the possibility of synergizing them is very high. Current IWRM legislation and institutional setting theoretically base on a stationarity assumption, a holistic thinking and integrated approach, while climate change adaptation entails an uncertainty assumption, bottom-up approach and localized responses. On the surface, it is difficult to mainstream adaptation within IWRM related legal and institutional framework due to the gaps identified between

[217]Mitchell and Aalst (2008, 1).

[218]GA Res 60/195, UN GAOR, UN Doc A/RES/60/195 (2005).

[219]Gupta and Nair (2012, 163, 164).

[220]The requirement of adaptation will be expounded in Sect. 5.1 of Chap. 5.

IWRM paradigm and adaptation requirement. Nonetheless, in-depth analysis reveals that there is great potential to integrate them in the same process if these gaps are properly filled or bridged.

First of all, the legal assumption on IWRM has been questioned and reflected by climate change and water scientists, which will eventually inform the decision-making circle. Meanwhile, legislation on adaptation is required to reduce the sensitivity to information to allow for certain flexibility in the decision-making process. Some legal principles and approaches are available in China to bridge the gap between stationarity and uncertainty.

Second, both IWRM and adaptation demand a holistic thinking and full consideration of local realties. Embedded with an integrated management approach, IWRM needs to consider local physical and socio-economic realities so as to deliver effective outcomes. With regard to adaptation, while strategies must be tailored to local conditions, they should harbor a holistic mentality to avoid maladaptations for other scales and regions in order to achieve policy consistency and benefit optimization. For China's major river basins, IWRM and adaptation could find a meeting-point at the sub-basin level where local interests and basin interests are well considered and coordinated.

Third, the crosscutting and complicated nature of IWRM and adaptation determines that a multi-level cooperation framework among various levels of government is essential to build a common water vision and resolve issues with high uncertainty. Fourth, although adaptation has not been a priority of Chinese water managers, the threat to water security presented by negative climate change impacts asks them to consider adaptation in their macro planning as well as day-to-day water management practices. Additionally, the common points identified between IWRM and adaptation also provide great potential to mainstream adaptation.

IWRM could provide a theoretical and practical framework of which its principles, approaches and processes could serve for climatic risks reduction and management. Its inherent flexibility and adaptive capacity developed against natural and social changes also offer valuable insights for addressing climate-associated uncertainty. Its potential in managing external climate change has been widely acknowledged by water management communities. Nonetheless, to mainstream adaptation, the legal and institutional mentality, paradigm and approaches of IWRM need to be reflected and developed to satisfy the requirements of adaptation. For Chinese water managers, the first step would be to understand and recognize the need of mainstreaming adaptation in the improved IWRM framework. Chapter 2 has given some feasible recommendations on improving China's IWRM from a legal and institutional perspective. If adaptation could be fully considered while taking these recommendations, IWRM could minimize climatic risks, reduce the vulnerability to changes and improve China's water management effectiveness.

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Chapter 5
Setting the Legal Enabling Environment for Adaptation Mainstreaming in the IWRM

Literature review shows that crucial steps of successful mainstreaming process mainly include: awareness-raising, the establishment of an enabling environment, development of tools, training and technical support, change in operational practice, measuring progress and lastly, learning and experience sharing.[1] Theoretically, these steps are sequential and successive, but in practice, they might overlap and interact with each other or even reverse in order. Among these steps, reforming the enabling environment to develop related policies, legislation, institutional arrangements is crucial for adaptation mainstreaming. It is not only the premise of taking successive steps of developing adaptation tools or technologies, but also could significantly influence adaptation strategies, the functioning of government bodies and the behavior of individuals and business. A supportive enabling environment could promote the shift of discourses and paradigms towards the recognition of the necessity of mainstreaming adaptation measures in the planning and implementation process.[2] Furthermore, series of project studies in practice also generate numbers of adaptation lessons, of which developing an enabling environment is identified as one of the crucial lessons to overcome barriers and facilitate the adaptation process.[3]

The analysis of adaptation-related legal and institutional framework in Chap. 3 shows that it is very weak in coping with uncertainties associated with climate change. It is unable to reflect the changing societal context where mainstreaming takes place and thus unable to provide meaningful legal and institutional incentives and guidance for adaptation activities.[4] Chapter 4 has analyzed the challenges to the water-related legislation and institutional settings presented by climate change adaptation, as well as the possibility of mainstreaming adaptation in the IWRM. The next question is how the existing legal and institutional frameworks could be modified to facilitate adaptation mainstreaming.

Climate change impacts have changed our scientific understanding of water cycle, which inevitably will affect water management regimes. This reality needs to

[1]Benson et al. (2008, 14).
[2]Sietz et al. (2010, 494).
[3]Leary et al. (2007).
[4]McDonald (2013).

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be reflected in legal and institutional framework regulating water allocation, utilization and conservation. This process usually begins with the changes in legal values, perceptions and principles that will inform the changes in legal provisions, institutions and instruments.[5] In turn, it could shape people's behavior. Different legal assumptions could produce different legal values, objectives, requirements and approaches. The dead 'stationarity' and pervasive 'uncertainty', analyzed before, demonstrates that future adaptation related legislation should be developed to reflect the changes in legal assumption.

As the previous chapter argued, the cascading climate change uncertainties in the water management context could act as real barriers to water managers who are used to dealing with predictable impacts and who prefer to act based on legal certainty.[6] It would be a great challenge for them to justify their decisions if sufficient information or knowledge is not available. To manage these uncertainties, water-related legal and institutional frameworks should be flexible and resilient enough to facilitate adaptation mainstreaming and implementation. This flexibility and resilience could be achieved through variety of legal instruments, institutions and approaches, such as legal principles, adaptive management and dynamic monitoring. Some legal principles widely accepted in water management and climate change areas have been employed to justify adaptive decisions and measures in some countries. For example, Australia has established the linkage between climate change risk consideration and development proposals based on the ecological sustainable development (ESD) principle.[7] The application of the ESD principle in the court requires both government and business to consider climate change factors in their actions.

Legal principles are significant to provide guidance and frame for the adaptation mainstreaming process at an early stage. More importantly, they not only could help to deal with the uncertainties associated with adaptation, but also could bridge the gap between the changes in legal values, perceptions and the establishment of statutory framework.[8] In addition, simply realizing and recognizing the death of 'stationarity' assumption will not provide legitimacy and justification for undertaking adaptive actions. Instead, it needs a tool or channel to translate this change properly into statutory requirements. Some environmental law principles contributing to flexibility, sustainability and resilience could serve this purpose.[9] They could help to set the objectives and mechanisms of adaptation-related laws, identify adaptation methods and complement implementation when specific regulatory mandate is absent or weak. Some of the principles analyzed in this part are fundamental for water management, such as the principle of sustainable development

[5]Ke and He (2011, 27–35).

[6]Interview with interviewee 5, member of the Research Centre for Climate Change, the Ministry of Water Resources, China (email interview, 24 May 2013).

[7]Godden (2012, 346–348).

[8]Ke and He (2011, 27–35).

[9]Ibid.

(PSD), the precautionary principle (PP) and the principle of public participation (PPP). However, the adaptation mainstreaming process requires re-interpreting these principles in order to improve their capacity of adapting to water-related climate change impacts. At the same time, it also provides an opportunity to reflect the understanding and applications of these principles in China's water management practices.

In addition to these well-recognized principles, the principle of social justice which has been marginalized for many decades is proposed and regarded indispensable when addressing water-related adaptation issues, due to the strong social dimensions of adaptation. Lastly, based on the institutional challenges identified in Chap. 4, Sect. 5.5 will provide recommendations on improving the adaptive capacity of water-related institutional system.

5.1 Rethinking the Principle of Sustainable Development

5.1.1 Reviewing the Principle of Sustainable Development for Adaptation

Section 4.1 of Chap. 4 analyzes the nexus between climate change adaptation and sustainable development and concludes that the principle of sustainable development should be implemented in order to mainstream adaptation in the IWRM. However, in practice, this principle has long been criticized for its ambiguous and rhetoric description which does not provide applicable and practical guidelines.[10] Other critics argue that, originated during severe environmental crises, the principle of sustainable development has a strong bias in favor of the environmental (ecological) side.[11] Its social aspect, on the other hand, has been overlooked. Dominant development paradigm tends to target predictable environmental harms without considering those emerging and complicated risks and challenges.

Misinterpretations of Sustainable Development

Adapting to climate change impacts and risks, on the contrary, requires further development in the understanding and applications of the sustainable development principle. This is the first step to effectively mainstream adaptation in the IWRM regime. While climate change poses new challenges to China's sustainable development practice, it also provides an opportunity and impetus to reflect the conception and understanding of sustainable development and to 'revisit some long-standing problems of environment and development in an innovative way.'[12]

[10]Glaeser (2001, 12).

[11]Ibid.

[12]Soussan and Burton (2002, 29), Zhang (2008, 81–82).

This research will review the following three misinterpretations of sustainable development principle in China in an adaptation context.

First, the sustainable development principle in China has long been used to guide how to achieve a development goal sustainably without questioning whether the activity itself is needed or not. For example, water managers are wild about building hydraulic projects for the purpose of sustainable development through improving natural resource utilization efficiency and assuaging environmental impacts. Unfortunately, the question whether the project per se is necessary, or sustainable, for the whole environment is seldom asked. In addition, sustainable actions on environmental protection have tended to emphasize the symptoms of environmental degradation rather than the underlying driving factors of these environmental problems and vulnerability.[13] China's current efforts in adapting to climate change impacts are typical examples of this mindset. Most strategies and actions focus on adapting to climate change impacts, such as extreme events in the Yangtze River Basin, without examining underlying factors relating to vulnerability, which usually results from ecological, economic and social disadvantages.

Second, the perception and application of the sustainable development principle focuses on development outcomes, without giving adequate attention to development paradigms that have more focuses on the development process. Sustainability, which is the ability to 'tolerate and overcome damage, diminished productivity and reduced quality of life from an extreme event without significant outside assistance', is seldom targeted by practitioners.[14] Referring to the process of responding to risks, managing uncertainties and producing sustainable outcomes, this concept focuses more on the process of development by constant learning and ability improvement to make better decisions. This is especially crucial for adaptation—related decisions and practices must develop a high capacity to manage climate change risks. Adaptive capacity against climate change-related risks should be one of the criteria to measure sustainable development in the context of climate change adaptation.

Third, although there is general agreement that the sustainable development principle involves a comprehensive and integrated economic, social and environmental process, both environmental and social aspects tend to be either manipulated or ignored. Environmental protection practices have long been manipulated to serve traditional, unsustainable economic development. This utilitarianism in interpreting environmental protection too often ends up with giving way to the economic development when enforcing environmental laws.[15]

Overemphasis on Economic Growth of Sustainable Development

Based on a progress or backwardness dichotomy, economic growth is overwhelmingly assumed as the best way to solve poverty, to bring employment and improved welfare and to protect the environment. Thus, it is not surprising that

[13]Drexhage and Murphy (2012, 13).

[14]Mileti (1999, 4).

[15]Cao (2006, 262–263).

economic growth has been treated as tantamount to sustainable development in China.[16] For example, the gross national product (GDP), personal incomes, industrialization, technology advance and the employment rate have long been deemed as the criterion of development.[17] However, recently, this assumption has been severely questioned and criticized throughout the world due to its adverse effects, such as the loss of biodiversity, the abandon of some valuable traditional customs and the dividing gap between the rich and the poor.[18] Recent study shows that

> the notion that global economic growth is the only way of reducing poverty for the world's poorest people is the self-serving rhetoric of those who already enjoy the greatest share of world income and relying on growth to bring the world's poorest people out of poverty is both economically and ecologically inefficient.[19]

What is more, according to the New Economics Foundation (NEF)—an independent think-tank aiming to inspire and demonstrate real economic well-being,

> global economic growth is an extremely inefficient way of achieving poverty reduction, and is becoming even less effective. We need to move decisively away from the inefficiency of relying on global growth for poverty reduction, towards a system in which policies are designed explicitly and directly to achieve our social and environmental objectives, treating growth as a by-product.[20]

This utilitarianism was not abandoned until April 2014, when the newly amended EPL was issued. In this new version, socio-economic development is required to be coordinated with environmental protection.[21] Yet the development mindsets and path dominant in the past few decades need time to change.

As the two core interests of Chinese government (economic development and social stability), continuous economic prosperity is assumed as fundamental to maintaining social stability.[22] Ironically, in practice, over-development (or development without due consideration of environment and social justice) is often the source of social unrest. It accords with Sen's arguments that economic development is only a tool to facilitate human development by providing economic security, rather than the ultimate end of sustainable development.[23] It does not automatically enable a high quality society and the realization of human freedom—other aspects

[16]Cannon and Müller-Mahn (2010, 625).
[17]Lu (2004, 38).
[18]Ibid., 37.
[19]Woodward and Simms (2006).
[20]Ibid.
[21]Environmental Protection Law of the People's Republic of China (2014, art 4).
[22]Lewis (2007).
[23]Sen (1999, 14, 24), UNDP (2001).

of sustainable development deserve equal attention as well.[24] While it is true that the wealth is unevenly distributed and the poor are bearing the unfair share of cost, such as climate change, the dominant understanding of sustainable development must be reflected and changed.

In China, in the past decades, the economy has developed rapidly and the awareness of environment protection has been raised. However a synchronized social development including governance systems and civil society have been much less developed. Their positive role in resilient preparedness and responses to economic and environmental disasters has not yet been recognized. The ignorance of social sustainable development has resulted in social inequity—both intra-generationally and inter-generationally. More explicitly than ever before are social inequities linked to environmental problems intimately connected with economic development. Furthermore, the absence of attention on social sustainable development also leads to less development in the procedural justice, such as public participation, access to information and the judicial remedy. Although it mainly derives from the long history of feudal dynastic system—an embedded cultural and traditional inertia one would argue,[25] the selective ignorance coming from current political and legal system aggravate the backward procedural development.

According to Sen's argument, political freedom, economic facilities, social opportunities, transparent guarantees and protective security are five distinct, but interconnected, types of freedom.[26] For instance, political freedom and social opportunities could promote economic development and participation.[27] Similarly, backward social development undermines the ability to achieve economic and environmental sustainability in the long run. This trend is becoming obvious in the context of climate change. Most marginal groups are extremely vulnerable to climate change impacts because of their economic position and lack of political and social power. Sustainable development, in the context of climate change, requires that this unsustainable social development must be resolved to eliminate the economic and environmental inequity.

5.1.2 *Developing the Principle of Sustainable Development in the Adaptation Mainstreaming Process*

Considering the sustainable development principle in regards to climate change impacts raises an inevitable dilemma. As an integrated part of sustainable development, adaptation also brings about series of threat and challenge which need to be dealt with in the mainstreaming process.

[24]Sen (1999, 14).
[25]Zhu (2011, 129).
[26]Sen (1999, 38).
[27]Ibid., 11.

Sustainable development is often included in the objectives of China's water management policies and legislation, but is often not a mandatory standard to evaluate and review decisions made under it.[28] On the flip side, climate change is able to provide an experiment to evaluate sustainable development in a much more specific manner: whether climate change impacts are properly managed or not could be used as a lens or criterion to assess the sustainability of IWRM strategies. Sustainable development could also be the objective and guiding principle for taking adaptive measures in water management. Nonetheless, it is important to realize that, as a conceptual principle which is featured with its amorphous quality, there is no fixed or one-size-fits-all metrics to measure sustainable development—it is a dynamic and iterative developing process. A sustainable status for one region or sector in a specific time may be unsustainable for another region or sector in different spatial and temporal circumstances. The evaluative criteria for sustainable development must be tailored to specific situations, constantly revised and improved to reflect developing economic, social and cultural conditions.[29]

Acknowledging the clear urgency for further development and experimentation of the sustainable development principle in the mainstreaming process, following aspects will be identified while mainstreaming adaptation considerations towards the robust sustainability of China's water management regime:

First, China's water management activities should be reviewed and redirected to reduce water-related climate change risks rather than increase risks. Too much of the so called 'water development' has been proven to increase people's exposure to climate change hazards and add the vulnerability of the disadvantaged or marginal groups.[30] For example, the rapid development of hydraulic projects has increased the vulnerability of ecosystems; the urbanization process has reduced the resilience of agriculture due to the loss of skillful farmers; fast economic growth has led to severe environmental problems, increasing inequality and social conflicts.[31] All these development trends are examples of climate change maladaptation that could increase risks.

Second, a successful mainstreaming approach in the water management process should work on addressing the underlying factors of water vulnerability rather than just responding to water-related climate change impacts retrospectively. Related economic and social policies and strategies should be reviewed or assessed to see to what extent they facilitate or impede adaptation.

Third, the social aspect of water-related adaptation activities should be given particular attention, which will be analyzed in detail in Sect. 5.4 of this chapter. Chinese water managers need to take sustainable development out of the economy 'box', or even the environment 'box', and to coordinate with social interest in a

[28]Craig and Jeffery (2011).

[29]Lu (2004, 52).

[30]UNDP (2012).

[31]Cannon and Müller-Mahn (2010, 624–625).

holistic manner.[32] Current social inequity and injustice must be minimized. Reducing inequity means coming closer to promoting intra-generational and inter-generational equity which is at the heart of sustainable development. Furthermore, besides traditional dimensions such as economic wealth, information (and knowledge) and technology (and infrastructure), social capital also plays a crucial role in determining adaptive capacity.[33] If a comprehensive method to facilitate the social aspects of sustainable development (such as promoting democratic processes, reducing social injustice, facilitating information access and public participation, and recognizing basic rights such as the freedom to organize) is progressively employed, the adaptive capacity is expected to be improved in a much more balanced and sustainable way.[34] In addition, new metrics comprising social factors and adaptive capacity are also supposed to advance integrated sustainable development.

Finally, in the light of the nature and feature of sustainable development, flexible and resilient water management mechanisms are proposed to be designed for different climate change scenarios. These mechanisms, on the other hand, premise fresh risk perception, reasonable risk identification and cost-effective risk management, where robust decision-making process involving the government, private sector and civil society is desirable.

5.2 Institutionalizing the Precautionary Principle

After recognizing the limitations of scientific and technical information, the precautionary principle (PP) was formed in order to promote legal actions to prevent the threat of serious or irreversible environmental harms, even in circumstances of lack of full knowledge.[35] In some countries, the PP is regarded as part of a suite of principles of sustainable development. For example, Australia lists it as one of the sub-principles of the principle of ecological sustainable development (ESD). By contrast, in Chinese research literature, it is an independent principle parallel with the principle of sustainable development.[36]

The irreversible climate change consequences are so great and diverse that they may destabilize both society and ecosystems, and lead to unacceptable permanent damages.[37] At the same time, most of climate change risks are unquantifiable and undefined, providing an undeniable experimental field for the PP. Yet, research gap

[32]Drexhage and Murphy (2012, 13, 20).
[33]McDonald (2010, 1–37), Klein et al. (2005, 580).
[34]Cai (2011, 23–30).
[35]Santillo et al. (1998, 939–940).
[36]Peel (2009, 13).
[37]Guidotti (2012, 63–64).

still remains in regard to the application of the PP in the adaptation mainstreaming process which is around with a range of different types of uncertainties.

5.2.1 Understanding the Precautionary Principle in the Context of Climate Change Adaptation

The Development of the Precautionary Principle

The PP has experienced great development since its transition from German environmental policy to international instrument dealing with marine environmental pollution.[38] It is generally recognized that the 1987 Second International Conference on the Protection of the North Sea for the first time described the requirement for precautionary measures against hazardous substance in the international setting.[39] Later, the *Montreal Protocol on Substances that Deplete the Ozone Layer* in 1987 asks for precautionary measures even when there is unknown knowledge about the precise substances depleting the ozone layer. However, it was not until 1992 at the Rio Conference where the PP was recognized and accepted widely around the world. The definition given in the *Rio Declaration on Environment and Development* (Rio Declaration) has gained the most popularity.[40] Principle 15 of Rio Declaration states that the precautionary approach shall be widely applied by States according to their capacity. It says that:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as an excuse to avoid or postpone cost-effective measures to prevent a risk of serious or irreversible harm to human health or the environment.[41]

By adopting the term '*precautionary approach*' rather than '*precautionary principle*', and the adjective term '*cost-effective*', Rio Declaration actually expressed a very weak version of the PP. This concept has received particularly legislative, judicial and scholarly attention after its birth, both at the international level and domestic level.[42] This principle was further written in another two important international environmental treaties—*Convention on Biological Diversity* and the *United Nations Framework Convention on Climate Change* (*UNFCCC*). Following that, many nations have incorporated the PP as an integral part of their advanced environmental regulations to guide actions against environmental risks,

[38]Peel (2009, 2).

[39]Cameron and Abouchar (1991, 4–5).

[40]Peel (2005, 239).

[41]Rio Declaration on Environment and Development (1992).

[42]Gardner et al. (2009, 49).

such as Canada, France and the Great Britain.[43] Efforts that are more progressive have been made in some countries like Australia to apply the PP in the court for judicial review. Its application by the Australian judiciary has provided great opportunity to develop its meaning and presented a myriad of answers on how the PP should be interpreted and applied.[44] In just a few years after its birth, the PP has gained its popularity in areas of ozone layer protection, climate change, hazardous substance treatment and biological safety.

With a very distinct statutory thinking with traditional ones, the PP signals a different paradigm to resolve the gap or tension involved in translating scientific knowledge to policy or decision making process.[45] Scientific analysis and technical evidence is seen as necessary and essential rather than sufficient basis for effective decision-making. Nevertheless, this principle by no means indicates a decrease of the role of scientific research and technical evidence. On the contrary, it requires an improvement in scientific understanding and research in order to provide the best available knowledge. The threat of serious or irreversible environmental damage must be sustained by reasonable degree of scientific evidence rather than mere conjecture. In addition to the shift in public decision, the adoption of the PP in a legal context also signifies a series of changes in liability, burn of proof, infringement act and justice issues.

Its wide acceptance and refreshment in the field of both international and domestic environmental law, however, does not conceal its problems and controversies in practice. Application realities of the PP are very diverse on international environmental issues. Different environmental treaties employed terminologies of precautionary *principle*, precautionary *measures* and precautionary *approach* to show their diverse perceptions of, and willingness to be bound by the PP.

With regard to country level application, some of which set stringent invocation condition while others are relatively flexible. On the one hand, it shows very intense conflicts of different interests on issues applied. On the other hand, it indicates that it is impossible to design a one-size-fits-all standard and procedure for the PP to deal with uncertainties and risks in different areas. Questions about the PP mainly remain over burn of proof, invocation condition, risk level defined, and enforceable precautionary measures, leaving much room for reinterpretation and discretion. Another frequent criticism about this principle concerns the requirement of decision-making. Does it mandate certain precautionary outcomes from a substantive view? Or it merely acts as a considering factor of decision makers to evaluate environmental risks from a procedural perspective? Nonetheless, as a principle of customary international law,[46] this weak version could provide significant incentives and guidance for its reinterpretation and development in domestic environmental policies and laws.

[43]Zhang and Zheng (2010).

[44]Peel (2009, 25).

[45]Santillo et al. (1998, 941).

[46]Sadeleer (2002, 92).

Adopting the Precautionary Principle for Adaptation

Realizing the urgency of acting on climate change, the UNFCCC largely echoes the Rio Declaration formula, in a weak version, by stating that:

> The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.[47]

The PP, in the climate change area, has been adopted to persuade decision makers to undertake precautionary mitigation measures regardless of its scientific uncertainty. Unfortunately, unacceptable or irreversible environmental harms induced by climate change and verified by scientific observation (to a certain degree) has not been the primary battlefield of the PP. That is to say, adaptation per se is not deemed as precautionary approach to those environmental risks. Neither are proactive adaptation actions regarded as indispensable precautions when confronting with uncertain disastrous environmental risks. As earlier argued, uncertainties about adaptation not only include scientific uncertainty—the underlying science of climate change and its effects, such as the causality, timing and probability, but also contain epistemological and ethical uncertainties. The latter two are uncertainties about taking adaptation actions, such as what impacts should we adapt to, who will make decisions, when to take action, what are the social and economic impacts of these actions, and to what extent are these impacts 'acceptable' in regards to social justice. That is to say, adaptation mainstreaming not only concerns traditional scientific uncertainty which is the backdrop of precautionary decisions, but also is made more complicated by the risk of decision making which is proceeding in social and legal uncertainties. Efforts to reduce natural climatic risks could also produce new type of risks. These multi-layer risks pertinent to adaptation indicates that the PP is expected to not only resolve traditional problems, but also respond to new challenges to prepare our water managers for all kinds or risks.

