MAINSTREAMING CLIMATE CHANGE ADAPTATION IN THE YANGTZE WATER RESOURCES MANAGEMENT IN CHINA: A LEGAL AND INSTITUTIONAL PERSPECTIVE

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A thesis submitted in fulfilment of the degree of

Doctor of Philosophy

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The work presented in this thesis is, to the best of my information, knowledge and belief, original as acknowledged in the text. I declare that I have not submitted this thesis, for a degree at this or any other university or institution.

The research presented in this thesis was approved by University of Western Sydney Human Research Ethics Committee, Reference number: H9252 on 6 September 2011.

Xiangbai He

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2013
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Three years ago, in a conversation with one of my friends, I said I would not conduct a PhD study. Realising that this argument was too arbitrary, I then added ‘even if I pursue a PhD degree, I will not do research on climate change.’ Ironically, this argument was even more arbitrary. Now, I am about to submit a PhD thesis that is closely related to climate change.

It is time to pay my deepest gratitude to those who encourage me, care about me and even criticise me. Without them, it would have been impossible to finish this tough task on time.

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ABSTRACT

The management of the Yangtze River Basin (YRB) 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 thesis proposes an innovative approach of mainstreaming climate change adaptation considerations within IWRM regime in order to deliver sustainable and robust water management decisions and outcomes for the YRB. Mainstreaming adaptation in this thesis refers to the incorporation of climate change adaptation-related factors into water development planning and ongoing sectoral decision-making process. Current Yangtze water management regime and practices have not considered adaptation factors. Thus, this thesis attempts to contribute to the literature through analysing the rationale of mainstreaming adaptation in the IWRM-related legal and institutional frameworks and proposing applicable recommendations for Yangtze water managers.

Centred with this mainstreaming approach, this thesis addresses three overarching questions: first, what is the capacity of the Yangtze water management related legal and institutional frameworks in achieving sustainable development. Alternatively, to what extent do the Yangtze water-related legal and institutional frameworks contribute to climate change adaptation? Second, could water-related climate change impacts be mainstreamed in the legal and institutional frameworks on the IWRM of Yangtze River? Finally, if the answer to the second question is yes, what is the best way to implement adaptation mainstreaming?

An investigation and examination of existing legal and institutional frameworks on the Yangtze 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 analysing research literature and water management practices, the progress and deficiencies of these water-centred 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 arrangements 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 realise that climate change adaptation-related policies, legislation and institutional arrangements will challenge and shape the paths and approaches of managing water resources. This interactive relationship firstly 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 Yangtze water management regime are reviewed in the context of climate change adaptation. Since the potential compatibility and synergy between the IWRM regime and climate change adaptation is the premise of an adaptation mainstreaming approach, their distinctions and common points will be compared in this thesis.

To provide specific recommendations for Yangtze water managers, the last part of this thesis 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 practise mainstreaming from both substantive and procedural perspectives for Yangtze water managers. Integrated water planning from a substantive aspect and environmental impacts 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 thesis are employed to achieve climate-proofing water management strategies and outcomes.
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<thead>
<tr>
<th>Acronym</th>
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<td>Administrative Agreements</td>
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<td>Adaptive and Integrated Water Management</td>
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<td>Canadian Environmental Assessment Act 2012</td>
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<td>CASS</td>
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<td>Canadian Environmental Assessment Agency</td>
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<td>CFDH</td>
<td>Changjiang Flood Control and Drought Relief Headquarter</td>
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<td>CMA</td>
<td>China Meteorological Administration</td>
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<td>CNCCCP</td>
<td>China’s National Climate Change Programme</td>
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<td>CPAACC</td>
<td>China’s Policies and Actions for Addressing Climate Change</td>
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<td>CPNWR</td>
<td>Comprehensive Plan of National Water Resources</td>
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<td>CWRC</td>
<td>Changjiang Water Resources Commission</td>
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<td>DRCs</td>
<td>Development and Reform Commissions</td>
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<td>DRR</td>
<td>Disaster Risk Reduction</td>
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<td>DWC</td>
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<td>EES</td>
<td>Epistemological, Ethical and Scale</td>
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<td>The Law of the People’s Republic of China on Environmental Impact Assessment</td>
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<td>EPA</td>
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<td>FDO</td>
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<td>FYP</td>
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<td>GDP</td>
<td>Gross National Product</td>
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<td>Global Environment Facility</td>
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<td>Global Water Partnership</td>
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<td>HSBC</td>
<td>Honking and Shanghai Banking Cooperation Limited</td>
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<td>Interim Procedures of Public Participation in EIA</td>
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<td>IRBM</td>
<td>Integrated River Basin Management</td>
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<td>IUCN</td>
<td>International Union for Conservation of Nature and Natural Resources</td>
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<td>IWRM</td>
<td>Integrated Water Resources Management</td>
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<td>MDB</td>
<td>Murray-Darling Basin</td>
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<td>MDBA</td>
<td>Murray-Darling Basin Authority</td>
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<td>MDGs</td>
<td>Millennium Development of Goals</td>
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<tr>
<td>MEP</td>
<td>Ministry of Environmental Protection</td>
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<td>NCCCC</td>
<td>National Coordination Committee on Climate Change</td>
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<td>NDRC</td>
<td>National Development and Reform Commission</td>
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<td>NEF</td>
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<td>NGOs</td>
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<td>NLGCC</td>
<td>National Leading Group on Climate Change</td>
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<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
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<td>PP</td>
<td>Precautionary Principle</td>
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<td>PSD</td>
<td>Principle of Sustainable Development</td>
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<td>PX</td>
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<td>RBCs</td>
<td>River Basin Commissions</td>
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<td>RCCC</td>
<td>Research Centre for Climate Change</td>
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<td>RMWA</td>
<td>River Murray Waters Agreement</td>
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<td>RPEIA</td>
<td>Regulation on Planning Environmental Impact Assessment</td>
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<td>SD</td>
<td>Sustainable Development</td>
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<td>SEA</td>
<td>Strategic Environmental Impact Assessment</td>
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<td>SIA</td>
<td>Social Impacts Assessment</td>
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<td>SNWD</td>
<td>South to North Water Division</td>
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<td>SP</td>
<td>Subsidiarity Principle</td>
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<td>SSIC</td>
<td>Social Survey Institute of China</td>
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<td>SWRM</td>
<td>Strictest Water Resources Management System</td>
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<td>Tai Basin</td>
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<td>TBMR</td>
<td>Tai Basin Management Regulation</td>
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<td>Description</td>
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<tr>
<td>TGD</td>
<td>Three Gorges Dam</td>
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<td>UNCED</td>
<td>United Nations Conference on Environment and Development</td>
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<td>UNISDR</td>
<td>United Nations International Strategy for Disaster Reduction</td>
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<td>Yangtze Forum</td>
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<td>YRB</td>
<td>Yangtze River Basin</td>
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I INTRODUCTION