This book illustrates four main reasons for advocating precautionary measures to deal with uncertainties around climate change adaptation. First, no matter what the causes of climate change are—anthropogenic or natural—the obvious impacts of climate change are undeniable. Although it is difficult to quantify them, it is no doubt necessary to take proactive actions to adapt to those unavoidable impacts. Furthermore, some of climate change harms are identified as catastrophic, significant or irreversible, which provides reasonable justification for precautionary actions. Although climate change impacts are intrinsically uncertain, many climate change models are developed to reduce uncertainty and to provide best available scientific information for adaptation strategies.

[47]United Nations Framework Convention on Climate Change (1994, art 3.3).

Second, there are always risks and costs on both sides of a decision: actions can bring risk, but so can inaction.[48] An alternative action could bring risk, but so could another option. A more critical issue here is which action is more cost-effective and consistent with SD, rather than struggling about whether action should be taken. In some cases, although the costs of undertaking precautionary measures on climate change adaptation can initially be high, the costs of delaying actions to integrate climate change risk and vulnerability into investment and to adopt climate-proofing approaches will be significantly much higher.

Third, climate change uncertainty is only one of many factors that influence the decision-making process about adaptation, and should not be used as the excuse to delay actions. In many cases, it is individuals' and communities' knowledge and experiences of past climate events, that largely determines the responses to future climate rather than the results of a scientific climate model.[49] From a public perspective, central and local governments determine to take adaptation strategies mainly due to the pressure from international community, and the economic benefits or opportunities that adaptation could bring. Therefore, the PP challenges the decision makers to abandon traditional short-term views of policies and actions which are based on overzealous promotion of 'sound science', and to adopt a far-sighted view which favors cost-benefit risk reduction and management.[50]

Fourth, as mentioned in Sect. 5.1 of this chapter, vulnerability is a key factor resulting in severe risks and damage rather than our poor ability in predicting climate change impacts. Vulnerability reduction and resilience enhancement to climate change are very typical cost-effective measures that could minimize risks and adverse effects. Many risks and damage are preventable and manageable by undertaking proactive measures with today's technology and knowledge.[51] Policies and laws informed by the PP not only require taking proactive measures to prepare for future impacts and risks, but more importantly, to reduce stressors or vulnerabilities resulting in these affects and risks.[52]

In a nutshell, the uncertainty and irreversibility of negative climate change impacts, and the potential benefits of taking cost-effective precautionary measures make the adoption of the PP very desirable and commendable in the process of adaptation mainstreaming. However, the status and implementation of the PP in Chinese environmental legislation need to be examined to understand its legal environment.

[48]Douthat (2009).

[49]Adger et al. (2009, 343).

[50]Procee and Brecht (2012).

[51]Pielke and Sarewitz (2005, 266).

[52]McDonald (2010, 31–32).

5.2.2 The Application of the Precautionary Principle in China

Existing legal framework generally focuses on regulating predictable environmental harm and behaviors to which prevention principle is applied.[53] It does not pay particular attention to risks that are difficult to predict and quantify. The application of the PP in China has been hampered by a lack of political will to create legally binding principles capable of implementation. Although China has ratified some international treaties and protocols where the PP is adopted (such as the *Convention on Biological Diversity* and the UNFCCC), the PP is absent from environmental legal framework and has not been widely recognized and adopted in related decision-making process. The new amended EPL in 2014 clarifies environmental law principles by stating the primacy of protection, prevention, public participation and polluter pays principle.[54] While the meaning of the last three principles is comparatively consented among scholars, the interpretation about the primacy of protection is quite confusing. Some researchers argue that it should be perceived as precautionary principle due to its special legal context in this law.[55] Yet, it is not echoed by the legislative interpretation of the legislature. The legislators are still very prudent in terms of declaring the PP in China's comprehensive environmental law.

Among other specific laws and regulations, the essence of the PP is more or less reflected, although not in an apparent manner. For instance, some regulations on hazardous chemicals and genetically transformed organisms (GMO) stipulate that possible environmental risks should be prevented, embodying the requirement of the PP. The recent amended '*Air Pollution Prevention and Control Law*' in 2015 made significant progress in terms of acknowledging the PP through promoting risk prediction, assessment and management. Effective and proactive measures are required to precaution environmental risks of poisonous and harmful air pollutant.[56] In terms of climate change issues, however, the PP is absent in the *Climate Change Law* draft, although China promises to implement the requirement of the UNFCCC.[57] It reveals that Chinese regulators have been aware of the necessity of employing the PP, yet only in selected areas which have a relatively lower scientific uncertainty.

Incorporating the PP in the environmental law at the national level to deal with all kinds of risks is regarded as unrealistic and impractical, especially before the legal issues are clarified. It is suggested that the PP be applied in a narrow manner first in areas with high risk threshold, such as climate change, biodiversity

[53]Peng (2010).

[54]Environmental Protection Law of the People's Republic of China (2014, art 5).

[55]Zhu (2014).

[56]Air Pollution Prevention and Control Law (2015, art 78).

[57]ClimaXmi (2012).

and GMO.[58] For adaptation mainstreaming in the IWRM, the uncertainties and irreversible harms imposed by climate change have increasingly required water managers to take precautionary management approach to prepare for the future. In that case, how to incorporate the PP in the existing legal framework, how to make decisions in the face of climate change uncertainty, as well as how to distribute responsibility and liability between proponent and the government will be one of the most challenging tasks for Chinese water managers.

The ambiguous definition given by the Rio Declaration has, nevertheless, opened the way for judicial interpretation in order to determine how the principle could be applied in diverse practices (see Footnote 36). Based on different legal systems and judiciary tradition, the adoption and implementation of the PP could take several forms: (1) a legally non-binding statement by using the term *precautionary measures*; (2) a legally binding principle by adopting *precautionary approach*; (3) a statutory requirement from *precautionary principle*. In general, both precautionary approach and principle have a more stable legal status than precautionary measures which are usually temporary and reactive, case-based and result-oriented. Compared with precautionary approach which implies a dominant but flexible method for issues with scientific uncertainty, precautionary principle as a fundamental environmental law principle denotes a universal application or influence in legislation, enforcement and judiciary. The flexibility of being an approach is more viable for China's scenario, which not only avoids the conundrum of being a legal principle but also cater for the need of dealing with urgent challenges. Yet, the scope, procedure and legal effects of the PP being an approach should be clearly defined and clarified for decision makers.

5.2.3 *Applying the Precautionary Principle in the Adaptation Mainstreaming Process*

To some extent, mainstreaming adaptation in China's water management is one of the approaches to implement the PP, mainly because the PP attempts to manage uncertain climate change impacts in a cost-effective way. As an approach, the PP could be implemented from both substantive and procedural perspectives. Substantive implementation of the PP focuses on achieving certain outcomes through setting specific standards to decide whether and which actions should be taken in circumstances of uncertainty. It asks to define and set certain acceptable risk level and then take corresponding precautionary measures to keep risk under that level. While this method is workable for those traditional risks that could be credibly identified and qualified, it is problematic for climate change of which the risk is poorly known and hard to set quantitative standards. Applying the PP in the

[58]Li and Jin (2015).

adaptation mainstreaming process, therefore, asks for a change in the way climate change risks are identified, assessed and managed.

First of all, the PP was born to prevent or minimize those serious or irreversible risks hand harms. Therefore, risks with various probabilities, levels and types are better to be assessed and sorted, both in a qualitative way and in a quantitative way. Risks with low probability (or with little knowledge) but high impacts, though with little consensus among relevant actors, should not be ignored and placed out of the spectrum of precautionary actions. Furthermore, the PP quests for viable strategies in the face of uncertainty, which implies that certain flexibility and adequate monitoring is necessary for decision makers to revise or even reverse decisions with the advent of new information or knowledge.

At the same time, it has been submitted that the focus of PP should be switched from outcomes to the decision-making process in which precautionary concerns are taken into account from the very beginning.[59] Nonetheless, a procedural light of the PP should go beyond a simple commitment to a cautious decision-making process, or a ostensible promise to consider uncertainty. Rather, this procedural approach to the PP application in the mainstreaming process should clarify the factors that contribute to risks or possible environmental harms to ensure that a reasonable and careful consideration of sources of uncertainty. Full ranges of alternatives, as well as their respective likely environmental impacts are also expected to be identified and assessed in the decision-making process to prepare for various scenarios while precise scientific evidence is absent. Meanwhile, due to the uncertainty of taking precautionary measures, the application of the PP should be based on the recognition and implementation of proportionality principle in order to balance all aspects of interests.[60] According to this proportionality principle, precautionary measures against uncertain climate change risks should be proportionate and reasonable for the objectives to be achieved.[61] Cost-benefit analysis and the prioritization of no (low) regrets measures are highly recommended in this book to balance risks and benefits of undertaking precautionary actions.[62]

Based on above analysis, this book proposes that following factors and instruments to be considered and implemented while applying the PP:

Assessing the Risks Associated with Water-Related Climate Change Impacts

The historical and present focus of water investigation is on predictable impacts. However, the PP requires that uncertain risks should also be properly assessed to provide a baseline for precautionary measures. The underlying social and economic drivers (for example, over-reliance on exploitation of floodplain) should also be investigated to assess the extent to which they increase or reduce water vulnerability.

[59]Peel (2009, 24).
[60]Peng (2010, 27).
[61]Ibid.
[62]Ibid.

Identifying Possible Alternatives and their Potential Consequences

As mentioned earlier, any proactive or responsive effort toward risk reduction is likely to bring new risk. Thus, it is necessary to provide a range of possible options for decision makers to make thorough comparison about their socio-economic effects or possible risks. Alternatives of risk neutral or risk reduction should be given priority. Issues such as who benefit from these decisions, and who loses, should be identified when assessing risks. An appropriate and fair risk distribution mechanism is crucial for stakeholders and the affected public to be convinced of precautionary measures, even if they are the one under possible harms. Particular attention should be paid to those vulnerable or marginal communities and groups whose interests are easily ignored. Compensation to the economic or health losses is essential to reduce the risk of mass disturbance and social unrest.

Enhancing the Capacity of Monitoring and Early Warning

Our current monitoring system has an exclusive focus on environmental changes in a comparatively short term. Given the close interaction between human intervention and vulnerability, the PP requires that models of integrated ecological and socio-economic systems should be developed, so that changes on various spatial and temporal scales could be detected and monitored. Intensive and systematic monitoring efforts on these models are expected to send very early warning signals about changes or undesirable states that may happen, no matter how ambiguous these signals are.[63] Regulators, with the help of the PP, thus have more opportunities and motivation to respond to potential harms, reduce the exposure and vulnerability of the society, and prepare those under risk for the future.

Employing Innovative Approaches or Traditional Approaches in an Innovative Way

Traditional instruments such as risk management and environmental impacts assessment are important to prevent predicted environmental risks and harms, yet they do not particularly deal with unpredictable ones. Adaptation mainstreaming in the IWRM, therefore, entails a reflection and improvement in the way they touch and frame climate change uncertainties. For instance, EIA could be developed and tailored to requirements of the PP by incorporating a rigorous uncertainty assessment, considering available alternatives, and shifting the burden of proof to proponents to demonstrate that uncertainties are within threshold level. On the other hand, adaptive management is comparatively new in the cross section of adaptation and water management. Its great potential in delivering resilient decision makings with insufficient information cater for the underlying spirit of the PP, and has been well recognized by scholars from multiply disciplines. How these traditional and innovative approaches could be conducted in the mainstreaming process will be further elaborated in Chap. 6.

[63]Sluijs and Turkenburg (2006, 260).

Building Knowledge Partnership and Engaging with the Public

It is important to establish knowledge partnership between policy makers, scientists NGOs, industry, media and stakeholders and the public, in order to meet challenges from uncertainties. This platform for risk communication and information exchange is expected to communicate risks between action involved in a more transparent and interactive way, reducing the possibility of misunderstanding. Furthermore, as stated earlier, there is usually a political, cultural and social dimension of what risks are 'acceptable' or 'unacceptable', thus the perception of those affected should be considered in climate risk management. As an integral part of implementing the PP, the engagement of stakeholders and public in the decision-making process enables decision makers to balance various values, information and views when dealing with different types of risks.[64] It provides the decision makers with diverse dimensions about the effects they may encounter, the problems they may face or the solutions they may have, increasing the resilience and enforcement level of decisions. Yet, 'making full use of this reservoir of extra knowledge requires the establishment of an extended peer community not only in the phase where response options are debated, but also in the problem-framing and risk assessment processes that precede it'.[65]

Adopting Cost-Benefit Analysis and No-Regrets (Low-Regrets) Strategies

Most statements of the PP require measures be cost-effective. For China, which is facing multiple challenges, cost-benefit analysis entails a balance among the investment on climate change, vulnerability reduction and other urgent challenges. Based on the requirements of cost-benefit analysis, a no-regrets or low-regrets principle should be first applied to choose adaptation strategies. 'No (low)-regret' measures are also more loosely referred as win-win, or double dividend, actions. These measures could potentially provide a benefit now, and in the future, whether or not the projected climate changes occur.[66]

Nevertheless, the commitment to a proactive decision-making approach does not necessarily ensure that adequate precautionary actions are taken. In the adaptation mainstreaming process where a variety of interests are intertwined and conflicted, the assessment of environmental impacts induced by a proposed action is very likely to be overshadowed, especially when its uncertainty bothers decision makers while social and economic benefits could be estimated. Due to lack of binding provisions, water managers very likely ignore the PP. Decision-makers could argue that they have considered the PP as a 'factor', but do not necessarily take specific actions based upon it. In this case, institutionalizing the PP both in substantive and procedural aspects are necessary to ensure its down-to-earth application in practice. More importantly, empowering stakeholders, non-governmental organizations

[64]Godden and Peel (2010, 266).

[65]Sluijs and Turkenburg (2006, 262).

[66]Ranger and Garbett-Shiels (2011, 15).

(NGOs) and the public could be helpful in asking decision makers to justify their decisions regarding the possibility of significant risks involving irreversible impacts.

5.3 Advancing the Principle of Public Participation

IWRM recognizes that stakeholders should be part of decision-making structure and process for water management. Chapter 4 argues that the unique characteristics of climate change adaptation ask to improve the framework on public participation to provide valuable inputs to deliver robust and effective decisions. The principle of SD and PP analyzed earlier in this chapter clearly entail a much more effective public participation to bring pressure for decision makers who are very likely to postpone actions due to the ambiguity of these legal principles and the uncertainty associated with climate change. However, pursuant to Chap. 2, public participation has not been effectively institutionalized and implemented in Chinese water management framework and practices. Therefore, this part will put forward recommendations to facilitate broader and more effective public participation from following perspectives: the role of the public, the access to climate information and the decision-making structure.

5.3.1 Shifting the Role of the Public in the Decision-Making Process

In order to improve the effectiveness of public participation, it is crucial to redefine the role of the public in the decision-making process. Sen proposed to shift the role of the public from an 'agent' of a principal to an 'agent' of themselves, which is from an 'object' role to a 'subject' role.[67] Compared to the 'object' role, where public participation is assessed according to the government's goals, the 'subject' role of the public enables them to act and bring about changes. First, the public are not merely information recipients but also information producers as well. This is especially true for water management in a climate change era. The public themselves are generating valuable information on climate change risks and experiences in avoiding risks and adapting to negative climate change impacts. This grassroots information and experiences provide an important complement to the dominant, but insufficient, scientific information produced by government.[68] Furthermore, this approach requires that the effectiveness of water-centered adaptation strategies be judged according to the public's own interests and values rather than the criteria set

[67]Sen (1999, 18–19).

[68]Kropp and Scholze (2009, 16).

without their consent. The affected public will decide whether those strategies could protect their interests from being affected by adverse climate change impacts.

Based on Arnstein's 'ladder' theory, public participation can be categorized into eight types—from manipulation and therapy to inform, consultation and placation, and to partnership, delegated power and citizen control.[69] They present four different levels of public participation: passive participation, consultative mechanism, interactive processes and self-mobilization.[70] The first one treats the public as recipients of pre-determined decisions, designating all the responsibility of planning and implementing to the government. This has been considered as unsustainable and undemocratic due to the absence of public input. As analyzed in Chap. 4, public participation in the Chinese water resources management is confined to a consultative mechanism, of which people are permitted or invited to provide opinions on pre-determined decisions. The public are generally not regarded as an integral part of the decision-making process, having very limited influence on ultimate decision-making outcomes. Unfortunately, this participatory character of public participation often ends up with being 'controlled' or 'manipulated' by power holders and does not satisfy the need of mainstreaming adaptation.[71]

Shifting the public's role in the mainstreaming process requires going beyond this 'consultative' approach of organizing a meeting, presenting proposals and asking for comments to a partnership or interaction level of public participation, in which decision-making power is redistributed and the public are empowered to shape ultimate decisions. Power redistribution in the decision-making process is the first and most important step towards real public participation. It enables the public to get a genuine opportunity and bargaining power to construct, promote and discuss decisions by weighing different alternative options. As Arnstein argued, 'participation without redistribution of power is an empty and frustrating process for the powerless'.[72] This corresponds to the requirements of a risk society to open its decision-making structures, which has been analyzed in Chap. 4.

Nonetheless, this ambitious goal of achieving partnership or interaction between decision makers and the public may encounter numerous challenges and barriers, especially given present perceptions and mechanisms relating to public participation in China. However, this goal, and proper implementation of it, is essential for the research and practice of sustainable development. A myriad of research literature has provided recommendations to promote public participation, mainly through improving laws and regulations to provide an institutionalized public participation mechanism, reforming judicial systems to include public interest suits, disclosing information, loosening control on NGOs and raising public awareness.[73]

[69]Arnstein (1969, 216–224).

[70]Pimbert and Pretty (1996, 309–310).

[71]Few et al. (2006, 10).

[72]Arnstein (1969).

[73]Pu (2007, 22–24), Zhao (2010, 89–123).

They are all essential. Yet, reforming the entrenched mindset on the public and shifting their role will be the pre-requisite of undertaking above recommendations successfully.

5.3.2 *Improving Public Access to Climate Change Information*

The significance of public access to information for effective public participation has been recognized at both the international level and domestic level. For example, the *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* (the Aarhus Convention) signed by the EU in 1998, regards the right of access to information as one of the three pillars of public participation.[74] The other two are the right to participate from an early stage in environmental decision-making and the right to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in a court.[75] The Aarhus Convention has been widely used by the public throughout the world to justify their requirements for access to environmental information. As some scholars argued, 'access to environmental information is the necessary starting point for any public involvement in decisions.'[76] Insufficient access to information could undermine the ability of the inquiring public or stakeholders to participate in any legal and administrative environmental proceedings concerning their interests. Similarly, it is a pre-requisite to protect the interests of those affected while mainstreaming adaptation considerations in water management.

Regulations of Information Disclosure

There has been growing citizenry demand for access to environmental information in China in the past decade.[77] The public could use the following two methods to gain the information they need: free access to the information disseminated by governments and access to certain information by application. The former largely depends on government departments' information disclosure, while the latter relies on a well-designed administrative and procedural regulation. Existing Chinese legislation mainly focuses on information disclosure by regulating the governments' responsibility of disclosure rather than defining the public's right to know. At first glance, it benefits the public by allocating the responsibility to the government. However, without defining the rights and procedures for the public to access information, it transfers the initiative on information disclosure from the public to government—the government agencies have wide discretion to decide

[74]Xie (2009, 53).
[75]Ibid., 57–58.
[76]Holder and Lee (2007, 101).
[77]Riley and Cai (2009, 178).

what to share, how to share, and to share with whom.[78] The following part will analyze the statutory framework and practice on water-related information disclosure, mainly to assess their effectiveness and capacity in satisfying the information demand of stakeholders and the public.

Several laws and regulations could be applied to regulate water-related information disclosure. The 2002 *Water Law* stipulates that 'the basic hydrologic materials and information shall be made known to the public in accordance with the relevant regulations of the State'.[79] *The Compendium of Implementation for Fully Promoting Law-Based Administration* promulgated in 2004 by the State Council requires administrative agencies to disseminate all government information to the public except those related to state secrets, business secrets, or personal privacy.[80] In 2007, the *Regulation of People's Republic of China on Disclosure of Government Information* (RDGI) was issued to protect the legal access to government information and improve the role of information in serving people's water-related activities.[81] It has been the main legislation to regulate information disclosure and public access to information in China. In view of the significance of environmental information in protecting the environment, the far-reaching *Environmental Information Disclosure Measures* (EIDM) was approved by the SEPA [State Environmental Protection Administration, the predecessor of the Ministry of Environmental Protection (MEP)] in 2007 and went into effect on May 2008.[82] It not only regulates the environmental information disclosure of enterprises and environmental authorities, but also stipulates the rights and interests of the public to obtain environmental information.[83]

Assessing Practices of Information Disclosure

After 5 years' enforcement, the information published on the websites of water and environment authorities has increased greatly, ranging from legislation to government meetings. The access to information through application has also increased dramatically. For instance, in 2012, there were 17 applications for water-related information disclosure, while there were only two in 2009.[84] A faster development has been witnessed in the environmental area: there were 305 applications for environmental information disclosure and 45 for administrative reconsideration, compared to 68 and 2 in 2009 respectively.[85]

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[78]World Resources Institute (2003).

[79]Water Law of People's Republic of China (2002, art 16).

[80]The Compendium of Implementation for Fully Promoting Law-Based Administration (2004).

[81]The Regulation of People's Republic of China on Disclosure of Government Information (2007, art 1).

[82]Environmental Information Disclosure Methods (2007).

[83]Environmental Information Disclosure Methods (2007, art 4, 5).

[84]The Ministry of Water Resources (2009, 2013).

[85]The Ministry of Environmental Protection (2009, 2013).

Nonetheless, the information disclosure mechanism in China is criticized as 'hidden with half face' and far from the public's real information demand.[86] After analyzing relevant legal provisions, this book reveals four main factors relating to these limitations:

Limited Scope of Information Disclosure

For example, according to the EIDM, the result of plan level Environmental Impact Assessment (EIA) is not included in the list of information that should be published.[87] While plans drawn up by governments are the main possible sources of water management inefficiency, this stipulation implies the Chinese government's prudential attitudes towards information disclosure.

Ambiguous Language in Legislation

The ambiguous language in legislation too often leads to implementation deviation or 'flexible application' of these laws. In most of the laws related to information disclosure, there are two statements employed very frequently: one is 'all governmental information should be disclosed to the public except that related to state secrets, business secrets, or personal privacy'[88]; the other one is 'information disclosure should not harm national security, public security, economic security and social stability'.[89] Yet, they do not specify what kind of information could harm security and stability. In practice, the terms 'state secrets', 'national security, public security, economic security and social stability' are so broad that almost any information can be covered. In reality, these all-purposed provisions are often used as a good excuse to deny a stakeholder's application for information.[90]

Government-Centered Information Disclosure

Water-related authorities prefer to publish information that they are confident in and that has no strong social sensitivity. However, this information may be not the public's concern. A prominent example is the gap between the temporal and spatial scale of the forecast (large geographical and long-time scale) given by the agencies and the scales required for the affected people (they are often concerned with site-specific and more immediate information) to take specific decisions.[91] A user-centered information disclosure system, on the contrary, is able to reshape the information generation and communication process from the requirements of the stakeholders and public.

[86]Wu (2005, 313).

[87]Environmental Information Disclosure Methods (2007, art 11).

[88]Environmental Information Disclosure Methods (2007, art 12).

[89]Environmental Information Disclosure Methods (2007, art 10).

[90]Li (2012).

[91]Srinivasan et al. (2011, 8).

Conflicted and Inconsistent Information

The information provided to the public is required to be systematic and consistent. Unfortunately, extant fragmented management regime of China's water resources determines that the information collection is fragmented and information coordination is inadequate. Information collectors (mainly authorities of water resources and environmental protection) have gathered myriads of valuable information on water resources, but with different information-collecting mechanism and data compilation methods. This too often leads to information overlaps and vacuums, especially when the institutionalized information division and cooperation mechanism has not been established.[92] As a consequence, it impedes effective information dissemination and limits the public from obtaining meaningful information. In the 2002 *Water Law*, local governments at and above county level are required to establish an information system on hydrology and water resources (see Footnote 79). By distributing the responsibility of coordinating different sources of information to local governments, it seems that this provision recognizes the inconsistency of information provided by various water-related authorities. Nonetheless, the following provision weakens this assumption because it only emphasizes the role of water authorities and river basin commissions (RBCs) in dynamic monitoring of water resources (see Footnote 79). Also due to lack of detailed guidance on how to establish the information system, this provision has proven very weak in facilitating information coordination and cooperation.

In addition, most of the information is kept by related water management agencies as internal resources. The stakeholders and public are given little access to this information. Most of the related regulations on information state that data could only be released to the public by 'relevant government departments or authorized hydrological organizations', which permits total control over the release of independent assessments and monitoring.[93] The expression 'relevant government departments or authorized hydrological organization' is often too vague to assign responsibilities to any particular department, making it difficult for the public to apply for information. China's legal tradition does not include the notion of free access to information, presumption of disclosure or 'ownership' of information by the public.[94] The owner of most government information is the government by default. The public are regarded as merely passive and docile recipients rather than active participants. Information is communicated in a unidirectional process in which official and expert knowledge is 'passed to the public either to alleviate its ignorance or redress its misperceptions'.[95] In addition, the public are viewed as being ignorant and lacking capacity to understand while the governments are 'omniscient and omnipotent'.[96] Decades of highly centralized governance also

[92]Lu (2004, 38, 98).

[93]Zhang et al. (2012, 12144).

[94]Wu (2005, 292).

[95]Brunner and Lynch (2009, 223).

[96]Interview with interviewee 6, member of the Development and Reform Commission at the county level, Jiangsu Province, China (online interview, 22 May 2012).

determines that Chinese leaders are reluctant to disseminate information and open decision-making process to the public, for fear of causing chaos and undermining its ability in managing conflicts and divergence.[97]

Recommendations for Improving Public Access to Information of Adaptation

Climate change is characterized by imperfect knowledge and uncertainty, which too often is the excuse for governments to decline information disclosure. Yet, this is also exactly the reason why the public should be given timely and transparent information so that they could be informed by the actions or inactions affecting them at their own local community level and at higher levels. Sufficient information also helps the public undertake proactive adaptation measures to minimize risks and adverse impacts rather than waiting for government's initiatives. In addition to this known information, providing information on unpredictable climate change-related risks to the public is conducive to distributing different levels of risks. In view of the above understanding and assessment of the statutory framework on water-related information disclosure, progressive measures should be taken to facilitate public access to information on water related climate change impacts, as discussed below.

First, entitling the public with the right to know to entrust them with a substantive role in the decision-making process

The regulations on information disclosure could only be effectively implemented in conjunction with the public's right to know. This right to know could enable the public to be regarded as 'claimants' (rather than 'supplicants') who can require the agencies to disseminate information and bring actions to court.[98] It corresponds with the earlier requirement to shift the status of the public from 'object' to 'subject'. Furthermore, the environmental right, described as a substantive right to a safe, healthy, clean and ecologically balanced environment by many international treaties, declarations (such as the 'International Covenant on Economic, Social and Cultural Rights' and 'Rio Declaration') and national constitutions is increasingly recognized as a human right.[99] As an integral part of an environmental right, the right to know should be regarded as a human right issue as well.[100] Such an important and fundamental right is assumed to be protected by environmental laws.[101]

By entitling people with the right to know, from both substantive and procedural perspectives, it could enable them to challenge a decision which may infringe on the public interests. The right to access to information could also balance the dominant government power and discretion in the current information disclosure system. Although the RDGI stipulates that citizens and organizations could apply

[97]Moore and Warren (2006, 3, 10–11).

[98]Sax (1971), quoted in Vlavianos (2012, 2).

[99]Shelton (2002, 22–24), Vlavianos (2012, 4), UN (2010).

[100]Vlavianos (2012, 1).

[101]Swanson and Hughes (1990, 205).

for administrative reconsideration or file an administrative suit,[102] it proves very difficult to proceed in the administrative procedure and in the court due to the absence of regulations on the right to know. Chinese legislation is expected to clearly define the right to know, in order to effectively use climate information to adapt to uncertain water-related climate change impacts.

Second, incorporating climate change-related information in the legal framework and clarifying limitations

Climate change is primarily recognized as an environmental issue in China, which means the EIDM should be applied with regard to some of the information disclosure on climate change. Adaptation has strong connection with environmental protection and could be categorized according to the scope defined in the EIDM. In addition, most climate change associated information is possessed by development and reform commissions (DRCs) and meteorological authorities for whom the RDGI could be applied.

Not only should these laws be applied for climate information disclosure, should they also specify possible information scope. This book suggests that climate change-related information in water management include, but not be limited to:

(1) the specific water-related climate change impacts (for example, more precipitation or more glaciers melting). Due to uncertainty, a ranking list of risk description (for example, very high, high, very likely, likely, low) may be feasible for the public to understand;
(2) people or communities who are going to be affected and the way they are likely to be affected;
(3) projects or activities in process and their effects on the vulnerability and adaptive capacity of local regions or communities;
(4) plans or policies concerning adaptation.

Due to the economic and diplomatic implication of climate change, it is very possible that the government declines to disseminate climate change-related information in the name of protecting 'national security, public security, economic security and social stability' (according to Article 10 of the EIDM). To prevent the abuse of this clause, it would be necessary to provide an inventory of sensitive information relating to security and stability.

Third, improving information coordination and cooperation to provide systemic and consistent information for the public

The inconsistent and conflicting information disclosure among different authorities has weakened the public's ability in utilizing relevant information. Further challenged by crosscutting climate change impacts on water resources, this situation must be addressed. Under the context of climate change, most of the water-related authorities are confronted with the same challenge and they have to learn to apply a cooperative

[102]The Regulation of People's Republic of China on Disclosure of Government Information (2007, art 33).

approach. First, the complex and cumulative nature of climate change impacts implies that a single authority is not able to perceive or predict future scenarios by itself. Related water authorities must learn from other sectors to have a fair and comprehensive understanding of climate change impacts. Furthermore, water-related climate change impacts cannot be divided among water quality, water quantity, water agricultural water use. In most cases, they are affected by climate change simultaneously. For instance, the changing precipitation pattern may not only affect water quantity, but also have an effect on water quality, involving both water authorities and environmental authorities. Since the NDRC and the China Meteorological Administration (CMA) have the most advanced technology and information on climate change predictions, a collaborative mechanism among them, the MWR and the MEP could help to deliver accurate and timely information for the public.

Fourth, developing a public (user)-oriented information disclosure and communication system

The localized climate change impacts are the hardest to identify but often they are the most important to affected communities who need site-specific information for climate predictions and scenarios in order to take proactive and adaptive actions. There is a huge gap in the way scientists doing research on climate change impacts and the way end-users (such as farmers and urban residents) talk about climatic changes impacts on water availability.[103] Thus, efforts ought to be made to bridge this gap. Some studies propose that climate information transmitted to users must be salient (relevant), credible (higher quality) and legitimate (user-oriented) in order to influence decision-making process effectively.[104] This not only requires relevant government agencies to downscale their predictions of climate models, but also requires them to develop a good understanding of local exposure, sensitivity and vulnerability to climate change.

To meet the users' information demand, an institutional system with the user requirement as the core to connect information provider and users must be developed. In this system, there is an interactive relationship among the scientific community, decision makers and the public. The public and affected groups are provided with procedures and mechanisms to articulate their interests, exercise their legal rights and deliver their information demands. The input and feedback from the public should help the scientific community to tailor their research focus towards public concerns, which is then translated into the decision-making process. The scientific concepts, knowledge and insights could be used to help the public to understand the forecasts, to change their mindset and behaviors, which will influence decision-making and implementation. Considering the reality in China that the public has lost their trust in the information delivered by government and experts, the dialogue among three of them would contribute to trust re-building. Mainstreaming adaptation in water management is a complicated process, involving technology feasibility, scientific knowledge and issues of legal requirements and

[103]Feldman (2013).

[104]Lugon (2010, 5).

socio-economic aspects.[105] Only through intensive and effective information communication among these three parties could uncertainties be properly managed and robust decisions be made.

5.3.3 Recognizing the Role of NGOs

NGO's Involvement in Water Management

In the past decades, some environmental NGOs have actively devoted themselves to water protection in China, especially on issues such as dam construction and water pollution. Both the numbers and influence of NGOs, in tracking and monitoring water development issues, have expanded in the past few years. More importantly, NGOs have matured in terms of moving beyond raising public awareness to providing policy advice, carrying out social supervision, and safeguarding environmental rights.[106] They have made great progress in influencing environmental policy-making and presenting themselves as stakeholders in order to promote transparency in water management.[107]The involvement of NGOs has successfully delayed a few large hydraulic projects from degrading the water ecosystem.[108] For example, in 2004, some Chinese NGOs opposed a cascade development project on the Nujiang, one of the last two free-flowing rivers in China. Their efforts aroused national attention and led former Premier Wen Jiabao to halt the project pending a more comprehensive EIA.[109]

The experiences of NGO participation indicate that the public has the knowledge, ability and motivation to engage in water management issues. The traditional, top-down and unilaterally decision-making approach should be changed and transformed to a collaborative decision-making framework to let NGOs play their role.[110] The new EPL in 2014 acknowledges the public interest litigation and expands the range of subjects to social organizations that have registered with the civil affairs departments of governments at municipal level or above and have been engaged in public litigation on environmental issues for more than five years without any violation record. This is recognized as a significant benchmark in empowering NGOs in environmental issues.

Unfortunately, most NGOs struggle with strict registration procedures, financial requirements for registration and political control in China.[111] For example, a national civil organization must have no less than Yuan 100,000 (around

[105]Stálnacke et al. (2012, 7–8).
[106]Carmody (2010, 43).
[107]Eng and Ma (2006, 155, 181).
[108]Ibid., 179.
[109]Ibid., 177.
[110]Ibid., 179.
[111]Schwartz (2004, 42).

US$16,000) for registration, which is very difficult for most non-profit environmental organizations. If most of these barriers are removed from constraining NGOs, they are more likely to play a greater role in influencing decision-making and protecting the environment. What they need most is a loose legal control on registration, a transparent information publication and a supportive enabling environment.

NGO's Contribution to Climate Change and Adaptation

With regard to NGOs' devotion to climate change issues, they have undertaken actions actively and made great achievements. For example, in 2009, 300 NGOs jointly announced that they would continue to contribute to climate change mitigation and adaptation by their actions.[112] In the same year, the Chinese Civil Society Group on Climate Change composed by the Friends of Nature and six other NGOs (including domestic and international NGOs) published 'Chinese Civil Society on Climate Change (2009)' to express their opinions and expectations for international negotiations and domestic climate change policies.[113] In this document, they appeal to the Chinese government to ensure civil society participation in decision-making processes and implementation monitoring. These actions have contributed to raising public awareness, changing people's behavior and facilitating the communication between government and civil society. Nevertheless, owing to the strong international focus and the political sensitivity of climate policy in China, most domestic NGOs focus their work mainly on campaigning (influencing the public and communities to act on climate change) rather than directly challenging government policies.[114] Their roles and ability in shaping relevant decision-making are very limited.

In contrast, international NGOs have been very active in participating in international negotiations, lobbying politicians and launching climate change related programs. The Chinese government welcomes international NGOs' efforts in fighting climate change on the condition that they do not intervene in government policy.[115] Different from mitigation-oriented climate policy which involves much international negotiation and economic choice, adaptation strategies are more domestic-development oriented. NGOs could play a greater role in facilitating climate-proofing water management strategies and advancing the adaptive capacity of vulnerable communities.

Advancing NGO's Engagement in Adaptation Mainstreaming Process

Promoting NGO participation is also favorable to addressing the knowledge gap when mainstreaming adaptation in the IWRM. While the government's research and understanding of adaptation is still in its infancy, many NGOs (e.g. the WWF, Oxfam International and Greenpeace) have benefited China's adaptation research

[112]Gao et al. (2012, 70–71).

[113]Cao and Jiang (2010, 210).

[114]Richerzhagen and Scholz (2008, 319).

[115]Xinhua News (2010).

and practices from various perspectives.[116] Their research outcomes have provided important consultation for government decision-making on climate change issues. Prominent examples are the report 'Yangtze River Climate Change Vulnerability and Adaptation Report' prepared by the WWF, and a project titled 'mainstreaming adaptation to climate change into water resources management and rural development' initiated by the World Bank in the Huang-Huai-Hai Basin.[117] Their knowledge and experiences present valuable insights for further water-centered adaptation in China. It is also notable that some well-known NGOs have attracted many highly regarded experts to provide scientific-based comments and recommendations. If entrusted with power and responsibility in the decision-making process, they will provide valuable resources, scientific and technical support for mainstreaming-related policies and plans. Furthermore, their independence and transparency will help to make just decisions, minimizing potential moral risks of catering to powerful officials.

Nonetheless, since most of these international and national NGOs do not represent any particular interest group, grass-roots NGOs or community groups with specific interests should be included in the adaptation mainstreaming process. In this sense, by involving both technical-oriented NGOs and interest-oriented NGOs (or groups) in the decision-making process, a comparative counterbalance could be developed.

5.3.4 Developing Community-Based Participation

The Role of Community-Based Participation for Adaptation

Due to the importance of the site-specific nature of vulnerability and adaptation, there have been increasing calls for a community-based approach for adaptation to operate at the local level in communities encountering climate change impacts.[118] Drawing on participatory approaches and methods developed in both disaster risk reduction and community development work,[119] this approach could identify the risks threatening local communities and generate adaptation measures through involving local stakeholders and practitioners, in order to reduce local vulnerability and harm. With an important focus on reducing the vulnerability of marginalized communities, it prioritizes the participation of communities in adaptation-related planning and implementation.

Theoretical research of Adger argues that the effectiveness of local collective actions is the main determinant of the ability of a society to adapt to climate change

[116]Ibid.

[117]World Bank, *Mainstreaming Adaptation to Climate Change into Water Resources Management and Rural Development* (*2007–2012*).

[118]See e.g., Ayers and Tim (2009, 1), Dodman and Mitlin (2011, 640–659).

[119]Reid et al. (2009, 11).

impacts.[120] Experience also reveals that the capacity for collective community actions, to a large extent, determines their ability to cope with climate-related disasters and events. For instance, according to a survey and research carried out by Shi et al. on rural migration during the 2010 Yunnan Drought, massive forced migration did not happen mainly thanks to robust community-based responses.[121] Local communities of above affected area adopted diverse measures to manage disaster risks, reduce exposure and rebuild post-disaster life.[122] Nonetheless, community-based adaptation not only needs to be integrated in local development plans, but also has to fit with larger-scale adaptation policies and programs. This book argues that developing community-based participation in larger-scale decision-making process is crucial to cater for above requirements.

Defining Community-Based Participation in the Field of Adaptation

Community participation in China was introduced mainly in areas such as rural development, irrigation management and watershed management in the early 1990s, due to the efforts of the international donor community.[123] Yet in most of the literature, the term 'community' is not defined and popularized, partly because of the less developed nature of civil society in China. There is still controversy on the perception of community, which could be defined and identified according to ethnicity, gender, age, administrative region and literacy.[124] All these categories make sense in the context of climate change adaptation, since they have different vulnerabilities and requirements for adaptation. For instance, generally, both women (gender) and elderly people (age) are more vulnerable than other groups. However, increasing their adaptive capacity needs different strategies: women needs to be empowered and treated equally especially in decision-making process whereas elderly people require better welfare system due to their fragile health condition.

While realizing their differences in adapting to climate change impacts, this book will define a community as an administrative unit, such as a county, a town or a village, depending on adaptation issues involved. These types of communities have their unique livelihoods, institutional norms and collective action patterns. For instance, one village may rely on paddy rice growing and prefer to take action collectively while another village may have a higher level of mechanization and like to work as a household unit. In that case, engaging them in the decision-making process is better to be community-based, considering their local social, institutional and economic factors.

[120]Adger (2003, 388).

[121]Yu and Shi (2010, 29–34).

[122]Ibid.

[123]Plummer and Taylor (2004b, 36).

[124]Plummer and Taylor (2004a, 70–77).

Developing Community-Based Participation in the Adaptation Mainstreaming Process

Public participation in the Chinese water management framework and practice is mainly discussed and undertaken at a macro-level, and among urban stakeholders (such as industrial and residential water users). However, rural towns and villages, which are more climate-dependent and more vulnerable to climatic changes, have been marginalized in the public participation mechanisms for a long time. As a result, the voice and interests of these vulnerable communities have long been overlooked. On the other hand, these local communities have developed a rich bank of knowledge and experience in managing disasters and adapting to the complex, diverse and changing environment which they rely on. In that case, this dominant scientific-centered paradigm has lost the best chance to advance local adaptive capacity, learn from local knowledge and benefit from the experience of tackling climatic risks. Given the challenges facing water management, this book argues that community-based participation must be developed to reduce vulnerability and to adapt to water-related climate change impacts.

Nonetheless, developing community-based participation does not reject the importance and input of scientific knowledge in decision-making,[125] but rather it suggests a co-learning approach whereby local and external knowledge on climate change and adaptation complement each other through a sharing or exchange mechanism between communities and scientists.[126] The unpredictability and variability of climate change impacts and the uncertainty of taking proactive measures has increased pressure on local communities and pushed them beyond their ability to cope with. Modern science, technology and policy could help communities understand risks, reduce uncertainty and alleviate the loss. Meanwhile, the interests of the community must be considered and served while applying modern science and policy in the decision-making process. Having analyzed that, proposals in this book to develop community-based participation when mainstreaming adaptation mainly involve:

Recognizing the Role of Local Knowledge and Experiences

Local knowledge and experiences have great advantage in identifying local environmental changes and adapting to adverse impacts. They could be approached by adopting some innovations or measures rooted in community and empowering the community to make their own decisions on adapting to water-related climate change impacts. Local knowledge and scientific information should be verified by each other to provide the best available information for decision-making.

Increasing Communities' Awareness of Climate Change-Related Risks

Local communities are supposed to be equipped with fair understanding of various climatic risks, vulnerability and the causes (drivers) and effects (consequences) of climate change impacts, for example, the risks of flooding and their impacts on local

[125]Dumaru (2010, 752).

[126]Reid et al. (2009, 16).

livelihood. This could be realized through education, training courses and related public forums. Scientific knowledge and information disseminated to communities should be easily accessible, understandable and free of charge.

Making Use of Local Institutions and Organizations

Local groups, such as township government, village committee, local leadership and the Water Users Association (WUA), are best placed to collect voices and present interests. While some argue that the WUA has played a great role in coordinating water delivery and improving water use efficiency among different water users,[127] others disagree by illustrating its constraints and challenges in institutional alignment with existing local organizations.[128] Based on this observation, it is suggested that any further initiative on community-based participation should consider local institutional settings and coordinate with different levels of institutions.

Integrating Community Representatives to Existing Decision-Making Structures and Institutions

This would enable them to participate in local, regional and basin level adaptation-related planning, implementation, monitoring and reviewing activities.

There is not much experience of community-based participation in larger-scale planning and decision-making. Pilot projects would be useful in exploring the appropriate model of participation. For example, which form of information dissemination is more effective: training workshops or focused group discussions? Which level of institution should represent local community in participating basin level decision-making: township government, county level government or the WUA? All these questions need to be addressed through pilot studies in order to find the most appropriate participation model for local communities.

5.4 Developing a Principle of Social Justice

Climate change and variability is only one of the many factors that impinge on people's livelihoods and well-being. Risks and impacts posed by climate change-related disasters and natural hazards are often linked more to social and economic factors in different contexts rather than simply the size of physical events (such as droughts and floods).[129] These societal and economic factors interact with physical environment, either exaggerating existing social injustice or providing opportunities to alleviate present injustice. Much of the literature has identified three criteria to assess interventions on adaptation: effectiveness—initiatives should reduce vulnerability to climate change; efficiency—the benefits should outweigh the

[127]Lin (2003, 1–4).

[128]He (2012).

[129]Ayers and Tim (2009, 3).

costs; and equity—distributional consequences should be taken into account.[130] The first two criteria are widely employed to assess adaptation actions in light of their achievement and benefits/costs, whereas the equity criterion is too often neglected. This part suggests that the equity and justice issues related to adaptation should be understood, identified and addressed while mainstreaming adaptation in the IWRM.

In fact, analogous terms 'justice' and 'equity' are very confusing concepts. Ikeme argues that while 'equity' usually has strong procedural focus, 'justice' encompasses both distributive and procedural concerns.[131] In this book, justice will be generally used as a broad and overarching concept dealing with all justice and equity concerns associated with adaptation.

5.4.1 *Understanding the Social Justice Concern of Climate Change*

Environmental justice is not a new theme and it has been used to deal with different exposure of disadvantaged groups or minorities to environmental stresses and risks like pollutant and contaminated land.[132] It is based on the premise that all people should be treated equally and have a right to good environmental quality. Vulnerable populations should not bear a disproportionate share of adverse environmental impacts of public and private actions.[133] More importantly, they should also be involved meaningfully with respect to the development and implementation of environmental decisions, regardless of their race, income and nationality.[134] Focusing on equitable distribution of adaptation resources and benefits rather than the right to environmental quality,[135] climate justice presses our conventional legal framework due to the unprecedented complexity, scale and magnitude of climatic harms.

The justice implication on climate change has been underlying international negotiations for decades, especially in the fair sharing of mitigation burden and in distributing the responsibilities of developed countries to assist developing countries in adapting to the changing climate.[136] The major starting point of the justice debate at the international level is the argument that anthropogenic climate change is caused predominantly by the GHG emissions of developed countries (they are also benefiting from GHG emissions) whereas developing countries (especially

[130]See, e.g., Climato and Mullan (2010, 8), Adger (2005, 80–84).
[131]Ikeme (2003, 200).
[132]Ibid., 197.
[133]Ibid.
[134]Bass (1998, 84).
[135]Ruhl (2010, 407).
[136]Kasperson and Kasperson (2001, 13–14), Metz (2000, 111).

those least developed countries) are suffering the harms of climate change disproportionately.[137] What is worse, developing countries have a much lower capacity in adapting to those inevitable climatic disasters. This double whammy effect has made international law community to regard adaptation as a human right issue.[138] The delivery of adaptation assistance such as financial support and technology transfer to those least developed countries, small islands nations, indigenous people and those displaced by climate change has been a very central part of adaptation. The UNFCCC and its Kyoto Protocol also have extensive provisions on equity, in terms of both procedures and the differentiation of commitments for different countries.[139]

Downscaling to the domestic level, the argument between developed countries and developing countries also extends to adaptation in China, where different regions and river basins have very different emission contributions, development levels, vulnerability and adaptive capacity. Adaptation related justice issues should be considered and managed by related domestic policies and legislation.

5.4.2 Analyzing the Social Justice Implication of Adaptation

Rawls supposes that in a well-ordered society, reasonable citizens will agree on the principle of justice,[140] according to which, social and economic inequity could only be arranged to be of the greatest benefit of the least-advantaged members of society.[141] Yet Chap. 3 concludes that most of the existing adaptation-related policies, legislation and institutional settings in China are deeply influenced by the mentality and paradigm in managing environmental and economic issues. This means they do not prioritize the need of the vulnerable groups who are very likely to be harmed by climate change impacts. As a result, implementing these policies and legislation may exaggerate existing injustice relating to disadvantaged people —'dual social injustice' both substantially and procedurally.[142] In that case, understanding and assessing whether adaptive strategies to manage water-related climate change impacts reinforce or alleviate existing social injustice concerns would be very essential.