The purpose of this theoretical and empirical study is to provide recommendations for Yangtze water managers to adapt to climate change impacts by mainstreaming adaptation considerations in the legal and institutional frameworks of Yangtze water resource management. In this study, a legal and institutional perspective will be used to assess the adaptive capacity of current Yangtze water resource management regime in adapting to climate change – mainly the adequacy, effectiveness, efficiency and equity of current water management regime in delivering sustainable and resilient water management outcomes.

The legal perspective begins with reviewing present policies, laws, regulations and decrees on Yangtze water management and climate change adaptation. Theoretically, laws, regulations and decrees are clearly distinct from policies because they are legally binding while policies are not.\(^1\) However, due to the political system which mandates policy from top to bottom and the vague language adopted in Chinese legislation, policy is sometimes implemented more strictly than laws in practice. In many cases, various non-binding water policies even play a more important role in influencing and shaping water management activities. Therefore, in this research, relevant policies will be also considered as legal perspectives.

According to most of the literature, institutions are organisations or settings founded for a specific purpose based on certain working rules originating from an established custom, law or relationship in a nation, society or community.\(^2\) In this research, an institutional perspective can be ascertained from institutional arrangements, which involve the decision-making structure, procedure, and responsibility distribution and cooperation mechanisms among these institutions. Given the complex and multifaceted nature of water resources, the nature of the institutional arrangements largely determines the effectiveness of water resources management, especially when coordination between them is indispensable. To sum up, it is essential to assess whether present legal and institutional frameworks relevant to Yangtze water

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management are appropriate for adaptation or not. Effective legal and institutional frameworks should be able to provide right incentives, guidance and legal procedures for decision makers, stakeholders and the public to make proactive decisions on adaptation.

Facing with multiple water crises such as water shortages, water pollution and floods, Yangtze water managers have undertaken series of legal and institutional reform in order to achieve sustainable development. An integrated water resources management (IWRM) regime which regards water as an integral part of ecosystem and manages water, land and other resources in an integrated way has been widely acknowledged by Yangtze water managers. Having realised the emerging climate change impacts on Yangtze water resources, this thesis proposes that climate change adaptation should be mainstreamed in IWRM-related legal and institutional frameworks. As a crucial term, mainstreaming adaptation in this thesis refers to the integration of climate change adaptation-related issues into IWRM-related planning and implementation. To achieve this, the challenges to water-related legislation, institutional arrangements and the IWRM regime presented by adaptation, and the potentiality to integrate IWRM with climate change adaptation will be important focal points of this research.