Literature shows that most of the social injustice implications in adaptation area mainly take place in two dimensions: spatial and demographic.[143] For the former, while industrialization and high concentration of population are major sources of

[137]Paavola and Adger (2002, 2).
[138]Knox (2009).
[139]Metz (2000, 112).
[140]Rawls (1971, 397).
[141]Ibid., 302.
[142]Ji (2003)
[143]Brisley et al. (2012, 26).

GHG emissions, communities in less developed remote areas are more often than not suffering more than their counterparts who emit the majority of GHG in developed areas.[144] For instance, people living along the downstream of the Yangtze and Yellow River emit the majority of GHG while the adverse climate change impacts are experienced more intensively and frequently in the less-developed upper streams.

In terms of demographic vulnerability, it has also been noted that climate change is likely to have more serious impacts on groups and communities that have been marginalized by virtue of their social-economic status, age, gender or ethnicity.[145] For example, in the Yangtze River Basin area, the people who are dependent on agriculture and fishery are more likely to bear the highest risk of adverse climate change impacts. In addition, women, children, elder people and minority groups are among the vulnerable groups when confronted with climate change pressure, mainly due to their limited access to resources, technology, information, social capital, transportation and other sustaining systems.[146] Moreover, they have a relatively limited ability in influencing the decision-making process that may affect collective adaptation measures.

It reveals that, although both spatial and demographic vulnerabilities partly result from their geographic and ecological specificity that is difficult to change, their economic, social and institutional disadvantages largely aggravate their social vulnerability in dealing with and absorbing adverse climate change impacts.[147] The Yangtze River Delta, for instance, home to cities like Shanghai and Hangzhou is also vulnerable to climate change impacts, especially sea-level rises and typhoons, but people living there have a much higher capacity in addressing and adapting to these negative impacts than their counterparts in the ecologically fragile upper Yangtze area. In many cases, these two types of vulnerability overlap in the upper stream of most river basins, where the development is backward and many groups are marginalized. In this regard, both implications of social justice must be incorporated in forward-looking adaptation policies and legislation to not only alleviate existing injustice but also prevent potential harm to those vulnerable populations.[148]

5.4.3 Applying the Social Justice Principle for Adaptation Mainstreaming in the IWRM

After the Reform and Opening-up, China's policy-making and legislation formulation has been guided by economic-oriented mentalities and policies, without

[144]Khailani and Perera (2013, 615).
[145]McDonald (2010, 13).
[146]Climato and Mullan (2010, 18).
[147]Smit and Pilifosova (2001, 877–912).
[148]Dow et al. (2006, 95).

giving adequate attention to social equity and justice.[149] Many development policies, even though some of them with an objective to resolve social injustice, enlarge the injustice situation rather than addressing it. Research reveals that most of the impoverished people have even been seriously damaged by environmental protection policies, programs and measures of which the justice concerns are absent.[150] For example, many water infrastructures or environmental conservation projects conducted in the upper river basins are the drivers of poverty and social injustice because they are not accompanied by adequate economic development assistance, subsidies or long-term compensation payments.

Having witnessed the advantages and benefits of market mechanism in distributing resources in developed countries, many scholars and practitioners in China have proposed it as one of the main approaches to deal with current water crises.[151] In the past decades, water use efficiency, water rights market and water prices have dominated various water-related conferences, meetings and legal amendments about water resource management.[152] Starting with, and ending up, with efficiency,[153] this marketization contributes to water use efficiency improvement and water pollution reduction remarkably. However, it should also be made aware that aquatic degradation is also partly driven by marketization, thus it would be ineffective to completely rely on market mechanisms to address existing water problems.[154] Water use efficiency and equity should be well balanced. On the one hand, it is important to distribute finite water resources to those high-value sectors and people to maximize their efficiency; on the other hand, government should understand that the ultimate goal of improving water use efficiency is to raise people's livelihoods and wellbeing rather than maximizing the economic value of water resources (see Footnote 150). More attention should be shifted to resolving the social, legal and institutional issues where social inequity and injustice are generated.

Climate change adaptation could involve both distributive and procedural justice. The former focuses on the distribution of the beneficial and adverse effects of climate change and adaptation strategies, and the latter relates to how, why and by whom decisions on adaptation are made.[155] Detailed questions of the distributive justice include: who are the most vulnerable ones and how should they be compensated? Who benefits most due to GHG emissions? Who benefits and loses from adaptation strategies and actions? With regard to procedural justice, the following questions need to be answered: who should participate in decision-making and how? Who should bear the burden of proof? When there are conflicting interests or

[149]Wong (2004, 170–171).
[150]Cao et al. (2010, 439).
[151]See e.g. Li (2006).
[152]Varis (2011, 621–624).
[153]Lu (2004, 207).
[154]Ibid.
[155]Thomas and Twyman (2005, 116), Paavola and Adger (2002, 2), Anand (2001, 247–270).

rights, whose interests or what rights should be sacrificed?[156] As stated earlier in this part, vulnerability could be a result of disadvantaged socio-economic status, but also could be because of a lack of access to information and decision-making process. This indicates that both distributive and procedural justice must be properly addressed in adaptation responses.

Public participation, recognition of public interest and environmental rights, access to administrative and judicial review and fair distribution of power are the common elements of procedural justice (see Footnote 137). The legitimacy of plans, decisions and actions rests on procedural justice to empower affected groups to participate in relevant decisions. Therefore, the voice of the vulnerable and their interests or capacities should be taken into sufficient consideration.[157] Pertinent measures include entitling the public with the right to information, empowering grass-root NGOs to represent vulnerable groups and developing community-based participation, which have been analyzed in the previous part. Another important motion towards procedural justice is to improve the participation of women in influencing adaptation intervention, especially in water-related disaster preparation and risk reduction process. In China, a program called 'Gender Equity in Social Adaptation to Climate Change in Poyang Lake Community' has been carried out by the United Nations Entity for Gender Equality and the Empowerment of Women (UN WOMEN) to investigate women's vulnerability and their role in climate change adaptation.[158] It is a good start for proceeding social justice issues in adaptation area, but it needs to translate research outcomes to the decision-making process.

From a distributive justice perspective, realizing social justice requires future policymaking, legal implementation and measures undertaken around mainstreaming to recognize people's need, share benefits as well as allocate risks and burdens appropriately.[159] A standardized approach to assess the social impacts of decisions on vulnerable populations would be significant to identify possible negative impacts and mitigation measures. Some developed countries such as the US and Australia have integrated social impacts assessment (SIA) as an important part of environmental impacts assessment (EIA) to assess the social impacts of plans and projects in their planning stage.[160] 'Environment' in their environmental acts is clearly defined to include the surroundings of man both as an individual and social group.[161] As an apparatus for planning, SIA assumes a pluralistic political structure and an interdisciplinary approach, which is remarkably different from China's paternalistic, authoritative, technocratic and partial decision-making structure.[162]

[156]Wardekker et al. (2009, 513).
[157]Paavola and Adger (2006, 594–609).
[158]UN WOMEN (2011).
[159]Elster (1991, 273–291).
[160]Bass (1998, 91), Craig (1990, 37–54).
[161]Ip (1990, 118).
[162]Ibid., 113–122.

Given the increasing social protests due to social injustice in China,[163] incorporating and assessing the social impacts of policies plans or projects is imperative and commendable. This could be achieved by setting social justice as a principle of environmental laws, which then could influence the objective and process of decision-making. It first requires Chinese legislation to reinterpreting the definition of 'environment' and to expanding the scope of impact assessment to social impacts in the established EIA paradigm. Relevant decision makers are also expected to develop their value assumptions and decision-making approaches to accept SIA methodology as an integral part of the decision-making process. Based on a SIA methodology, if programs or projects are proposed in the upper stream in order to deal with the changing precipitation and intensifying extreme events, crucial steps should be taken to achieve social justice. Examples are identifying affected population, assessing the adverse social impacts of these programs or projects, preparing alternatives and undertaking mitigation measures.

Meanwhile, established tools relating to social justice must be improved, such as poverty reduction plans and ecological compensation mechanisms. In some cases, water-centered adaptation mechanisms or measures need to have dual-proposes: remedying historical injustice and preventing new injustices. For instance, due to inadequate ecological compensation in the Yangtze River Basin, developed downstream owns an 'ecological debt' to less-developed upper stream. What is worse, climate change adaptation adds another 'adaptation debt'. In that case, existing rehabilitation and compensation schemes should be improved to address both previous and present debts.

Distributive and procedural justices are not independent of each other. If vulnerable groups are not provided with procedural justice via participation in the planning and decision-making process, their interests are unlikely to be served by adaptation plans and decisions, undermining distributive justice and aggravating existing inequity eventually (see Footnote 158). In the same respect, procedural justice only provides a procedure to bring parties to the table. It cannot, in itself ensures acceptable decision outcomes or render justice. For example, decisions on distributing risks and benefits could be made by using existing procedural rules which neglect vulnerable communities, but do not deliver just and equitable outcomes. Thus, when mainstreaming adaptation factors in China's water management, measures need to be based on revised distributive and procedural rules that are inclusive and considerate of justice and vulnerability.

There has been a consensus that if social injustice in China is not addressed properly, it will lead to serious social risks and thus hinders the healthy development of the economy and society.[164] Motivated by a variety of factors such as power, prosperity, long-term stability and durability for the governance regime,[165] a 'harmonious society' slogan has been proposed by former President Hu's group to

[163]Zhu and Long (2012).

[164]Wu (2005, 82–88).

[165]Zheng (2005, 18–25).

resolve tensions over economic growth, social inequity and pollution in 2006.[166] It was the first time in 25 years to focus on social issues rather than on economic or political development.[167] It is believed that a 'harmonious society' should put people first and make all social activities beneficial to people's subsistence.[168] Although there are some critics of this slogan, such as the unclear definition and misunderstanding of 'harmonious',[169] and the utilitarianism of government's focus,[170] it no doubt will help to bring the concern of social justice to the frontline to be an emerging factor affecting decision-making process.

5.5 Developing Resilient Institutional Settings

Effective institutions as the center of vulnerability reduction are an integral part of high adaptive capacity. Institutional settings are required to be more flexible, innovative, responsive and resilient in order to make robust decisions that deal with risks.

To effectively mainstream adaptation considerations in China's water management, current institutional framework must be enhanced to deliver resilient and effective water management decisions and outcomes. Chapter 3 has assessed the capacity of the institutions on adaptation, and concludes that the marginal role of environmental authorities and the absence of institutionalized local governance hinder adaptation mainstreaming in China's water management practices. Chapter 4 has identified the institutional challenges to the IWRM regime when mainstreaming adaptation—the site-specific nature of adaptation and the requirement for broader, more effective public participation. It suggests that mainstreaming adaptation needs to think integrally, but act locally, to build collaborative mechanisms between local and central governments, and to improve the mechanisms of public participation. Recommendations on public participation have been analyzed separately in Sect. 5.3 of this chapter. Thus, this following section will particularly focus on the roles of local governments, environmental authorities and RBCs in building a resilient institutional framework for mainstreaming adaptation in the IWRM.

5.5.1 Rules of Developing Resilient Institutional Settings

Before providing detailed recommendations for institutional settings, it is important to understand that a resilient or robust institutional framework not only refers to the

[166]Xing (2006).
[167]Fan (2006).
[168]People (2007).
[169]French (2008).
[170]Economy (2007).

arrangement or structure of this framework, but also entails a series of procedural rules and principles for decision-making. Ostrom came up with eight institutional design principles for successful water governance after analyzing worldwide water management experiences: (1) clearly defined boundaries; (2) proportional share or distribution of benefits and costs; (3) collective choice arrangements that allow most resources stakeholders to participate in the decision-making process; (4) effective monitoring and evaluation; (5) graduated sanctions for those who violate community rules; (6) conflict prevention and resolution mechanisms; (7) minimal recognition of rights to organize; and (8) nested enterprises or polycentric governance.[171] Later, these principles are developed to include other key principles such as effective communication, internal trust and reciprocity, and the nature of the resource system as a whole.[172]

Huntjens and some other scholars on adaptation eliminate two of above principles that have no explicit and direct relevance with the governance of adaptation in the water sector: recognition of self-organization and graduated sanctions.[173] Instead, given the changing and uncertain nature of climate change, they propose another two additional institutional design principles for adaptation process: (1) a robust and flexible process; and (2) policy learning.[174] Generally, all of these principles are attempting to answer two questions in the water management process: (1) who are the decision makers and how do they work with each other (organizational rules); and (2) how decisions are made (decision-making rules). There is no clear distinction between these two types of rules, but instead, different organizational structures could shape positions of different actors, the outcomes of the decision-making process and the effects of those outcomes.[175] For example, whether responsibility allocation is clearly defined or whether the public is engaged in an early stage of the decision-making process largely determines the effectiveness and resilience of the decisions made. Therefore, it is vital to analyze who are the decision makers and how different actors play their roles while mainstreaming adaptation.

To translate and apply above design principles according to the adaptation requirements, this book emphasizes the following to orient the institutional reform for mainstreaming adaptation in the IWRM: (1) clear and fair distribution of risks and responsibilities, benefits and costs; (2) cross-scale interactions and networks that connect central and local (or higher and lower) institutions; (3) communication and collaboration among different sectors and authorities to prevent and manage conflicts; (4) flexible decision-making process to allow the input of new information. All the following recommendations on local governments, environmental

[171]Ostrom (1990, 90).

[172]Poteete et al. (2010).

[173]Huntjens et al. (2012, 68).

[174]Ibid., 70.

[175]Möllenkamp et al. (2007, 148).

authorities and RBCs towards a higher institutional adaptive capacity should be directed by these principles.

5.5.2 *Increasing Local Government's Role in the Adaptation Mainstreaming Process*

Both water management and adaptation are multi-level processes. According to the analysis of vertical institutional settings on China's water management in Chap. 2, water management takes place within a hierarchical structure of different levels of government. Adaptation to climate change in China has also been distributed between national and local governments from top to bottom. In most cases, central government creates and formulates water and adaptation-related policies and regulations for local government to implement. In reality, how local government reacts is usually constrained and influenced by a higher-level framework where their responsibilities, power scopes and working regime are defined.[176] A crucial question is which level of local government should take the main responsibility, and what powers and responsibilities it should have in order to deliver effective, efficient and just adaptation outcomes. This question is of significance since it affects the understanding, explanation, implementation and assessment of adaptation measures.[177] In order to improve local government's role in reducing vulnerability and building adaptive capacity, this book proposes that at least the following measures should be taken:

Empowering Local Government with Power of Adaptation

Chapter 2 lists well-defined responsibility as one of the pre-requisites for effective IWRM. However, it is slightly different in the context of adaptation mainstreaming because of the requirement to define the affected regions or groups, responsibilities and resources distribution for risk prevention and reduction. For example, in the case of floods, clarity must be made about who is affected by floods, and who has the responsibility, capacity, resources and information to tackle them.[178] In addition to the distribution of predictable impacts, a risk assignment framework on uncertain water availability and events should also be established by, and among, various levels of government. For instance, it is essential to clarify which level of government should act on 100-year-return floods and which is for 10-year-return floods. These distributions are better made before actual impacts take place in order to make earlier preparation. Meanwhile, it is important to leave certain responsibilities and relationships open, allowing boundaries to be re-negotiated and adjusted among different actors in the adaptation process (see Footnote 179). Nonetheless,

[176]Adger (2005, 79).

[177]Adger et al. (2005, 76).

[178]Huntjens et al. (2012, 70).

this responsibility distribution does not reduce the importance of collaborative framework between different levels of government. Instead, it argues that collaboration is the foundation to address complex and uncertain climate change impacts.

Water-centered adaptation entails a flexible institutional framework which avoids 'one-size-fits-all' prescriptions but allows strategies or measures to be undertaken appropriate for the content of the issue and local contexts.[179] Some water-related adaptation issues are best managed by provincial governments, while others are more appropriate to leave for the RBCs at the basin level. Chapter 4 has argued that plans of adaptation mainstreaming are ideally undertaken at tributary or sub-basin level when possible. No matter which level is pinned down, the central government should establish a good enabling environment of policies, legislation and institutional arrangements to support various levels of adaptation decisions and implementation. In addition to the general efforts on developing the CNCCP, drafting Climate Change Law and establishing a Climate Change Department, the central government should do more with regard to develop policies or programs on adaptation, provide technical and financial support as well as shift more political attention to adaptation.

Currently, China is carrying out political reform on decentralization, which influences adaptation-related responsibility allocation among different levels of government. As illustrated earlier, provincial governments are entrusted with the responsibility of managing local adaptation issues through making local adaptation plans, establishing corresponding institutions and initiating legislation procedure. Unfortunately, this reform is featured with insufficient transfer of powers and resources to local government, under tight central-government oversight.[180] In addition, due to the hierarchical institutional structure, local government is often accountable to its upper level counterparts rather than to their local communities. As a result, local governments are more likely to respond to the directives from a higher-level government rather than responding to local needs, especially on issues that do not produce direct economic benefits. Chapter 3 has revealed that most provincial climate change programs are reactive responses to the central government, lacking of sufficient endogenous awareness, incentives and capacity to adapt to negative climate change impacts. In the future, provincial governments should be delegated with more flexible power to initiate actions catering for their local needs. The effectiveness of adaptation strategies in reducing local vulnerability should be one of the criteria of assessing government officers' performance.

Furthermore, provincial policies and plans should provide guidelines and assessment standards for water-based adaptation implementation at the city, county and township level. These lower levels of government should also be entrusted with power of taking adaptive water strategies according to their jurisdictions and capacity. In turn, the experiences and knowledge gained at lower levels should offer insights for provincial policy and plan formulation. Defining all-purpose indicators for successful adaptation mainstreaming at different levels is very complicated and

[179]Ibid., 75.

[180]Ribot (2002).

contested due to specific contexts and requirements. Yet, at least equality, efficiency and justice criteria, which are widely recognized, should be employed to evaluate its effectiveness at various levels.

Promoting Partnership Among Local Governments

Government Partnership for Climate Change and Adaptation in China

Climate change impacts on water resources are context-specific, but it does not mean that these impacts will follow man-made administrative boundaries. Instead, they may share much in common in certain geographic areas, such as the tributary of the Yangtze River Basin and administrative boundaries vicinity. People living in these hot spots may have the same livelihoods, suffer from similar climate change disturbance or have the same level of adaptive capacity. For example, the provinces in the upper reach of the Yangtze River, which mainly covers the Xizang, Sichuan, Chongqing, Yunnan and Guizhou Provinces, may experience drought at the same time, as happened in 2010. In that case, administrative borders should not restrain adaptation initiatives. The cooperation or partnership among these local governments would be more effective in addressing confronting problems than efforts undertaken individually.

Another different scenario is that while some parts of the river basin are experiencing droughts, another part may be suffering from floods. In that situation, partnership would be helpful in complementing resources through agreements on water trading or water transfer. In addition, partnerships among governments also take credit on reducing the knowledge or information gap, and minimizing conflicts on trans-jurisdictional water resources, negative externalities and spatial spillovers of their adaptive actions.

China has not established effective partnership governance among local governments, due to a lack of a statutory framework and political environment.[181] Local governments are only designated with administrative responsibilities within their jurisdictions, while issues crossing administrative regions are usually in the charge of upper-level of government or the State Council.[182]In the 2002 *Water Law* and the *Water Pollution Prevention and Control Law*, water use disputes and water pollution disputes crossing different administrative jurisdictions are required to be resolved, through the negotiation among local governments, or by the mediation of higher-level government.[183] Theoretically, without specifying the form of negotiation, these provisions allow local government to address their common issues through cooperation, partnership and agreements based on equality, voluntary and negotiation. As an important form of regional partnership, the administrative agreements (AA) mechanism will be suggested in this book as a means to increase local government's initiatives and capacity to adapt to climate change impacts.

[181]Cai (2012).

[182]The Organic Law of Local People's Congress and Local People's Government (2004, art 59).

[183]Water Law of People's Republic of China (2002, art 56), Water Pollution Prevention and Control Law of People's Republic of China (2008, art 28).

AA among states have been widely used by many developed federal countries (for example, the United States and Australia) to distribute and protect natural resources, provide public service and resolve regional disputes.[184] This legal mechanism is premised on the constitutional equity among states and between states and the federal government.[185] It has been recognized as being very effective in mutual benefit and collaboration, in complementing each other and sharing resources.

As a unitary state, China has been dominated by hierarchical system where local governments are supervised by the central government and the AA is not popularized. However, in practice, along with the irreversible trend of regional economic integration, AA is highly recommended to facilitate regional cooperation and resolve cross-jurisdiction disputes with regard to economic, social and environmental issues.[186] Some local governments have put it in practice in advance. For example, provincial and prefectural governments (including some of their departments) in the Yangtze River Delta have made AA through 'Joint Meeting of Administrative Chiefs'.[187] Three provinces of Northeast China even have established cooperative legislation framework to provide a good legal environment for development.[188] Meanwhile, AA is confronted with many practical implementation challenges. The unbalanced economic and political power among different local governments as well as the intervention from upper-level government often hinders the equal negotiation and communication, especially when there is no relevant statutory framework.[189] In addition, the absence of a dispute resolve mechanism in agreement impedes its effective implementation (see Footnote 187). The neglect of the interests of marginal areas and groups also compromise the effectiveness of regional development.

Administrative Agreements Experiences in the Murray-Darling Basin

Recognizing the difference between China and Australia, this book argues that successful practices of employing intergovernmental agreements in the Murray Darling Basin (MDB) could provide some insights for China to manage some trans-jurisdictional water-related adaptation issues. In Australia, water resources have been traditionally managed by the states. In 1914, in order to manage the MDB cooperatively, the River Murray Waters Agreement (RMWA) was signed by three state governments—New South Wales, Victoria and South Australia. The River Murray Commission was established according to this agreement.[190] The Commonwealth was not given 'express legislative power over this resource at

[184]Ye (2006, 57, 59).

[185]Ibid., 58–60.

[186]He (2008).

[187]Ye (2006, 57, 61).

[188]Wang (2006).

[189]Ma and Li (2010, 208).

[190]Murray-Darling Basin Authority, *The Water Act* Australian Government. http://www.mdba.gov.au/about-mdba/governance/murray-darling-basin-agreement.

federation but has the power and capacity to affect, directly and indirectly, water resources management through several of its legislative and financial powers.'[191]

Before 2007, the federal government exercised its influence mainly by adopting policy guidelines, providing financial assistance and fostering interstate trade in water entitlements.[192] However, due to increasing water disputes and the deteriorating aquatic environment in the basin, the commonwealth has recently stepped into oversee a coordinated approach to manage the basin water resources for the national interest.[193] Replacing RMWA, the Murray-Darling Basin Agreement (Basin Agreement) was formed between the federal government and the four state governments to

> promote and co-ordinate effective planning and management for the equitable, efficient and sustainable use of the water and other natural resources of the MDB, including by implementing arrangements agreed between the Contracting Governments to give effect to the Basin Plan, the Water Act and State water entitlements.[194]

It provides the process and substance for the integrated management of the MDB, including the institutional arrangements, financial support, responsibility distribution and dispute resolution.[195] Meanwhile, the Basin Agreement established new institutions at the political, bureaucratic and community levels to underpin its implementation, including the Murray-Darling Basin Ministerial Council, the Murray-Darling Basin Commission (the Commission) and the Community Advisory Committee.[196] In the 2007 Water Act, the main piece of legislation under which the Murray-Darling Basin Authority (MDBA, the successor of the Commission) operates, the Basin Agreement was incorporated as part of the legislation. Furthermore, according to the Water Act, a contracting state government or the Commission could propose to review or amend the Basin Agreement from time to time according to any estimate of a baseline condition or its achievement.[197] More importantly, the document 'Murray-Darling Basin Agreement Consistency Review Issues Analysis' was published to clarify the conflicts and consistency among the Basin Agreement and other related policies from jurisdictional perspectives, such as the 'National Water Initiative' and 'The Living Murray Intergovernmental Agreement'. [198] Although there are still many difficulties with

[191]Carney and Gardner (2009).

[192]Ibid.

[193]Millar, *The Environmental Law Framework for Sustainable Development—Principles of Sustainable Development in International, National and Local Laws*. http://www.actpla.act.gov.au/__data/assets/pdf_file/0006/13893/Millar_paper.pdf.

[194]Water Act (2007) (Cth) schs 1(1).

[195]Water Act (2007) (Cth) schs 1.

[196]Murray-Darling Basin Commission (2007).

[197]Water Act (2007) (Cth) schs 1pt II(5).

[198]Dyson and Martin (2007).

the effectiveness and implementation of these legal and institutional arrangements, they illustrate the kind of frameworks that can be considered for water resource adaptation.

According to above illustration, it reveals that the effectiveness of the Basin Agreement in the MDB is mainly determined by: (1) its legal status in legislation; (2) the institutional setting for implementation; (3) a periodic review or assessment to reflect changes; (4) the consistency with other agreements or legislation; (5) the federal government's support, monitoring and reasonable intervention; (6) the public representatives as an integral part of the institutional settings; (7) provisions about disputes resolution.

To date, there has been no formal agreement on adaptation issues among state governments. Yet, the cooperative mentality has been employed by local councils to adapt to climate change challenges. For example, the Bass Coast Shire in the state of New South Wales (NSW) set up the South-East Councils Climate Change Alliance with seven other local authorities in 2004 to provide a regional response to climate change.[199] This partnership overcomes current local government's low adaptive capacity in dealing with climate change challenges by fostering institutional cooperation and learning.[200] This alliance enables local government to draw insights from local stakeholders to develop and assess adaptation options which are specific to their local areas.[201] Different from AA, this partnership is looser and does not pose any binding responsibility on its members. Concisely, both the binding AA and non-binding regional partnership could ally related levels of government (from local councils up to the federal government) to address problems they confront together.

Developing the Administrative Agreements for Adaptation in China's River Basins

As Chap. 2 mentioned, some river basins have conducted some regional cooperation to address existing water crises, such as the 'Five plus One' model, to protect water quality in the middle line of South-to-North Water Transfer project. This book argues that both AA and regional partnerships could be promising approaches in motivating relevant local governments to address pressing water-related climate change impacts cooperatively. Not only provincial government, but prefectural, county and township governments should also be entrusted with the power to build partnerships or make agreements with other governments within their responsibility ranges. In some cases, government agencies such as water authorities and environmental authorities from different administrative jurisdictions could, and should, work together to tackle water or environmental issues. Regional partnership is expected to be built and facilitated when there is a need for cooperation or negotiation.

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[199]South East Councils Climate Change Alliance (SECCCA), *SECCCA: Local Governments in the South-East Responding to Climate Change*. http://www.seccca.org.au/about.asp.

[200]Serrao-Neumann et al. (2013).

[201]Ibid.

In terms of AA, several improvements should be progressed to deliver effective adaptation outcomes. Learning from the Australian experience, and taking into account China's reality, this book puts forward the following key messages to enable AA to play a greater role:

(1) A statutory framework on AA should be developed to provide a legal foundation. Some literature suggests that it could be achieved through initiating an individual 'AA law', formulating a comprehensive 'AA and administrative contract law' or incorporating it in existing 'administrative procedure law'[202];
(2) The mechanism 'Joint Meeting of Administrative Chiefs' should be institutionalized to provide organizational support for AA;
(3) Dispute resolution mechanisms should be developed and incorporated in AA;
(4) Upper-level or central government could play a vital role in promoting cooperation, mediating conflicts and providing guidance. Nonetheless, they should not restrain local governments' initiatives and innovations, neither should they intervene in those decisions made legitimately by local governments;
(5) Broader public, including business sectors, research institutes and highly related stakeholders, must be involved in the agreement-making process to facilitate interactive communication between them and decision makers. This is best done by setting up a committee or organization representing stakeholders and the public. Based on the social justice principle analyzed earlier in this chapter, the interests of rural and marginal areas must be given special attention. The agreement content should be disseminated to the public;
(6) The agreement and its implementation should be reviewed and evaluated periodically to input emerging information and experience. This is of great importance to water-related adaptation due to the changing climate.

With these proposals in place, AA is expected to help local government to develop a higher capacity in addressing water adaptation issues as a legal mechanism.

5.5.3 *Engaging Environmental Agencies in the Adaptation Mainstreaming Process*

In Chap. 3, it concludes that the marginal position of the MEP in climate change policy-making and legislation has obstructed the best chance to formulate and implement climate-proofing policies through environmental policies and laws. It also reveals that environmental agencies are recognized, by most countries, as being essential contributors in climate change mitigation and adaptation. While it is very unlikely for China to shift climate change issues from the National Development and Reform Commission (NDRC) to the MEP, it is essential and possible to

[202]Ye (2006, 57, 69).

improve the MEP's role in the decision-making process of adaptation mainstreaming, implementation and institutional settings.

The adaptation-targeted strategies and actions undertaken by the US Environmental Protection Agency (EPA) and their achievements could serve as empirical studies for the Chinese government to understand the MEP's role in facilitating adaptation.[203] Compared to the Congress and other agencies, the EPA has led the nation actively in taking mitigation and adaptation actions.[204] It has contributed to climate change adaptation significantly through issuing adaptation-related policy statements, formulating adaptation plans and integrating adaptation into its mission, operations, and programs.[205] In addition, the EPA has built substantial partnerships with other agencies in sectors such as coastal management and water management to assess climate change vulnerability and develop adaptation strategies.[206] It also has programs designed to help federal and regional decision makers to better understand and address risks posed by climate change. All these achievements rely on the substantive and procedural power the EPA has in accessing information, making relevant policies, and coordinating various agencies.

Compared to the EPA in the US, China's MEP is not entrusted with sufficient substantive and procedural power in challenging policies and decisions that may bring harms to the environment. This not only limits MEP's role in reducing vulnerability through pollution prevention and control, but also constrains its initiative and ability in taking innovative actions towards adaptation. Therefore, it is very important to resolve existing constraints and deficiencies the MEP faces. Much of the literature has the consensus that the failure of the MEP as an effective watchdog of environmental protection is mainly due to structural, personnel and financial constraints.[207] Addressing these above constraints will be crucial for the MEP to play a part while mainstreaming adaptation in the IWRM. Under this premise, and inspired by the EPA's adaptation actions, this book puts forward the following propositions to engage the MEP in the water-centered adaptation mainstreaming process:

(1) delegating it with certain power to formulate environment-related adaptation policies or guidelines for water management;
(2) enabling it to bargain with the NDRC to influence adaptation-related decision-making and planning;
(3) building close cooperation or partnerships with the MWR and the Meteorological Bureau to address water-related climate change impacts and develop adaptive strategies;
(4) developing adequate access to climate change knowledge and information.

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[203]United States Environmental Protection Agency, *What is EPA Doing about Climate Change*. http://www.epa.gov/climatechange/EPAactivities.html.

[204]Kenney (2010).

[205]United States Environmental Protection Agency, *Federal and EPA Adaptation Programs* http://www.epa.gov/climatechange/impacts-adaptation/fed-programs.html.

[206]Ibid.

[207]See, e.g., Mao et al. (2008).

In addition to those improvements from an external perspective, the MEP itself should incorporate adaptation factors and criteria in its existing responsibilities of approving environmental planning, issuing permits and preceding the environmental impact assessment procedure. It is also important for the MEP to build and develop capacities in understanding climate change risks, delivering resilient decisions and monitoring adaptation implementation. If this is the case, the MEP is supposed to contribute climate change adaptation in a preventative and environmental-friendly way. These recommendations should also be applied to lower levels, where local environmental agencies facilitate adaptation at their local level.

5.5.4 Increasing the RBCs' Institutional Adaptive Capacity

The RBCs should take the responsibility of assessing the vulnerability and adaptive capacity of China's water resources, identifying key entry points of mainstreaming adaptation and implementing adaptation-related water plans, strategies and actions. As a result, it generates greater requirements to increase their institutional capacity in undertaking adaptive water management measures and delivering resilient and sustainable adaptation outcomes. This part proposes three approaches to improve RBCs' awareness and capacity in addressing water-based adaptation issues.

Building Institutional Coordination and Collaboration with Other Adaptation-Related Agencies

RBCs should build a cooperative mechanism with climate change-related agencies, such as the national and provincial DRCs, meteorological agencies, water agencies and environmental agencies. Cooperation among them could benefit the access to the best available information, consistent water planning development and climate-proofing water management outcomes. In 2007, the 'Research Centre for Climate Change' (RCCC) was established by the MWR to investigate and assess climate change impacts on water resources, the aquatic environment and hydraulic infrastructures. It has developed climate change impacts assessment models for Han and Gan tributaries of the Yangtze River Basin. In the future, on the one hand, the RBCs should make good use of these research outcomes to provide scientific information for decision-making. On the other hand, effective communication should be established to deliver the RBCs' information requirements of decision-making to the RCCC.

Improving Knowledge and Information Communication Through Forums and Dialogues

Various water forums have been held by Chinese water managers to resolve severe water problems and facilitate sustainable water management. The China Water Forum initiated from 2003 has focused on the scientific research on Chinese water resources, of which climate change impacts is one of the important perspective. For the major river basins, only the Yellow River International Forum and Yangtze Forum (YF) are organized by the RBCs regularly to exchange experiences and

collect ideas on water management. Both of these two forums have listed climate change impacts on water security as a topic or sub-forum. Yet there is still a big gap between research outputs and decision-making outcomes. Most of the research and analysis is merely limited to theoretical discussions and has not been translated into concrete adaptation considerations in the decision-making process. Therefore, more research should be done on how to identify and integrate adaptation considerations in water management practices and how to translate research outcomes into decision-making. In addition, the aim of these forums should be to build a dialogue, collaboration and an academic exchange platform among decision-makers, researchers, practitioners and various representatives (rather than merely among central government departments, provincial governments, research institutes and international NGOs).[208] The absence of local NGOs, lower levels of government (mainly prefecture and county government), and stakeholders has made RBCs lose good chances to obtain local knowledge, information and experience in adapting to water-related climate change impacts. This book suggests that this communication structure must be opened up to invite these grass-root participants to facilitate the bi-directional flow of information and knowledge.

Initiating a Water and Climate Dialogue

In addition to existing mechanisms and instruments, mainstreaming adaptation entails that a water and climate dialogue is essential through the RBCs or in the RBCs. The 'Dialogue on Water and Climate' (DWC) has been carried out in many developing and developed countries, with the aim of stimulating cooperation between the water management communities and climate communities from the local up to global level.[209] As of 2004, 18 dialogues have been initiated throughout the world at regional, national and basin level, including China's Yellow River Basin.[210] At the 2010 Cancun Conference, the importance of conducting a dialogue between water and climate gained much attention and support from development banks, governments, research institutes and companies.[211] In practice, it has helped to formulate policies recommendations and inventory activities on water-based adaptation.[212] The DWC is regarded as a promising mechanism in promoting communication, and preparing for adaptation actions by inputting knowledge and information produced in the dialogue into the policy and decision-making process.[213]

This dialogue initiative could be introduced for other RBCs to provide a platform for knowledge base development and information exchange between water

[208]长江论坛[China's Forum], 关于长江论坛[*Introduction to the China's Forum*]. http://www.yangtzeforum.com/aboutus.asp.

[209]International Secretariat of the Dialogue on Water and Climate (2004).

[210]Liu, 'Dialogue on Water and Climate in the Yellow River Basin (China)' (Dialogue on Water and Climate, 2002).

[211]National Water Commission of Mexico (2010, 5).

[212]Ibid., 6.

[213]Kabat and Schaik (2003, 106).

communities and climate communities. It could be organized jointly by the RBCs and RCCC, and includes participation of broader communities (representatives of various local governments, NGOs, affected communities and the interested public) rather than just policy makers, scientists and water managers.[214] Better tools should be developed to communicate information on climate variability and water availability at various temporal and spatial scales to stakeholders and to translate local knowledge and experience into the decision-making process. Dialogue among different communities and stakeholders could contribute to the legitimacy of policy-making, the credibility of the knowledge, the resilience of decision outcomes and the support from practitioners.[215] Compared to the aforementioned water forums, it gives much more focus on the water and climate change interaction, which could largely increase awareness on water adaptation.

5.6 Conclusion

This chapter mainly provides recommendations of a legal and institutional enabling environment for adaptation mainstreaming, before illustrating how adaptation considerations are integrated in IWRM. On the one hand, a well-established enabling environment is the pre-requisite to initiate and justify adaptive and resilient water management strategies in the context of climate change uncertainties. On the other hand, it also provides legal and institutional support for their implementation and enforcement when flexibility could be an excuse of delaying proactive actions.

The principle of sustainable development and precautionary principle are analyzed and assessed, and conclusions drawn that they should be developed to incorporate adaptive objectives and to provide guidance and instructional support. The principle of sustainable development has been widely acknowledged by the water management community but needs to be more specific, comprehensive and process-oriented. Applying the concept of sustainability is crucial for this principle to establish resilience to uncertain climate change impacts.

The precautionary principle should be clearly defined in water-related laws to motivate decision makers to take proactive measures against unpredictable and uncertain climatic risks. It also requires developing different water management approaches to resolve the gap between available knowledge and decision-making requirement. Based on the legal system in China, this book concludes that placing the precautionary principle as an approach rather than a universal legal principle of adaptation mainstreaming process would be more politically and legally practicable. Decision makers need to clarify the factors and tools that could contribute to risk

[214]International Secretariat of the Dialogue on Water and Climate, *Dialogs for Water and Climate Change: Call to Action* (2010).
[215]Ibid.

identification, prevention and reduction in the face of uncertainties in order to justify their decisions regarding the possibility of significant risks involving irreversible impacts.

Given the chronic problems of public participation in China, this book suggests that shifting the role and perception of the public from an 'object' to the 'subject' is the premise of subsequent recommendations on public participation. For mainstreaming adaptation in the IWRM, improving adaptation-related information dissemination, establishing user-centered information system, recognizing the role of NGOs and developing community-based participation will be desirable for China's water managers to deliver legitimate and robust decision outcomes.

Lastly, with regard to the spatial and demographic dimensions of social injustice associated with adaptation, this chapter suggests that the substantive and procedural perspectives of social justice should be placed conjunctly and unequivocally at the heart of the mainstreaming process so as to produce equitable and just measures on water-based adaptation. Developing social justice as an environmental law principle is essential to rectify existing 'ecological injustice' and prevent future 'adaptation injustice'.

The analysis of these four principles, however, does not repudiate the application of other principles of environmental law such as polluters pay and prevention principles. On the contrary, it requires a comprehensive, systematic and consistent understanding and implementation of these principles. For example, social justice principle, to some extent, is based on the implementation of polluters pay principle to identify GHG emitters and victims. Nonetheless, applying above environmental law principles is only the first step of mainstreaming adaptation in environmental policies, plans and activities. How to mainstream specific adaptation considerations in the IWRM under those developed legal principles will be given in-depth analysis in the next chapter.

Through improving management power and responsibility sharing, collaboration and the participatory process, institutional reforms of the local government, environmental agencies and the RBCs could facilitate adaptive governance and enhance their institutional capacity in managing uncertainties and complexity. These institutional reforms and the development of legal principles, instruments and institutions are expected to provide aspirations and criteria for robust water management decisions in the context of climate change impacts that are complex, uncertain and often interdependent.

The effective implementation of any one of these reforms depends largely on the improvement or operation of the other reforms. For example, the application of principle of sustainable development and precautionary principle, as well as the integration of social justice concerns, entail effective public participation. In turn, public participation could be enhanced through the institutional reform where the role of local governments is recognized and communities are represented in the RBCs. In addition, whether the RBCs are regarded as a fledged river basin commission or not is largely determined by the adequacy of public representation and the implementation of institutionalized public participation procedures.

In a nutshell, there is no once-and-for-all solution for addressing water-related climate change impacts. It requires systematic improvement and cooperation of different water management and adaptation-related institutions, approaches and instruments at multi-levels to provide adequate resources for long term planning, assessment, decision-making, monitoring and continuous learning.

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Chapter 6
Recommendations for Mainstreaming Climate Change Adaptation in China's IWRM—Examples of Two Key Entry Points

Previous Chap. 5 analyzed how to set the stage for mainstreaming adaptation through examining and reforming existing water-related legal and institutional frameworks. The next pivotal issue is to demonstrate how adaptation considerations can be mainstreamed in China's water management plans, strategies and actions.

According to the United Nations Development Program (UNDP) and the United Nations Environment Program (UNEP), mainstreaming adaptation should proceed in three levels:

(1) finding the entry points and making the case—setting the stage for the mainstreaming process by understanding the link between climate change and development, identifying relevant institutions and raising the awareness and capacity;
(2) mainstreaming adaptation into policy process—integrating climate change adaptation issues into ongoing policies such as national planning and sector planning;
(3) meeting the implementation challenge—ensuring the budgeting and financing, implementation and monitoring of mainstreaming adaptation.[1] This identification is largely based on a three-step planning cycle: agenda setting and enabling environment building—policy-making—implementation and monitoring.[2]

Inspired by above different levels of interventions in mainstreaming adaptation, this book argues that there are three hierarchical layers of entry points in the context of legal and institutional frameworks:

(1) the entry point of sectors: determine which sectors or resources are more vulnerable to climate change variability and make them the frontline of adaptation;

[1]UNDP-UNEP (2011, 3).
[2]Ibid, 14–15.

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(2) the entry point of policy/plan: for this specific sector or resources, determine which policy or plan could serve as the entry point of mainstreaming adaptation; and
(3) the entry point of implementation: what are the adaptation factors and considerations that should be mainstreamed in above policy or plan.

These three layers of entry points are illustrated in Fig. 6.1.

This chapter identifies two entry points to illustrate how to mainstream adaptation factors in China's IWRM practices in detail: integrated water planning (Sect. 6.1) and EIA (Sect. 6.2), from a substantive and procedural perspective respectively. It has to be acknowledged that this is illustrative rather than an exhaustive identification of the entry points of adaptation mainstreaming.

Hierarchical entry points	Suitable entry points	Entry points in this book
The first layer: which sectors are more vulnerable to climate change	Water resources, agriculture, terrestrial ecosystem, coastal ecosystem	China's water resources
The second layer: (1) which policy, plan or project can mainstream adaptation (2) which approach of decision-making (policy, plan and project) in current water-related legal and institutional framework is a feasible tool to mainstream adaptation	(1) water resources planning; hydraulic project planning; emergency planning; disaster risk reduction planning (2) Environmental Impact Assessment (EIA); Social Impact Assessment (SIA); cost-benefit analysis; implementation monitoring; agencies collaboration; stakeholder consultation and public participation	(1) integrated water resources planning (both basin and sub-basin level) (2) EIA and SIA of water planning and project construction
The third layer: how to mainstream adaptation considerations in above entry points	Developing and implementing water-related legal and institutional frameworks; assessing climate change impacts, vulnerability and adaptive capacity; integrating adaptation factors; adopting adaptive approaches	Integrating key adaptation factors in the steps of water planning, SIA and EIA in the context of legal and institutional frameworks

Fig. 6.1 Three layers of entry points in adaptation mainstreaming analysis

Water planning, in this book, is chosen as one of the most significant tools to mainstream adaptation. It provides a vision and a roadmap for managing water resources over a relatively long period. Large-scale (both spatially and temporally) water planning is more likely to be affected by climate change impacts and thus is more scientifically appropriate to incorporate long-term climate change impacts. Therefore, it is submitted that the integrated water planning of one river basin and its sub-basins could serve as a significant entry point to mainstream adaptation.

As an integral part of decision-making process, EIA provides an important procedural entry point to mainstreaming adaptation in the decision-making process of plans and projects. EIA, if properly designed, is future-oriented rather than reactive. Through identifying climate change impacts on, and the vulnerability of, a plan or project, EIA is able to prevent maladaptation possibilities and provide climate-proofing solutions. Both water planning and EIA could enable adaptation to be factored in water management practices at an early stage—the early stage of managing one basin's water resources and the early stage of making individual plan and decision. They are currently the priorities of the Chinese water management, which provides the best political and social environment for adaptation mainstreaming. This chapter will illustrate and analyze how these two entry points could operate, based on the enabling legal and institutional environment established in the previous chapter.

Yet, an observant reader will notice that this choice of planning and EIA may be at odds with the bold declaration of the demise of stationarity. As important methods of managing water resources, planning and EIA are front-end, pre-decisional and dependent on the assumption of stationarity and predictability to respond to climate change realities.[3] It is vital to distinguish the method per se and the process of running this method. The contradiction we discuss here primarily refers to the inconsistency between the emerging climatic challenges and entrenched operating condition of these methods rather than methods itself. The task here, thus, is to examine existing presumptions, mentalities and approaches of implementing these methods, to see whether and how climate change impacts could be absorbed.

6.1 Key Entry Point One: Mainstreaming Adaptation in Water Planning

Planning, by definition, is a forward-looking, anticipatory and preventative instrument to achieve sustainable development through translating visions into actions and budgets.[4] Development planning is the process of setting goals for social, economic and environmental development, and designing strategies to achieve these goals

[3]Ruhl (2011, 1393).

[4]Fankhauser et al. (1999, 67–78).

through the distribution and management of available resources.[5] An appropriate water planning system could possibly provide the opportunity to gather information about water resources and values, to identify existing legal rights and interests, to evaluate present and future water needs and to set guidelines for future management and statutory decision-making.[6] The content and implementation of strategic water plans will largely determine the planning, investments and specific actions conducted under them. For example, the water distribution plan among different regions and sectors at the basin level will influence the planning of water allocation at the local level. In the same manner, the adaptation considerations in the basin level water plans could motivate the systematic consideration of climate change and adaptation in the subsequent planning stage, such as hydraulic projects planning and delta development planning.[7]

Generally, literature shows that the strategic stages of water planning are constituted of:

(1) baseline or situation investigation (understanding the water condition, and social, economic and environmental development situation in the water sector of a particular region);
(2) vision and goal setting (describing what water resources management in this region wants to achieve through planning);
(3) advantage and disadvantage identification (resources, opportunities, weakness and constraints in achieving the vision should be identified);
(4) priorities identification (among various water issues, which one should be given high priority);
(5) strategy and action formulation (developing a set of corresponding measures to achieve the targeted goals);
(6) monitoring and evaluation (tracking progress and measuring the achievements of water plan implementation).[8]

Meaningful water planning should be seen as an iterative process requiring periodic review and revision to provide guidelines and roadmaps for both the governments and the concerned communities. Mainstreaming adaptation requires adaptation factors to be identified and analyzed in each of above steps. Well-designed legal and institutional frameworks on water planning will stipulate responsibility distribution, water rights of different users, conflict resolution and goal assessment. In an adaptation context, these frameworks are expected to provide support for proactive and adaptive planning approaches and strategies. This part will start with the example of water plans in the Yangtze River Basin (YRB) and its consideration of adaptation factors. Given the requirement for adaptation mainstreaming, the following section of this part will analyze the shift

[5]OECD (2009, 163).
[6]Gardner et al. (2009, 273).
[7]UNDP-UNEP (2011, 47).
[8]OECD (2009, 165–166).

towards a more adaptive water management regime. The last section will focus on how various adaptation factors could be integrated in each planning step.

6.1.1 China's Concerns on Integrating Climate Change Impacts with Water Planning

Integrated water resources planning based upon the principle of sustainable development is a prerequisite and the first step for the effective implementation of IWRM.[9] All water-related projects and measures should take place within the context of the approved water plans, in which the predetermined objectives of maintaining the health of river and promoting sustainable water utilization are expected to achieve. Water planning is a multi-level and multi-time scale activity, which usually takes place at the national, basin, sub-basin and local levels.[10] In terms of managing Yangtze water resources, this part mainly focuses on planning at the basin level and sub-basin level, but the research outcomes here may provide insights for water plans at the lower levels.

According to the 2002 *Water Law*, water planning at a basin level mainly includes comprehensive water planning and that of specialized.[11] The former is about the strategic deployment of water resources exploration, utilization and protection, while the latter focuses on specific aspects such as flood prevention planning, water supply planning and irrigation planning. Comprehensive water planning is critical to set the vision, frameworks and guidelines for the specialized one. If there is regional water planning within a river basin context, it should also be consistent with the comprehensive planning. Comprehensive water planning of the YRB is compiled by the Ministry of Water Resources (MWR) and approved by the State Council.[12] Among the tributaries of the YRB, only the water planning of Tai Lake Basin identified with national significance needs to be approved by the State Council. Water plans of other tributaries crossing jurisdictions are conducted by the Changjiang Water Resources Commission (CWRC) together with related provincial water agencies, and approved by the MWR (see Footnote 12). In this case, the attitudes and capacity of these water-planning authorities (the MWR and CWRC) towards climate change impacts, largely, determine the status of adaptation mainstreaming in the water planning process.

Although there have been urgent appeals to formulate a comprehensive Yangtze water resource plan to support sustainable water development in the past decade, latest information shows that there has been no such plan in the YRB thus far. Until 2012, Yangtze water resource planning at the basin level has been guided by 'The

[9]Chen and Xia (1999, 507–516).

[10]Lebel et al. (2012, 9).

[11]Water Law of People's Republic of China (2002, art 14).

[12]Water Law of People's Republic of China (2002, art 17).

Report of the Yangtze River Basin Comprehensive Utilization Planning' formulated in 1990.[13] For more than two decades, this planning has provided important rules for the overall allocation and arrangement of Yangtze water resources. However, it emphasized the development and utilization of water and hydraulic resources with inadequate focus on water ecosystem conservation and protection. To reflect new changes in water resources and economic-social development in the past twenty years, 'The Integrated Yangtze River Basin Planning (2012–2030)' was approved by the State Council at the end of 2012, after five years of revision.[14] Later, 'The Integrated Tai Lake Basin Planning (2012–2030)' was approved by the State Council as well in order to promote the basin's water supply security, food security and ecosystem security.[15]

After reviewing the content of these new plans, it shows very weak evidence of climate change impacts consideration. A 'climate change adaptation lens' has not been widely adopted by water managers in the planning process. Nevertheless, before this new planning was approved, there were discussions and proposals to consider climate change impacts in the planning process. In 2007, the year the China's National Climate Change Program (CNCCP) was released, the conference on river basin planning revision identified some key points of climate change impacts for planning revision.[16] It articulated the need to analyze systematically the impacts of climate change and the rapid social-economic development in the YRB.

In addition, at another conference of reviewing the YRB plan organized by the MWR in 2010, the Vice Minister of the MWR (Jiao Yong) argued that the Yangtze River was vulnerable to water scarcity, floods, droughts and other extreme events due to the impacts of climate change.[17] Therefore, he recommended that planning of hydraulic infrastructure should be tailored accordingly in the comprehensive planning to improve their capacity in adapting to negative climate change impacts. He also proposed to consider water-related climate change impacts in the process of planning revision in one of his research articles (see Footnote 16). After analyzing the potential negative effects on Chinese water security as a result of the increasing intensity and frequency of extreme water events (floods, droughts and storms), the change in water availability and distribution as well as the change in water quality, he argued, must be considered in flood prevention planning, water utilization planning and project planning.[18]

Unfortunately, these discussions and concerns have not been reflected in the new basin and sub-basin plans, let alone those at lower levels. Although above illustrations show that the Yangtze water managers have recognized the climate change impacts on the river basin and the necessity to reflect them in water planning, the

[13]Wang (2005, 5–7).

[14]The Ministry of Water Resources (2013a).

[15]The Ministry of Water Resources (2013b).

[16]Jiao (2008, 10–3).

[17]China Water (2010).

[18]Ibid.

absence of climate change factors consideration concludes that there is a time gap between scientific awareness and policy change, as well as a disparity between theory and practice.

Furthermore, in-depth inspection reflects the 'research deficit' in climate change adaptation in China. Specific impacts of climate change, such as rainstorms, floods and sea level rise, are emphasized without understanding the vulnerability of the YRB as an ecosystem. Another apparent deficiency is that any preparation for climate change-induced disasters has not been considered. As an integral part of river basin planning and sub-basin planning, the incorporation of disaster preparation could enable governments and communities to enhance their resilience through disaster prevention, mitigation, preparedness and vulnerability reduction.[19] In addition, all these recommendations appear confined to theoretical suggestions such as 'consideration', without realizing the need for the transformation of current water management regime through policies, legislation and institutional settings.

To effectively mainstream adaptation in the Yangtze IWRM planning, this book argues that not only should the research on climate change adaptation be improved but that proactive tools and instruments should be developed to promote the regime shift in managing water-related climate change impacts. Both of these new plans have a long period (2012–2030), demanding periodic reviews to reflect the rapid changing economic and social developments. If the scientific understanding of climatic impacts, the cost of climate change impacts and adaptation, as well as the benefits of undertaking adaptive actions, are improved, it would be less of a political risk for policy makers to expand their attention and take adaptive measures. Therefore, the following sections will propose recommendations on how to mainstream adaptation considerations in the Yangtze integrated water planning, mainly from a legal dimension. What has to be emphasized is that these recommendations may also be applied in other river basin when mainstreaming adaptation in the water planning.

6.1.2 Developing Adaptive Water Management for Water Planning

Understanding Adaptive Management

Based on a stationarity assumption, the current water management regime in China is characterized by data collection, an assessment-based predict-and-control approach as well as an emphasis on expensive engineering solutions, in order to provide water security. Aiming to provide a strategic long-term vision (a decade or more) for water exploration, allocation and protection, water planning in the YRB relies upon a robust capacity to predict future scenarios and to assess the plan's costs and benefits. Unfortunately, both the uncertain, nonlinear and complex climatic, hydrologic and

[19]Khailani and Perera (2013, 616).

social systems (such as population growth, industrial growth and demographic changes) challenge this water management regime by making long-term prediction problematic. It would never be able to predict accurately the long-term climate change impacts, water demands, water availability or the specific legal and institutional responses which would be appropriate. Thus, addressing climate change risks in a changing society will ultimately require managing water resources in such a way that it is able to tweak and manage changes rather than merely resorting to prediction.

Under this circumstance, the adaptive management theory developed in the ecology field (especially in natural resources policies) has been employed to respond to this need. Despite its limitations, which have been noticed by some researchers, adaptive management has held 'real promises for creating the flexibility and strength that will be necessary to be resistant, resilient and adaptive in climate change.'[20] It intends to free decision-making process from setting rigid standards based on comprehensive rational planning to one of experimentation using continuous monitoring, assessment, iterative learning and recalibration.[21] In the decision-making process, it allows and assists water managers to act without complete knowledge and information, and to minimize uncertainties through monitoring, adjustment and collaboration. More importantly, it integrates the study of climate change risks with decisions regarding plan priorities and design, and then builds in opportunities for learning over time.[22] This is a 'learning-by/while-doing' approach which requires resources managers to

> monitor the outcomes of their choices and evaluate those outcomes in light of their conceptual understanding of the system, and adjust both their understanding and their next round of management choices accordingly.[23]

In terms of the definition of adaptive management, the one given by Pahl-Wostl will be adopted: 'adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of implemented management strategies.'[24] With an adaptive management approach, actions are treated as experiments rather than as final solutions.[25] It also has been regarded as a highly useful approach when addressing environmental problems (including climate change) collaboratively.[26] The main elements of adaptive management that are widely recognized are:

(1) revisiting and revising objectives periodically;
(2) integrating new conditions and information into future decisions;
(3) developing a range of management options;

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[20]Fischman and Rountree (2012, 19, 29).
[21]Ruhl (2011, 1388).
[22]Conrad (2012, ix).
[23]Doremus (2010, 80).
[24]Pahl-Wostl (2007, 51).
[25]Eng and Ma (2006, 155, 159).
[26]Ibid.

(4) monitoring and evaluating management actions;
(5) learning-by-doing;
(6) stakeholder participation.[27]

It shows an active culture of reflection, evaluation, collaboration and openness to learn by acknowledging the uncertainty and complexity of social-ecological systems.[28] In contrast to the traditional dominant front-end decision-making paradigm, which is heavily reliant on prediction, adaptive management is centered by revisiting, revaluation and iterative learning. This merit has made adaptive management as the most promising approach to address uncertainties on the climate change arena.[29]

Implementing Adaptive and Integrated Water Management

With respect to water resources management, adaptive management requires the development of a capacity to respond to changing water management scenarios, and emerging information, experiences and insights. The incorporation and application of adaptive management in the IWRM has been referred to as adaptive and integrated water management (AIWM) by some scholars.[30] To apply an AIWM regime in the integrated water planning stage, the following key elements should be developed in the plan-making process and implementation:

Ongoing assessment of climate change risks on Yangtze water resources

The pattern, magnitude and scale of climate change risks will change over time and could not be able to be estimated precisely. Thus, an ongoing process is needed to integrate the changes of climate change risks or the emerging risks into the planning process and its implementation.

Ongoing integration of new information, knowledge and experience

As more water-related climate change impacts manifest, new tools and research are developed, new information becomes available and new experience acquired, water plans should be adjusted accordingly to integrate and reflect these new changes. Due to the long-term vision of water resources planning, it is better to be updated periodically (varies from six months to five years) by relevant authorities to accommodate the changing natural, social and economic scenarios.

Monitoring and evaluating outcomes of water plans and implementation

Water planning makers and practitioners should monitor the implementation outcomes of planning to assess the extent to which strategies and measures are producing the intended effects (whether there are unintended effects and whether other factors are unexpectedly affecting the outcomes). Slightly different from monitoring, evaluation attempts to answer how and why these measures are, or are not,

[27]Panel on Adaptive Management for Resource Stewardship et al. (2004, 2).
[28]Tan (2010, 145).
[29]Camacho (2009, 40), Arivai (2006, 219).
[30]Huntjens et al. (2011, 263–284).

achieving the goals. This periodic assessment process is critical, for it is expected to reframe adaptive management by reviewing management assumptions, reshaping implementation procedures, revising outdated information and adjusting management strategies.

Adopting a bottom-up approach to incorporate a broader range of stakeholders

From above three aspects, it is clear that the collecting, sharing and assessing of relevant information and experience is a crucial process for river basin planning and adaptive management under the climate change context. Hence, mechanisms on stakeholder participation should be in place to bring additional information, experience and perspectives to bear, review proposed decisions, and the information upon which they are based, and to build support for the outcome that can facilitate implementation.[31] Stakeholder engagement, as argued by Saavedra and Budd, constitutes an integral part of local community's inherent resilience.[32] The traditional and indigenous knowledge of local residents could only play its optimal role if it is integrated in the planning and decision-making process. In that sense, a participatory water resources planning, both in the formulation process and in implementation process, is able to facilitate climate change adaptation as well as enhancing inherent resilience.

Although recognized as a conceptually promising approach to manage water resources under climate change, AIWM is possible to descend into 'a vague promise of future adjustments without clear standards'.[33] However, this difficulty should not be the pretext for discarding this adaptive approach. Instead, its adoption in future water management strategies increases the need for substantively legitimate support and procedural mechanisms. AIWM will be possible only if existing legal and institutional frameworks are reformed to establish flexible mechanisms and meaningful procedures to respond to the changing conditions and emerging information.[34] Furthermore, the implementation of AIWM also requires existing legal and institutional frameworks to provide a normative framework, through clarifying clear objectives and priorities, engaging stakeholder participation, providing underlying mandate for monitoring, preparing alternatives and periodic revision. Therefore, the integration and implementation of adaptive management through water-related laws and institutions is imperative.

Unfortunately, given the state of IWRM in the YRB and the understanding of adaptive management in China, implementing AIWM may be politically, socially and legally difficult for Yangtze water resource managers. The reality is often that the selection of an 'optimal' choice is based on social/cultural preference and political priorities, rather than on analytical theory and engineering design criteria. The traditional mindset about regulatory framework has been stability and certainty,

[31]Bruch et al. (2005, 6).

[32]Saavedra and Budd (2009, 246–252).

[33]Ruhl and Fischman (2010, 434).

[34]Bruch (2009, 100).

making the employment of flexibility very challenging. As a result, as Bruch et al. state, 'changing a legal framework is resource-intensive; changing it to reflect an underlying paradigm of continuous change and response may be all the more challenging.'[35] There is also concern that the flexibility and unspecified standards of adaptive management would allow authorities to delay or avoid taking actions,[36] especially given the political and social status of adaptation in China. A policy and legal transformation to practice a fully realized version of adaptive management may be too ambitious for Yangtze water managers at this stage of development.

However, even a compromised version of adaptive management could be helpful in making adaptive decisions to manage uncertainties and adjust implementation.[37] This book argues that integrating the core elements of adaptive management may be a humble but politically acceptable start. For example, if the understanding of ecosystem dynamics, the uncertainties wrought by climate change and the periodic revision of plans and dynamic monitoring are integrated in related water legislation and considered seriously by water managers, AIWM could inform and influence water-related plans and decisions. At the same time, it is necessary to raise the awareness of Yangtze water managers with respect to the nonlinearity, complexity and uncertainty of hydrological systems and climate change. Only if water managers are aware of the necessity and benefits of developing flexible and adaptive strategies and the need to improve adaptive capacity, can an AIWM regime be transformed from the conventional water management regime.

6.1.3 *Identifying the Entry Points of Mainstreaming Adaptation in the IWRM Planning Process*

Mainstreaming adaptation in the water planning is an ongoing and iterative process, which calls for the integration of adaptation considerations from the preliminary step of water status investigation to the stage of design and implementation, and to the last step of monitoring and evaluation.

Water resources investigation and assessment is the preliminary step of water planning to understand the carrying capacity of water resources and the aquatic environment. '*A Guide to Water Resource Assessment*' compiled by the MWR in 1999 and the '*Detailed Regulations about National Integrated Water Resources Planning Technology*' formulated by the MWR in 2003 are the main professional standard and statutory frameworks to conduct water investigation and assessment. Pursuant to their content, the projection of precipitation, evaporation, water quantity, water quality and water availability are the main aspects of comprehensive

[35]Bruch and Troell (2011, 839).

[36]Thrower (2006, 894).

[37]Ruhl and Fischman(2010, 427).

water resources investigation and assessment.[38] Climatic conditions have been considered as one of the factors affecting them, yet the incremental challenge from climate change has not been fully realized. The analysis of climate change impacts even is deliberately excluded by stipulating that 'the impacts on water resources due to the change in temperature and precipitation effected by greenhouse gas will not be analyzed'.[39]

In 2003, when this regulation was formed, climate change impacts on water resources were not so obvious that they could act as policy drivers. The technology of assessing and capturing water-based climate change impacts was not mature enough either. Ten years later, when current water management regime is apparently being challenged by climate change impacts and when the technology has advanced to a higher confidence level for water managers, this regulation about water planning should be revised to include climate change factors. It is only when climate change impacts are investigated and assessed in the first step that integrating them in the following planning steps is possible.

To mainstream adaptation in the water planning process, a 'climate change adaptation lens' should be applied to identify and assess adaptation considerations in each planning step.[40] The result of that is supposed to enable water plans to be more effective and robust in achieving their designed goals, even under different climate scenarios. Based on the basic steps of the water planning process illustrated earlier in this part, seven entry points are identified in order to manage water-related climate change impacts. By integrating the monitoring and evaluation results in the next round of planning revision and formulation, adaptation mainstreaming closes the loop and creates a cyclic process (Fig. 6.2). In most cases, the requirement that greenhouse gases (GHG) could be identified and reduced in the water planning is an integral part of the planning process.[41] Given the research scope of this paper, the mitigation of GHG in water planning will not be purposely investigated here unless it is necessary. These seven entry points in the water planning process are:

(1) Water resources investigation and assessment—climatic factors should be extended to include climate change impacts in order to reflect water-related climate change impacts.
The physical vulnerability of water resources and its related ecological system should be assessed to see the degree to which Yangtze water is susceptible to —and indeed able to cope with—the adverse effects of climate change. The projected climate change impacts on Yangtze water resources, such as the changes on precipitation, water quantity and quality, the frequency and intensity of floods and droughts, and the water availability should be carefully examined to provide a better understanding of water resources. This may be

[38]A Guide to Water Resources Assessment (1999), Detailed Regulation on National Integrated Water Resources Planning Technology (2002).

[39]Detailed Regulation on National Integrated Water Resources Planning Technology (2002).

[40]Lebel et al. (2012, 8).

[41]Conrad (2012, 6–7).

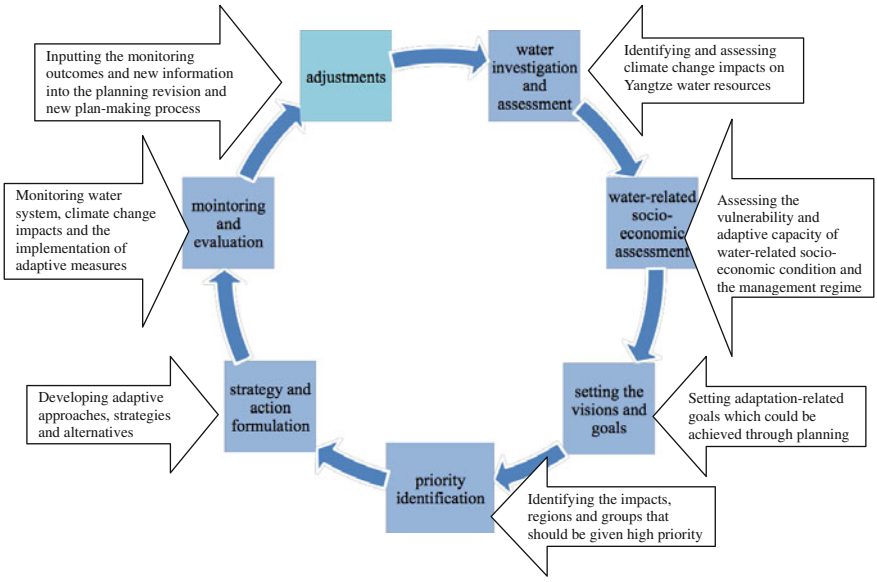

Fig. 6.2 The process of the integrated water planning after factoring in adaptation considerations

done by providing a range of estimated results, or specifying a confidence level (in terms of the scientific uncertainty), for projected climate impacts.[42] The impacts of future climatic risks should also be assessed as well to provide possible information for long-term water planning and strategies.

(2) Water-related social and economic condition assessment—this analysis and assessment is crucial to understand the capacity of water-related socio-economic conditions and the current water management regime in accommodating adverse climate change impacts.
This involves examining whether and how economic and social resources support or impede adaptation; the degree to which the current water management regime could deliver climate-proofing decisions; and what instruments or tools could be used to buffer those negative climate change impacts. This socio-economic vulnerability could be assessed according to a checklist ranging from very high to very low.
The assessment in (2) should be combined with that in (1) to delineate the overall vulnerability map throughout physical and socio-economic dimensions. This result will determine the priorities, tactics and approaches set in water planning in order to achieve the designed goals.

(3) Setting the vision and goals of Yangtze water planning—mainstreaming adaptation indicates to redesign the aim of planning.

[42]UNDP-UNEP (2011, 344).

In addition to the recognized IWRM objectives, the adaptation-relevant objectives (such as vulnerability reduction and adaptive capacity improvement of Yangtze water management regime and related economic-social system) should be another important goal in the water planning. Suggested crucial elements are: (a) to what extent the resilience of Yangtze water resources could be enhanced through planning? (b) To what extent current water management regime (such as the principles, mechanisms and approaches) could be reformed or transformed to increase the adaptive capacity? These goals should have certain flexibility for periodic review and revision rather than being 'locked in'.

(4) Priority identification—the mainstreaming approach requires identifying the adaptation priority and focus in water management practices.
Suggested new priorities may include: what types of impacts should be given high priority, for example, floods or sea level rise? Which water issue should be given special attention in the context of climate change, water quality or water quantity? Which group is more vulnerable and should be given special concern in the planning process? Which group or community should be identified as key stakeholders and should be engaged in the adaptation mainstreaming process?

(5) Strategy and action formulation—corresponding adaptation strategies should be developed to achieve the predetermined goal in water planning.
Proposals include but do not limit to: analyzing and selecting possible adaptation strategies; facilitating institutional coordination to build consensus among different water-related authorities; providing stakeholders with crucial knowledge and information in terms of managing uncertainties to advance their participation. Corresponding alternatives containing vulnerability reduction and adaptation strategies should be developed by planners to prepare for various climate scenarios. Not only can alternatives provide a comparison and evaluation among different methods achieving the same goal, can they also shift the attention of communities away from a narrow focus on water and climatic risks to a much wider ranges of strategic pathways of responding to climate change impacts through reducing vulnerability and improving adaptive capacity.[43]

(6) Monitoring and evaluating—dynamic water ecosystems and climate change impacts should be monitored continuously to estimate their effects on plan implementation.
Based on various scenarios, the scientific foundation and hypotheses of water planning should be tested. The effectiveness of adaptation strategies and approaches identified in the water plans should be evaluated periodically through monitoring and evaluation. The water plan should be evaluated to see the extent to which it achieves the objectives.

[43]Aerts and Droogers (2009, 92).

(7) Adjustments—this requires a 'learning-by-doing' mentality and approach which enables water managers and more widely, water users, to make timely adjustment and reform.
Emerging information and experiences after plan implementation should be integrated into goal assessment and next round of planning revision process; pre-set goals and strategies may then be revised according to the monitoring and evaluation outcomes.

The above entry points are only the generalized and speculative modules for mainstreaming adaptation in the integrated water planning process. Water planning at different scales, for different water issues and in different regions, should tailor its preferences and priorities to the realities based on impacts, vulnerability, adaptation assessment and socio-economic analysis. The approach of developing pilot programs and case studies would be helpful to find out certain applicable factors and criteria for adaptation mainstreaming. Given the conclusion reached in previous chapters, mainstreaming adaptation in the sub-basin level water planning process to identify effective experiences could be a good start. In the long run, whether, and to what extent, adaptation-related factors are integrated in the water planning process should be regarded as important criteria in the decisions about whether to approve the plan. This climate change adaptation lens is essential to ensure that IWRM plans to investigate, consider and address water-related climate change harms, from a preventative perspective.

6.2 Key Entry Point Two: Mainstreaming Adaptation in Water-Related Environmental Impact Assessment (EIA)

Water plans and projects may have effects on GHG emissions as well as the vulnerability of society to climate change impacts. Thus, there has been wide recognition at the international level that climate change indicators should be integrated in the designing stage of these plans and projects.[44] As an important environmental decision-making vehicle, an EIA methodology is required to be applied prior to the water plans/projects approval and commitment in order to assess and minimize potential significant adverse environmental impacts.

The EIA of hydraulic projects has made some progress in China but the EIA of water plans has been weakly implemented. However, both of them are facing multiple challenges in the context of climate change.[45] Developed and implemented

[44]Agrawala et al. (2010, 8).
[45]Jiang (2005, 8–10).

as an instrument to prevent environmental damage induced by plans/projects, EIA relies on a robust capacity to predict and assess environmental impacts of a plan/project, and does not put a premium on climate change impacts on the proposed plan/project and its operating environment. Climate change impacts at a large-scale and in a long-term are neither assessed, nor are climate-friendly and climate-proofing alternatives considered. However, for adaptation, analyzing the impacts of environment, especially the changing climate, is crucial and essential. Thus, it is important to survey whether fundamental methodologies of EIA and its practice can still play out for adaptation issues.

Based on these skepticism and questions, this part will discuss: (1) whether the underlying paradigms and tools for EIA are relevant and useful to manage climate change adaptation; and (2) how EIA could be modified to serve as an important entry point to gauge adaptation needs, identify adaptation inputs and manage uncertainties.

Chapter 3 has illustrated that climate change poses series of threats on the China's water quantity, quality, distribution, water infrastructure and the aquatic environment. This implies that if climate change impacts are not sufficiently considered in the EIA process, they will have a large potential to affect the actual performance of water plans/projects. Water plans may fail to achieve their goals, dams and reservoirs may be unable to respond to extreme disasters. Furthermore, in cases where plans/projects are designed and implemented under a particular circumstance or scenario, climate change impacts may paralyze these plans and projects by significantly changing their operating environment (see Footnote 44). For instance, the conduct of China's giant South-to-North Water Transfer project, which attempts to alleviate the dry situation of Northern China by transferring water from the abundant supplies of the Yangtze River, requires further review and investigation because some parts of the basin have been struggling with water deficiency and emerging droughts induced by climate change in recent years.[46] In contrast, if water-related climate change impacts are factored in the formulation or review process of these water plans/projects through EIA, the opportunities to support adaptation or increase resilience could be highlighted and the negative effects on the goal achievement could be prevented or managed.

Section 6.2 of this chapter will start with the theoretical introduction of EIA and its related legal framework in China. It then identifies the legal and institutional difficulties of mainstreaming adaptation considerations in the EIA modality. Against these difficulties, the following part tries to identify viable countermeasures based on the enabling legal and institutional environment established in Chap. 5, as well as the experimental practices in other countries. Existing practices of EIA are also analyzed to define the barriers and opportunities when mainstreaming adaptation.

[46]The climate change impacts on the China's River have been analyzed in Part A of Chapter 3.

6.2.1 EIA: A Preventative Approach to Protect the Environment from Climatic Harms

EIA was first introduced in the USA in 1969 as a mechanism which mandates that all levels of government decision-making for policies, acts, plans, programs, approvals and infrastructure projects, should undergo an assessment process to prevent and mitigate adverse environmental impacts.[47] It could take place at three different scales:

(1) policy level EIA—EIA that applies to national or regional policy, legislation of relevant laws and creation of high level economic development plans;
(2) plan or program level EIA—a lower level EIA that focuses on comprehensive or specific plan or program;
(3) project level EIA—EIA targets at specific construction projects.

The first two categories are usually catalogued as Strategic EIA (SEA), which envisage a broader vision of the relationship between the environment, economy and society.

Compared to the retrospective 'End of Pipe' treatment approach which responds to pollution reactively, and the punitive 'command-and-control' approach which advocates the setting of standards and rules enforced by pecuniary and criminal forms of punishment,[48] EIA is distinguished by its preventative nature. It has been demonstrated as an effective tool to assess potential environmental impacts and to prevent those negative ones. The requirement that a comprehensive EIA should be conducted prior to the final approval of a plan/project is a significant addition to the development of environmental laws.[49] This requirement, if effectively implemented, enables environmental impacts to be given equal consideration in the assessment of social, economic and environmental impacts.[50] In addition to its potential benefits in balancing short-term economic development and long-term environmental protection, other advantages of EIA include disseminating knowledge and information, educating the public and reshaping the decision making process. Over 100 nations have unilaterally adopted EIA,[51] including China.

China has more than three decades of experience in researching and practicing EIA. EIA in China is defined as an approach and procedure to analyze, predict and evaluate potential environmental impacts, to identify effective measures for preventing and reducing adverse impacts and to monitor activities.[52] In China, EIA is

[47]Christopher (2008, 551).
[48]Jeffery (2006, 451).
[49]Ruhl (2010, 413).
[50]Bates (2010, 307).
[51]Gao (1999, 20).
[52]The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 2).

mainly applied to plans and projects.[53] A relatively comprehensive legal framework has been established in China since the concept of EIA was introduced in 1973. Reviewing the evolutionary process of crucial EIA legislation helps us to understand the characteristics and problems of EIA implementation in China.

In the trial version of the *Environmental Protection Law* (1979), EIA was given legal status as an important environment management approach. The 1998 *Regulations on the Administration of Construction Project Environmental Protection* has served as the basic legal foundation for the project-level EIA. Nevertheless, it was not until *The Law of the People's Republic of China on Environmental Impact Assessment* (EIA Law) in 2003 that certain plans are required to conduct EIA. Later on, the *Interim Procedures of Public Participation in EIA* (IPPP) was released to provide a detailed procedure for public involvement in the EIA process. Being aware of the deficiency of EIA Law in promoting plan-level EIA, the *Regulation on Planning Environmental Impact Assessment* (RPEIA) finally took effect in 2009. Based on this framework, the recent years have witnessed a rapid extension and development in the application of plan and project EIA. For instance, after more than ten years of implementation of EIA Law in China, approximately 500 plan-level EIAs have been undertaken which, according to some commentators, represents a remarkable progress.[54]

According to the EIA Law:

> competent departments under the State Council, the local governments or their competent departments at or above city level shall organize environmental impact assessment and compile the environment impacts while making land utilization related plans and plans for construction, exploitation and utilization of regions, basins and sea areas.[55]

Article 8 of this law also stipulates that when formulating special plans for energy resources, water conservancy and natural resources exploitation, EIAs should be organized before submitting the draft of special plans for approval.[56] These provisions denote that both comprehensive water planning at a basin and sub-basin level and specialty water planning should conduct EIAs to assess their impacts on the environment. However, as pointed out in the beginning of this part, adaptation requires assessing the impacts of the environment, which entails a reflective discourse of EIA mentality and methodology.

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[53]In Chinese, Guihua can represent both plan and program. In this article, the term plan will generally refer to plan and program.

[54]Bina et al. (2011, 515).

[55]The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 7).

[56]The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 8).

6.2.2 Identifying the Difficulties of Mainstreaming Adaptation in the EIA

The Legal and Institutional Difficulties of Mainstreaming Adaptation

The legal challenges to EIA theory and implementation presented by adaptation mainstreaming mostly refer to the dilemma brought by the requirements of climate change adaptation and the original intention of EIA methodologies.

Based on the stationarity assumption that the surrounding environment of a plan/project is stable, stationary or constant, EIA premises that all the individual and cumulative environmental effects caused by and affecting that action over time can be dependably predicted at the time the action is designed.[57] Thus, EIA is primarily designed to identify and mitigate the proposed plan/project's impacts on the environment, rather than the impacts of environmental change on the plan/project.

In that case, only those plans/projects having potential adverse environment impacts are screened to commence the EIA process. 'Environmentally benign' plans/projects are therefore not considered, even though they may be vulnerable to climate change impacts.[58] In the technical guidance of planning EIA, GHG emission has already been clearly listed as one of the environmental objectives and assessment indictors of regional planning, land-use and urban planning.[59] More research outcomes and government conferences have called for the integration of GHG emission control in EIA legislation.[60] By contrast, the climate change impacts on proposed plan/project where adaptation measures are needed have not been paid adequate attention.

Under current EIA paradigm, water plans/projects sensitive to the climatic risks and changing scenario are not screened. As mentioned in the previous part, the technical guidance of water planning excludes the analysis and assessment of water-related climate change impacts (see Footnote 39). Neither are those which may increase vulnerability to the surrounding (natural and social) environment or encourage maladaptation (for example, those water projects that may stimulate activities in flood-prone area). Employing EIA as a tool to tackle adverse climate change impacts requires developing our understanding of the surrounding environment and revisiting (and revising) extant EIA legislation about triggering mechanisms to extend the screening process to include climate sensitive water plans/projects, as well as those that may increase climate change vulnerability.

Furthermore, in the process of EIA, climate change factors are not taken into account. For example, during the environmental baseline investigation stage—an indispensable step of EIA—climate change impacts, such as the rising temperature, changing precipitation pattern and the intensity and frequency of extreme weather

[57]Ruhl (2010, 378). Quoted from Holling et al. (2005).

[58]OECD (2009, 123).

[59]Technical Guidelines for Plan Environmental Impact Assessment (2003).

[60]See, e.g. Shi et al. (2012, 55–58).

events are not scoped and assessed. In addition, the vulnerability and capacity of the socio-economic system relating to water plan/project in responding to climate change impacts is not listed as part of environmental baseline investigation and assessment (see Footnote 59). This may not provide meaningful and correct foundations to identify appropriate adaptation needs and measures. Factoring climate change considerations in EIA requires reviewing, redesigning and modifying assessment indicators, revising regulations and recalibration to reflect the adaptation requirement in the EIA process. The complexity, nonlinearities and uncertainty inherent in changing climatic dynamics, environmental feedbacks and their interactions is at odd with our conventional EIA paradigm, acting as another impediment for the mainstreaming process.

From an institutional perspective, inputting adaptation factors also presents some challenges to EIA decision-making and implementation. As presented in Chap. 3, there are two separate institutional systems in managing environmental issues and climate change issues. This could generate a series of institutional difficulties when mainstreaming adaptation issues which may cut across multiple fields of environmental protection, adaptation, water management and climate forecast. For example, environmental agencies are responsible for approving the EIA of some basin and local water plans, whereas climate change and adaptation-related technology and information are mainly managed by the development agencies (development and reform commissions) and meteorological agencies. Integrating climate change considerations in the EIA entails much greater power and authority of environmental agencies to assess those water plans/projects proposed by the water agencies and development agencies. Meanwhile, a cooperative mechanism among them is demanded for environmental agencies to collect adaptation-related information in order to assess vulnerability and adaptive strategies. In practice, the limited institutional capacity of environment-oriented environmental agencies due to their marginal position, limited power and inadequate resources has restricted them from supporting climate-proofing water plans/projects and challenging those vulnerable to climate change impacts.

Difficulties of Assessing Climate Change Impacts on Individual Water Plan/Project

To assess climate change impacts, one of the key challenges is whether impacts-related information is meaningful and robust enough to be translated in the EIA process. Firstly, many climate change impacts cannot be tracked through existing databases or records. The scientific uncertainty relating to the probability, magnitude, timing and location of climate change impacts will challenge the EIA community who is accustomed to taking initiatives on the premise of certainty and has not developed appropriate technical and information capacity of uncertainty management. Furthermore, in terms of the impacts of climate change on an individual plan/project at various spatial levels, there are even more difficulties due to the lack of advanced technology on downscaling. The underdeveloped understanding and information on local vulnerability also creates difficulty in assessing the resilience of proposed water plans/projects.

Difficulties in Separating Climate Change from Climate Variability

Derived from the stationarity assumption, China's current EIA legal framework has listed climate variability as an important parameter in water resources baseline investigation.[61] However, in order to factor climate change impacts in the EIA, it is necessary to first discern climate change from climate variability. Unfortunately, drawing a clear boundary between them has been revealed scientifically and technically difficult. Climate variability reflects a year-to-year fluctuation in the climate record, while climate change is an alteration of the composition of the global atmosphere and is *in addition to* natural climate variability observed over comparable periods.[62] Climate variability may be tracked and predicted through historical databases or scientific models, whereas for climate change, the past has an uncertain impact on the future, and is therefore of little help in the prediction of future trends. Compared with climate variability, climate change is projected to present impacts at a much larger scale and with more diverse forms through changes in precipitation, evaporation and temperature.[63] It is also acknowledged that climate change and its impacts distinguish themselves from climate variability by their larger-scale uncertainty, complexity and cumulative effects.

Nonetheless, they are qualitative rather than quantitative descriptions—to what extent climate change is different from climate variability is very difficult to measure. For example, current EIA has failed to effectively address the cumulative effects of proposed plans/projects due to lack of coordination and cooperation among different sectors and agencies.[64] The new cumulative effects caused by climate change on a new scale worsen this deficiency.[65] Unfortunately, it is not always easy to discern whether cumulative effects are a result of climate variability or climate change. In some cases, cumulative effects may modify parameters of climate variability and then affect the performance of a plan/project.

Notwithstanding these theoretical difficulties, this book will attempt to explore the potential of EIA in screening, assessing and mitigating adverse climate change impacts on water plans/projects, through reviewing EIA legislation and obtaining references from other countries.

6.2.3 Approaches of Mainstreaming Adaptation in the EIA

There are gaps between intention, operational guidance and actual implementation.[66] Through expressing its intention to address climate change in the

[61]Fan and Zhou (2008, 192–193).

[62]*United Nations Framework Convention on Climate Change*, opened for signature 9 May 1992, 1771 UNTS 107 (entered into force 21 March 1994).

[63]Malone and Brenkert (2009, 8–45).

[64]Shen (2004, 356).

[65]Zinn (2007, 80).

[66]Agrawala et al. (2010, 13).

planning/design stage and project construction process but without specifying how to do that, China is clearly on the first stage only.[67] As an important instrument applied in the planning and designing stage, EIA is not clearly identified as one of the approaches to address adverse climate change impacts. In this section, recommendations will be developed towards operational guidance and actual implementation for factoring adaptation into EIA. This will need a series of adjustment or development of existing EIA legal and institutional framework. Meanwhile, this book acknowledges that research in this area is in its infancy and the innovative recommendations require further efforts to test in order to develop effective strategies and approaches.

Canada is probably one of the few leading countries considering climate change factors in its EIA paradigm.[68] It requires the assessment of climate change impacts for major development projects, including climate change impacts on the project and the impacts of the project on GHG emissions. The Canadian Environmental Assessment Agency (CEAA) promulgated 'Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners' in 2003 to provide guidelines for EIA practitioners. Although challenges remain after years of practice,[69] Canada has gained relatively rich experiences on this topic. In this part, Canada will be used as a comparative example to see how it overcomes the aforementioned difficulties and to use EIA as a tool to address climate change issues. Its experiences are supposed to provide valuable insights for Chinese water managers when employing EIA to manage adverse water-related climate change impacts.

Identifying the Possibility of Mainstreaming Adaptation in EIA Laws

The objective of EIA is to prevent and mitigate adverse environmental effects brought about proposed plans/projects, which means those that may increase GHG and vulnerability should be included. More importantly, EIA entrusts decision-makers and proponents with the flexibility and discretion to design their own environmental stewardship strategies. Procedural compliance by setting out well-defined steps is imposed on responsible agencies, rather than substantial outcomes or goals.[70] This intrinsic flexibility in the EIA legislation provides an opportunity for incorporating climate change impacts.[71]

Furthermore, the adoption of the principle of sustainable development and the precautionary principle provides the legal foundation for considering climate change adaptation in EIA. Pizarro articulates that:

[67]The Twelfth Five Year Plan for National Economic and Social Development (2011, Chap. 21).
[68]Agrawala et al. (2010, 14).
[69]Byer and Yeomas (2007, 85).
[70]Tang et al. (2007, 244).
[71]Christopher (2008, 553).

> sustainable development is perhaps the most appropriate conceptual and practical framework to identify problems, to involve the public, and to devise strategies to deal with climate change mitigation or adaptation in communities large or small in countries of the 'First' or the 'Third World'.[72]

In order to promote sustainable development, decision makers are required to identify those obvious climate risks and take any appropriate countermeasure. In both Canada and China, EIA has been regarded as a powerful tool to help decision makers achieve the goal of sustainable development.[73] The EIA Law in China provides the possibility to consider climate change risks by stating that 'the environmental assessment report should include the analysis, prediction and evaluation of *likely adverse environmental impacts* and measures for the prevention or reduction of the impacts' (emphasis added) (see Footnote 55). Although climate change is not viewed as a typical environmental issue, its impacts on ecosystems have resulted in severe environmental problems. This open-structured provision enables decision makers to consider climate change impacts and possible measures to protect the environment.[74]

One of the central assumptions in this book is that uncertainty will prevail in the decision-making and implementation process, and that we need to learn to embrace it. According to the analysis of the precautionary principle presented in the previous chapter, a lack of scientific certainty should not be used as an excuse to postpone cost-effective measures to anticipate, prevent or minimize adverse effects of climate change. Compared to current preference of 'sound science' in public policy, the precautionary principle requires decision makers to adopt a more cautious approach by changing embedded statutory thinking and information demands to embrace uncertainty.[75] By assessing and mitigating environmental impacts at a very early stage of plans/projects, EIA acts as a significant legal method to manage climate-related uncertainties through its underlying paradigms such as alternatives, evaluation and dynamic monitoring. Recently, the precautionary principle has been stipulated as a requirement under the Canadian Environmental Assessment Act 2012 (Canadian Act),[76] while in China's EIA legislation there is no mention of it.

Approaches of Managing Climate Change Uncertainties

Accommodating inherent climate change uncertainty is the most important but also the most challenging part when incorporating climate change factors in EIA. Canada acknowledges that climate change uncertainty has not been addressed very well in its own jurisdiction, and the CEAA has funded comprehensive research to address it (see Footnote 69). With regard to China, there may not be sufficient

[72]Pizarro (2009, 227–229).

[73]Canadian Environmental Assessment Act, SC 2012, s4 (1) (h), The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 1).

[74]Durrant (2010, 220).

[75]Godden and Peel (2010, 239).

[76]Canadian Environmental Assessment Act, SC 2012, s4 (2).

information and technology to predict climate change impacts, especially when downscaling to an individual plan/project in a particular region. Therefore, in addition to advancing the research and technology on climatic impacts assessment, developing local and regional climate models is also crucial to increasing the confidence in the accuracy of the predictions. Furthermore, developing the understanding and assessment of the vulnerability of local environment and community is another vital approach to reducing uncertainty of assessing climate change impacts on individual plan/projects.

Moreover, as recommended in the last chapter, a cooperative mechanism (for example, dialogue and communication) among the National Development and Reform Commission (NDRC), the China Meteorological Administration (CMA) (they have the most advanced technology and information on climate change predictions) and the MEP could benefit the EIA process when assessing climate change impacts. More importantly, local experience and traditional knowledge could contribute to the identification of climate change considerations significantly. The Canadian Act requires that community knowledge and aboriginal traditional knowledge should be taken into account,[77] which relies on effective stakeholder and public participation. Relevant responsible authorities in Canada are even obliged to establish a participant-funding program to support public participation.[78] Those who are directly affected, who have community or aboriginal traditional knowledge and those with relevant expert knowledge can apply for this funding.[79] By incorporating informal knowledge on climate change into the decision-making process, this stipulation in the Canadian Act could greatly contribute to uncertainty reduction. The proposals to increase local governments' role, develop local community participation and improve public participation in Chap. 5 could benefit the input of local information in EIA process in China.

Second, Canada employs adaptive management as a learning tool to address climate change uncertainties. It realizes that uncertainty about vulnerabilities and risks can be reduced by data gathered from personal experiences; however only if these experiences are identified and passed on (to others) can it benefit other projects.[80] As the most promising approach to address uncertainties in the climate change arena, adaptive management 'requires the internalization of the ability to identify, document and disseminate best practices, and the ability to learn from emerging experiences with adaptation strategies and actions'.[81] Chinese EIA practitioners could start by adopting and implementing some of the basic elements of adaptive management, such as periodic review of objectives and learning from experiences.

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[77]Canadian Environmental Assessment Act, SC 2012, s19 (3).

[78]Canadian Environmental Assessment Act, SC 2012, s57, 58.

[79]Canadian Environmental Assessment Agency, *Basics of Environmental Assessment*. http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=B053F859-1#gen01.

[80]The Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment (2003, 20).

[81]Patwardhan et al. (2009, 222).

Third, preparation of alternatives is crucial to make optimal choices and reduce risks associated with uncertainty. Climate change is an issue involving various aspects such as social choice, economic growth and environmental protection. The consideration of alternatives exhibits the opportunity to consider different ways of achieving certain goals or addressing certain issues,[82] and subsequently selecting the most effective and efficient one. Different climate change scenarios presented by current climate change science require preparing and assessing alternatives that achieve the same goal in order to provide resilient choices. In that case, when proposed actions fail to deliver their development outcomes due to unexpected climate change impacts, feasible alternative options at hand could provide proponents with proper remedial measures at an early stage. Given the intrinsic uncertainty associated with climate change risks, the adoption of alternatives indicates a higher adaptive capacity to respond to these uncertainties and surprises.

Canada have adopted and implemented the first two approaches to incorporate climate change factors in EIA. In the Canadian Act, environmental assessment of the designed project is asked to take into account the 'alternative means of carrying out the designated project that are technically and economically feasible, and the environmental effects of any such alternative means'.[83] While mainstreaming adaptation issues in the EIA, it is suggested that technically and economically feasible alternatives are required to prepare for different climate change scenarios. Since there is currently no clear legal requirement to consider alternatives, developing relevant provisions of EIA legislation in the climate change context will be very essential for China.

Assessing Climate Change Impacts on Proposed Plan/Project and its Environment

For the purpose of EIA, Nova Scotia in Canada identifies three layers of climate change impacts in a hierarchical system:

(1) primary—temperature changes;
(2) secondary—for example, changes in sea level, wind and precipitation patterns, with increasing frequency and intensity of climatic events;
(3) tertiary—changes in physical, biological and social patterns.[84]

In light of that, EIA in Nova Scotia undergoes a systematic consideration of climate change in three layers:

(1) changes may occur to primary and secondary climate parameters;
(2) impacts of those changes on the Valued Environmental Components within the boundaries defined for the EIA;
(3) changes to the project itself.[85]

[82]Posas (2011, 115).
[83]Canadian Environmental Assessment Act, SC 2012, s19.
[84]Bell et al. (2003, 5–6).
[85]Ibid.

Inspired by that, this book argues that EIA under a climate change context should be understood and assessed in an interactive way where the plan/project and its surrounding environment could affect each other. Based on different coupling models between the surrounding environment and plan/project, climate change impacts could trigger three different types of interactive patterns:

(1) impacts on the plan/project, mainly the operation and life of plan/project (climate change impacts → plan/project);
(2) impacts on the environment and the social condition where the plan/project operates due to the impacts on the plan/project (climate change impacts → plan/project → environment);
(3) direct impacts on the environment and social condition which may affect the plan/project (climate change impacts → environment → plan/project).

Type (1) is the simplest assessment of impacts on plan/project where surrounding environment is not influenced. Type (2) mainly could be translated to the resilience of plan/project to see whether they could respond to climate change impacts without affecting the public and the environment. Another dimension of type (2) is to see whether proposed plan/project could increase or reduce the vulnerability of surrounding natural and social environment. Type (3) needs to detect the vulnerability of the surrounding natural and socio-economic environment which either supports or impedes plan/project to achieve its goal. It is clearly shown that both (2) and (3) scenarios entail a social impacts assessment paradigm where the social impacts of the plan/project and the social vulnerability of local community is assessed. The coupling effects between plan/project and the surrounding environment could interact with each other, producing different cases and responsive measures. For example, if the plan/project is not robust enough to absorb climatic risks and the risk of climate change affecting the public environment are high, risk assessment, monitoring and adaptive management measures should be undertaken to reduce risks or minimize the adverse impacts (see Footnote 80). While in cases where the plan/project is sensitive to climate change impacts but the environment has a low risk against climate change, only normal EIA procedure is required.

EIA in China can benefit from Canada's experience of identifying, assessing and managing these three types of climate change impacts. Whether climate change impacts will compromise the integrity, effectiveness or longevity of current plan/project directly or indirectly should be appropriately identified. First, to assess climate change impacts on the proposed plan/project, EIA in China should redesign its parameters and procedures to integrate climate change factors. Plans/projects sensitive to climate change effects (for example, precipitation, water levels, wind and temperature) and those that may create barriers for adaptation should be screened and identified. Second, based on the assessment of climate change impacts on the plan/project, proponents should detect whether the surrounding environment will be affected indirectly through the plan/project. Some may increase the vulnerability level of the surrounding environment or encourage maladaptation activities. Third, since the sensitivity of the surrounding and enabling environment to climate change may affect the performance and duration of the plan/project, their

vulnerability and adaptive capacity should be assessed as well. Here, dam construction will be used as an example to illustrate how these different patterns of climate change impacts could influence the proposed project and the environment in which the project operates:

(1) The impacts of climate change (such as changing precipitation pattern) on the dam should be assessed.
(2) If the proposed dam might be severely affected by changing climatic parameters, failure in controlling floods for example, its impacts on the surrounding environment should also be assessed. For example, how floods may affect local people and environment.
(3) The surrounding environment's vulnerability (for example, to what extent is this region prone to floods and to what extent regional water or climate policy supports adaptation) needs to be assessed to understand how the environment may affect the operation of the proposed dam.

Improving the Monitoring and Following-up Mechanism to Provide New Inputs

Being aware that climate change related knowledge, technology, policy and legislation are evolving and that it is necessary to incorporate new lessons learned into routine procedures, Canada has highlighted the importance of monitoring and following-up mechanism in the EIA process (see Footnote 80). Here, this mechanism could enable new information and lessons to be integrated in EIA procedures to shape forthcoming steps—a 'learning by doing' paradigm. Although a monitoring and following-up mechanism is stipulated in China's EIA legislation, it does not include much focus on integrating new information or lessons by taking a 'learning by doing' attitude.

Relying on a robust capacity to predict and assess the environmental impacts of plans or construction projects and their overall costs and benefits, Articles 15 and 27 of China's EIA Law require all EIAs to carry out assessment to monitor possible adverse environmental impacts. Should adverse environmental impacts become apparent during implementation, mitigation (this 'mitigation' is different from that of 'climate change mitigation') measures must be put forward.[86] Based on an equilibrium model of the ecosystem and with the assumption of long-term ecosystem stationarity, these provisions rely heavily on human capacity and knowledge to predict and manage various scenarios.[87] The aim of following-up assessment is to monitor whether the implemented measures have led to the achievement of the pre-established goals. It is a linear process, which involves two steps: developing (decision-making) and implementing (see Footnote 34). Although originated as a preventative approach, EIA in this provision is more of a reactive method in alleviating predicted impacts. In addition, this provision is also based on

[86]The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 15, art 27).
[87]Ruhl (2011, 18).

the premise that existing technology and knowledge has the capacity to predict possible impacts, which has already been discredited either because of a lack of a data collection procedure or because specific causation is inseparable from vast cumulative emissions contributions in an increasingly warming world.[88]

In order to improve the capacity to tackle uncertain risks triggered by climate change, subsequent suggestions are to be followed. First, monitoring should be targeted to provide valuable data and information to evaluate and shape the decision-making process rather than solely concentrating on the environmental status and potential predictable impacts. While current monitoring and following-up assessments primarily emphasize inevitable environmental externalities, future climate change risks which may present in an unpredicted and surprising way should also be properly monitored and managed. The monitoring results should be employed by decision makers and practitioners to assess whether there is any unintended impact or whether other factors are unexpectedly affecting the outcomes. Where there is interplay between corporation law and environmental law, this effectively requires companies to address adverse findings in environmental audits and to revamp their procedures on decision-making accordingly.

In addition, rather than assuming that all impacts can be predicted and assessed before the decision, an effective following-up mechanism requires proponents to incorporate emerging information, knowledge and lessons within an ongoing decision adjustment process. As analyzed in earlier chapters, due to limitations of climatic science and technology, it is essential to engage potentially affected stakeholders and the public in the decision-making process, to transfer related information, knowledge and experience. A 'learning by doing' attitude is crucial for proponents in China to constantly collect and integrate emerging information and lessons and consequently reshape future decision-making. This new following-up assessment mechanism is expected to adapt to changing situations more effectively without changing the goals of EIA.

Inputting Climate Change Adaptation Factors in EIA Steps

To factor in climate change adaptation, the entry points to integrate climate change parameters should be identified at each step of the EIA process. This integration does not necessarily result in a fundamental modification of the EIA process. Nevertheless, it will change some of the parameters and criteria of EIA. For China, where some of the key procedures are not effective and well-implemented (for example, alternatives and public participation), it also requires an improvement of EIA per se. Different water plans and projects have different entry points when inputting climate change factors, depending on the manner in which they are interacting with climate change impacts. For example, glacial melting and emerging droughts in the upper Yangtze River might act in a cumulative fashion, not only affecting the development and implementation of the proposed water plan/project but also changing the natural environment where plan/project operates. In this case,

[88]Christopher (2008, 565).

both climate change impacts and environmental impacts on the initiated water plan/project should be identified, assessed and mitigated.

Although EIA procedures vary slightly between plans and projects, the majority of them follow the same flow from screening, scoping to implementation and monitoring. Therefore, this research will analyze how adaptation considerations are considered in the following six EIA steps:

(1) Screening: this is the stage to decide whether there are adverse environmental effects and whether EIA is needed after a proposed water plan/project is submitted for approval (see Footnote 55, 56). Water plans/projects in vulnerable regions, or sensitive to climate change impacts, should be selected in this step. Those may increase vulnerability to natural or social environment, or of local communities should be targeted as an important component of adverse environmental effects.

(2) Scoping: EIA action outline is prepared in this step to set the parameters of the assessment and to determine which information will be included in the EIA process and report. It mainly comprises the following sub-steps: the initial analysis of a plan/project; investigation of environmental baselines; identification of significant impacts; establishment of the action-classes for each individual impact (depending on whether the adverse impacts are significant or not); and preparation of an EIA action outline.[89] This is a pre-procedure before formal impact assessment is conducted. Relevant climate variables and impacts to initiatives or the environment should be identified. More detailed regional and site-specific climate change information will be collected. EIA practitioners should develop a matrix to rank the plan/project's (and the environment's) sensitivity to various possible climate variables in a range of very low/low/medium/high/very high, using the most available and relevant climate change information. Appropriate objectives and criteria are set up based on this rank. Those with a lower rank of sensitivity may not require additional impact assessment.

(3) Conducting EIA: in this stage, the environmental baseline is analyzed, environmental impacts are predicted and assessed, and the mitigation measures are proposed. With regard to climate change, climate change impacts on water resources and associated environment, as well as impacts on the plan/project should be identified in detail to provide meaningful and reliable environmental baseline. In this baseline investigation, the vulnerability and adaptive capacity of affected communities is best measured to map the extent to which they could respond to adverse climate change impacts. This is a crucial entry point to consider and assess the impacts of climate change on a water plan/project. According to different sensitivities categorized in the scoping stage, those with high sensitivity or risks are required to assess the magnitude and manner of the impacts on the plan/project and its performing environment. For possible

[89]Wang et al. (2003, 555).

adverse outcomes, effective and efficient measures must be taken to reduce the plan/project's vulnerability and climatic risks.

The above analysis will produce an EIA Statement (EIS) which is the formal document of the findings of baseline analysis, impacts assessment and mitigation measures.[90] Based on this document, environmental agencies shall then make informed decisions.

(4) Alternatives: alternatives are crucial to compare different paths of achieving the same goal but often are weakly implemented in the case of China's EIA. Adaptation requires that a reasonable range of alternatives to reduce different scales of vulnerability under different climate change scenarios should be prepared. Meanwhile, it is important to realize that the analysis and assessment of the effects and vulnerability of alternatives are also crucial.

(5) Decision-making: environmental agencies will decide as to whether or not to grant the permission of plan or project from the perspective of environmental protection,[91] after weighing and reconciling economic and social considerations with the environmental issues identified previously. When making decisions, climate variables should be given equal weight with other environmental factors in assessing the proposed plan/project. In addition to the environmental consideration, the vulnerability to climate change should be another benchmark for decision-making. If a proposed plan/project is permitted, mitigation measures should be put in place to reduce the plan/project's vulnerability.

(6) Implementation, monitoring and following-up: when a plan/project is implemented, mitigation measures of reducing vulnerability or risks of climate change should be undertaken at the same time. Following that, the practitioners should monitor and evaluate the performance of a plan/project and the effectiveness of mitigation measures. If adverse impacts become obvious during the implementation, countermeasures must be put forward immediately.[92] Climate change impacts and adaptation measures require dynamic monitoring. Due to the uncertainty associated with climate change impacts, the adaptive management approach is better implemented so as to input emerging information and lessons, which could be able to shape the next round of EIAs or the review process of the plan/project.

While factoring in adaptation considerations, other underlying EIA paradigms such as public participation and expert consultation are implemented in appropriate stages. The recommendations provided earlier, such as local knowledge input and

[90]Not all the projects need to prepare EIS. According to the degree of impacts, some of them only need to prepare environmental Impact Form or Environmental Impact Registration Form. For the plan level EIA, a more detailed elaboration Environmental Impact Chapter is required.

[91]The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 13, 14).

[92]The Law of the People's Republic of China on Environmental Impact Assessment (2002, art 15).

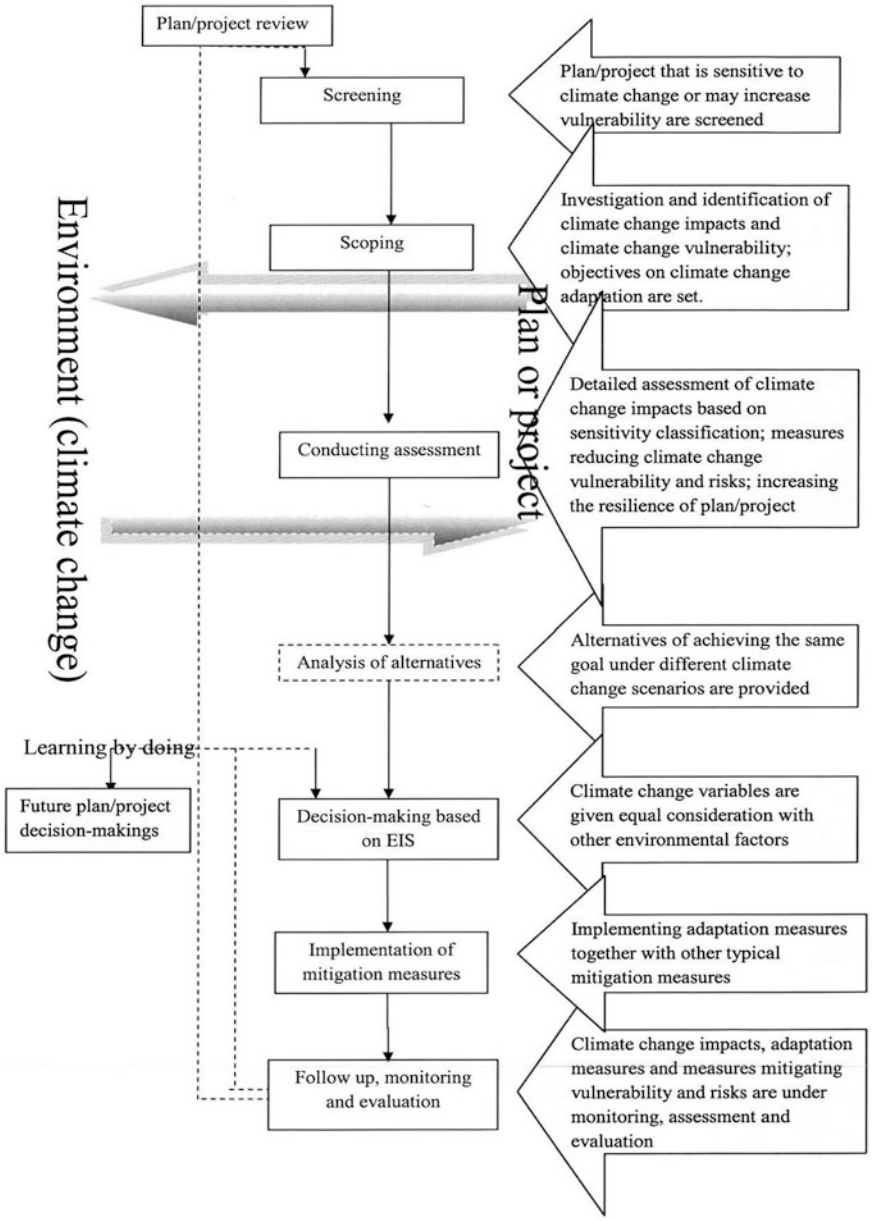

Fig. 6.3 An improved EIA process after factoring in climate change adaptation

collaboration among authorities concerned should underlie the process of EIA. After inputting the climate change factors, an interactive and dynamic relationship between the proposed plan/project and the environment can be built (Fig. 6.3).

6.2.4 *Difficulties and Opportunities of Implementing Adaptation Mainstreaming in the EIA*

While above recommendations about factoring adaptation in EIA are innovative and ambitious, putting them into practice is also challenging, especially given the performance of EIA in China. After reviewing the legal framework on EIA, it is revealed that China has developed its own version of EIA which mainly includes plan-level and project-level EIA. The current EIA Law is a compromise between the original EIA theory and China's specific political and social conditions—policy level EIA is absent, public participation is not institutionalized and the requirements of alternatives are understated.[93] These deficiencies in the design not only hinder the effective operation of EIA in China but also impede the meaningful mainstreaming of adaptation considerations in the EIA process under the context of climate change.

Nonetheless, a challenge does not always have negative implications. In Chinese, *weiji* (meaning both challenge/crisis and opportunity) is one word, indicating that challenge and opportunity interact with each other and can transfer to the other. As one study argues, 'climate change is the latest evidence of our failure to exercise proper stewardship, and constitutes a critical opportunity for us to do better'.[94] In many instances, climate change only reinforces the need to take measures that should be implemented.[95] Decision makers in China should respond to the challenges brought by climate change and transform them into opportunities for EIA improvement. Therefore, in this part, the barriers to climate change consideration in EIA will be illustrated first, followed by a consideration of the opportunities it provides.

The Missing Target of Policy and Some Plan Level EIAs

Unlike EIAs in the U.S., which developed from and focus on proposed state agency actions including policies, legislative proposals, plans, programs and projects,[96] China's EIAs were initiated from, and mainly focused on, construction projects by interpreting 'proposed actions' differently. Due to a compromise between environmental interests and other non-environmental interests,[97] policy level EIA was totally removed and certain types of plans (such as plans made by the State Council and county level government) were excluded from the present EIA legal framework. As a result, policies and plans conducted without EIAs often become the sources of adverse environmental effects. As the former director of the MEP stated:

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[93]Zhu and Ru (2008, 620–2).

[94]Evangelical Climate Initiative, *Climate Change-An Evangelical Call to Action* (2006) Christian and Climate http://christiansandclimate.org/statement/.

[95]Agrawala and Aalst (2005, 20).

[96]UNEP, *Environmental Impact Assessment Training Resource Manual* (June 2002). http://www.unep.ch/etu/publications/EIAMan_2edition_toc.htm, Posas (2011, 112).

[97]Zhu and Ru (2008, 620).

> [I]mproper policy is one of the most important factors that have caused severe environmental pollution and ecological degradation. If we cannot make sound judgments at the policy level, preventing environmental degradation will be extremely difficult – environmentally irresponsible policy is the most important cause of [China's] environmental pollution and ecological degradation.[98]

In terms of integrating climate change considerations through EIA, if the possibility of GHG emission and the climate change vulnerability are not considered in the strategic policy and plan level EIA, it will lose the best opportunity to address climate change impacts. First, from a spatial perspective, the government's policies and large-scale plans contribute more to the vulnerability reduction than individual projects. They are also more sensitive to the changing climate parameters. For example, a water allocation plan is more sensitive to the changing rainfall pattern than a small-scale water project focusing on the local level. It could, to a large extent, reduce the vulnerability to climate variables through the adjustment of the water supply and demand. Furthermore, climate change uncertainty has a more obvious manifestation over a longer period. Given the long-term nature of most water policies and plans, climate change uncertainty will have more influence on the implementation of policies and plans. In that case, in order to address climate change impacts in an efficient and effective way, policies and plans should be screened to apply the EIA paradigm so as to explore alternatives, reduce vulnerability and to include adaptation measures at an early stage and at a higher level.

The Weak Implementation of Alternatives in the EIA Legal System

Developing a set of alternatives is regarded as the 'heart' of the EIA process in the US.[99] Nonetheless, according to Article 17 of China's EIA Law, there has been no mandatory requirement of alternatives for proponents. Although alternatives are stated in the technical guideline for plan EIA (see Footnote 59), their absence in EIA statutory framework often leads to inadequate implementation in practice. The ratio of alternatives in the EIS submitted to the relevant agencies for review and approval is extremely low. For instance, among the EIS produced in Shanghai from 2003–2005, only 20.83 % contain alternative analysis.[100] In addition, alternatives provided are significantly different from those of the US. They assume that plan/project is to be approved in any event and alternatives are just different choices of conducting this plan/project. 'No-action plan' to cancel the plan/project seldom takes place in China due to the vested interest plan/project represents.[101] The most common conclusion of EIS censorship is 'recommended changes and mitigation measures from the environmental perspective,' which implies that the EIA will be approved after

[98]Qu (2002).

[99]Steinemann (2001, 4).

[100]Wang (2011).

[101]Wang et al. (2003, 561).

alteration.[102] In the context of climate change, the understatement of alternatives in EIA legislation and their weak implementation in practice reduce the adaptive capacity of EIA in managing the damages of unpredicted climate-related risks.

As previously discussed, alternatives preparation is an important approach to reduce and manage uncertainties associated with climate change impacts and adaptation. Without them, unpredicted and unexpected climate change impacts may change the surrounding scenarios and compromise the goal achievement of proposed plan/project.

Lack of Effective Institutionalized Public Participation

Public participation is an essential and core principle for good EIA practice. Although both IPPP and EIA Law require public participation in the EIA process, their enforcement is extremely weak.[103] The large gap between legal regulations and current practices has been well acknowledged by governmental officials and scholars. According to a survey carried out by some scholars in China, more than 77 % of the interviewees from government agencies, environmental assessment and consultation institutions, universities and other environmental research institutes, view public participation as insufficient, pro forma or ineffective.[104] This is partly due to lack of public knowledge and financial support,[105] but mainly because of a lack of effective legal procedures and access to information. Limited access to the decision-making process restrains the role of the public in delivering more scientific, transparent and credible decisions.

As stated repeatedly in this book, addressing climate change impacts and related uncertainties require higher standards of public participation in EIAs. The affected communities who usually have abundant knowledge and experience in adapting to local climate variability should be provided with institutionalized procedures in order to participate in the EIA process and to communicate uncertainties. Uncertain and complicated climate change impacts may provide a good opportunity and stimulation to engage with the public to make robust decisions.

Barriers to the EIA Implementation

In China, the success of EIA as a tool to facilitate environmental protection very much depends on the government's strong political will, a well-designed institutional framework, and a sound judicial system. While strong leadership is essential for the enforcement of EIA, it reflects the inadequacy of the institutionalization of the EIA paradigm.[106] In the long run, an effective institutional framework, along with environmental management capacity, must be established in order to facilitate

[102]Wu et al. (2011, 81).

[103]Wang et al. (2003, 562).

[104]Wu et al. (2011, 80).

[105]Duan and Li (2004, 56–58).

[106]Bina et al. (2011, 519).

implementation. Due to the fact that the proposed plan/project usually relates to the core interests of current China—economic development and employment,[107] EIA for them is, in many cases, concluded with 'non-obvious adverse environmental impacts'. The power and capacity of environmental agencies in challenging and reviewing a proposed plan/project through EIA is very limited. As a consequence, environmental authorities are unable to play their role as watchdogs of environmental protection in plan and project implementation. A large number of plans/projects have proceeded without going through the EIA process. According to a survey on new projects under construction, conducted by the State Environmental Protection Administration (SEPA, the predecessor of the MEP), the NDRC and the Ministry of Land and Resources, the rate of EIA implementation is very low and the violation of environmental rules is rampant. While provinces claim that the EIA was implemented at a rate of 86.9 %, the central government's own audit found that the rate was much lower at well below 50 %.[108]

Given the present practice of EIA implementation, there are reasons to doubt how effectively the ambitious initiative to integrate climate change impacts can be implemented in China, especially when adaptation integration involves other agencies such as various levels of development and reform commissions. Nonetheless, the complication and uncertainty of climate change impacts may provide a unique opportunity for all the key authorities to collaborate with each other in order to tackle severe climate change challenges.

6.2.5 *Concluding Remarks*

Water-related climate change impacts are best addressed through integration with proposed water policies, plans and projects rather than initiating specified policies, regulations and projects. EIA is one of the most important tools that can mainstream climate change adaptation considerations in proposed plans/projects. Its potential in contributing to adaptation has been demonstrated in Canada which has several years' experience in employing project-level EIA such as water-retention or tailings-containment structures, bridges, as well as large buildings and linear infrastructure to address climate change impacts.[109] At the same time, difficulties have also been encountered in this process. For instance, climate change uncertainties and inconsistencies among similar projects have not been adequately explained and resolved in most EIAs (see Footnote 69). Nonetheless, these difficulties do not repudiate EIA as a crucial vehicle in accommodating adverse climate change impacts. In some jurisdictions, climate change considerations have been extended from project EIA to planning EIA, such as the EU and Australia.[110]

[107]Moore (2011, 148).

[108]People's Daily (2007).

[109]Agrawala et al. (2010, 23).

[110]Europe Union (2009, 13), *Sustainable Planning Act 2009* (Qld), s5, 11.

EIA in China should not be discouraged by the barriers and difficulties of factoring in complex and uncertain climate change impacts, but should take proactive and innovative measures by learning from the experiences and lessons of other countries. Uncertainties have to, and can be managed properly through various instruments. EIA legislation should be developed to include those water plans/projects sensitive or vulnerable to climate change impacts. The climate change impacts on plans/projects should be gauged based on the best available information to provide meaningful understanding of the operating environment. An adaptive management approach credited with learning-by-doing mentality is desirable for practitioners and proponents to manage uncertainties. In addition, while climate change impacts bring additional challenges to the deficiency of the current EIA legal framework and implementation, they also provide the incentive and opportunity for further improvement. The development in policy level EIA, alternatives and public participation could largely contribute to the resilience of water plans/projects. Eventually, the EIA community in China will be aware of the potential and need to use EIA as an effective tool to climate-proof proposed water plans/projects which are recognized as vulnerable in the nation's climate change program.

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Chapter 7
Final Conclusion and the Way Forward

When water meets climate change, it is imperative to identify where do they encounter and how do they interact with each other. The legal framework on water management, as a consequence, is expected to be reviewed and developed for better adaptation to climate change impacts. Yet, this book suggests that external challenges from adaptation be integrated with those internal challenges from the new Integrated Water Management Regime (IWRM) regime by adopting a mainstreaming approach. This promising approach is expected to deliver both sustainability and adaptive capacity even in the context of uncertainty and various scenarios. More importantly, it is much more applicable and effective for China where economic development and social stability are the core interests of various levels of government.

Chinese government has undertaken series of proactive strategies to respond to adaptation under the pressure of both international and domestic societies. Top-down initiatives from policy to plan and regulation seems ready to fight with problems brought by climatic disasters and harms. The legislative propose to formulate a niche targeting *Climate Change Law* represents Chinese government's attitude and roadmap towards pressing climate change issues. Yet, dramatic environmental change does not justify radical reactions, especially for laws and regulations which are meant to be moderate and progressive. This book warns that thorough theoretical and empirical research should be undertaken before provocative measures are proposed.

After elaborative analysis of the possibility of mainstreaming adaptation in the IWRM, water planning and water project environmental impacts assessment (EIA) are screened to illustrate the process transformation from substantive and procedural perspectives respectively. It shows that water managers should discard the assumption of water stationarity and place water-related decisions under a broad and fickle climate change context. Not only should be the factors put in each step reshuffled, but also the entire process itself reframed to close the loop. In the mainstreaming process, various innovative approaches, such as adaptive management, risk redistribution, community-based participation and social vulnerability assessment, are recommended for vulnerability reduction and resilience improvement. All these innovations, to a large extent, are justified by the extension and development of extant legal principles in the field of water management.

X. He, *Legal Methods of Mainstreaming Climate Change Adaptation in Chinese Water Management*, DOI 10.1007/978-981-10-0404-9_7

Nonetheless, it is important to acknowledge that to what extent these proposals could be implemented and enforced in practices are still very difficult to predict. Adaptation mainstreaming entails the reform of legal mentality and the rejection of path dependence to create supporting enabling environment. Therefore, forthcoming study should pay attention to emerging challenges in practices in order to make legal responses efficient and effective.

The heuristic and referential value of this book implies that the adaptation mainstreaming analysis displayed should not be confined to the water sector. Water management is just one of the key entry points for Chinese government to mainstream adaptation issues. Other sectors identified as vulnerable by Chinese climate change policies, such as agriculture, forestry and coastal zone, could gain some valuable insights with regards to legal responses to unavoidable climate change impacts. How the mainstreaming approach applied in other sectors is distinguished from that of water management, however, is another research topic that should be undertaken in the near future, especially when climate change impacts are becoming more and more self-evident.

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