A Research Background and Significance

The starting point of this research is the assumption that climate change is real and anthropologic factors are the main reasons of climate change. The foremost support for this assumption comes from the series of assessment reports of the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, future warming caused by the emission of Greenhouse Gases (GHG) is probably unavoidable. While climate change may generate economic opportunities (for example, increasing rainfall could contribute to grain production in some parts of the world), its adverse impacts are projected to outweigh its benefits, especially in

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developing countries. The increasing risks of natural disasters, sea-level rise, water crises and food shortage are often cited as examples of adverse climate change impacts. Therefore, it is incumbent upon both individuals and the global community to take actions to mitigate climate change and to adapt to climate change impacts.

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. 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. 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 heatwaves, floods and droughts are projected to become more frequent in the future, and water resource scarcity will continue across the country. These threats are particularly severe in agriculture and animal husbandry, forestry, natural ecological systems and water resources, and in coastal and ecological fragile zones.

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 affected by climate change. This has been verified, to some extent, through abundant evidence of hydro meteorological records and climate projections. Most importantly, water is also the primary medium through which climate change influences other ecosystems, people’s livelihoods and well-being. For that reason, how to better manage water resources in the context of climate change should be given higher priority by the governments around the globe.

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4 Nathalie Risse et al., ‘Strategic Environmental Assessment and Adaptation to Climate Change’ (Advisory Note, Organization of Economic Co-operation and Development, 2008)
5《中国应对气候变化国家方案》(People’s Republic of China) National Development and Reform Commission, Order No 17, June 2007
6 Zoe Knight, Nick Robins and Wai-Shin Chan, ‘Scoping Climate Change Risks: Which Countries are Most Vulnerable’ (HSBC Global Research Report, HSBC, 2011)
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.’\(^9\) It further notes that ‘adaptation to changing conditions in water availability and demand has always been at the core of water management.’\(^10\) These statements of the IPCC for the first time connect water resources management with climate change adaptation. Without recognising 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 thesis will focus on the adaptive capacity of China’s water-related legal and institutional frameworks in adapting to climate change impacts.

Climate change is not only a context and a problem, but also an opportunity. Climate change context means any development activity undertaken must consider climate change impacts in order to deliver certain flexibility or adaptability to these impacts. This is the backdrop to be taken into account by any future development. As a problem or challenge, decision makers must address climate change and its impacts, either through mitigation to reduce the process of climate change or through adaptation with respect to unavoidable impacts. However, climate change should also be regarded as an opportunity to resolve some chronic existing problems in the natural resources development process. Although climate change often exacerbates current problems, it also pushes decision makers to a threshold to take innovative actions. 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 institutionalised permanent water-saving rules accepted by the public, which demonstrate how climate-related extreme events can help people on the ground adapt water polices for sustainability.\(^11\) Horne asserts, with regard to water reform in Australia, that while most actions on water management are often characterised as responses to climate change, the prospect of climate change in reality becomes a

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\(^10\) M.L. Parry et al., Climate Change: Climate Change Impacts, Adaptation and Vulnerability, Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report (Cambridge University, 2007) 181.
The identification of climate change as both a context and a problem has been widely understood by both international and domestic communities. Unfortunately, the opportunity it brings in providing a much-needed catalyst to problem solving has long been ignored.

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 could 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. A further likely benefit is to allay concerns about change and promote transformation.

Mitigation and adaptation are widely recognised as two related but distinct methods designed to address climate change. However, much of the international debate about global climate change in 1990s and early 2000s has been pre-occupied by the mitigation of GHG, while adaptation has been put aside. It is only in the past few years that there is a remarkable increase in the attention paid to adaptation strategies – both theoretically and practically. In the article ‘Lifting the Taboo on Adaptation’, Pielke et al. provide three main reasons for adaptation to be put firmly back on the

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15 Jan McDonald, ‘Mapping the Legal Landscape of Climate Change Adaptation’ in Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), Adaptation to climate change: Law and policy (Federation Press, 2010) 1.
agenda. 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 who suffer the most severe climate change impacts have increasingly turned their attention and focus to climate change adaptation. 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 15 meeting of world leaders in Copenhagen in December 2009.

The failure of the Copenhagen summit together with the failure by negotiators at the subsequent COP 16 meeting at Cancun, Mexico, COP 17 meeting in Durban, South Africa and the recently concluded COP 18 in Doha 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. 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 in various sectors like water resources. Therefore, the critical issue here is how developing countries like China could adapt to this unchangeable situation without sacrificing other equally important development goals.

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B Research Objectives and Research Questions

For a populous country, water security is always given national significance by the Chinese government, and the sustainable development in the context of available water resources is usually the ultimate goal of water activities. As the longest river in China, Yangtze River and its management have been the front and centre of most scientific, socio-economic and legal research. Unfortunately, most of the existing research reveals that current Yangtze water management regime, water-related legislation and institutional arrangements do not deliver effective sustainable outcomes. Furthermore, climate change poses additional challenges to the capacity of this regime and related framework in achieving sustainable development. If the challenge from the Yangtze water management regime itself is considered as endogenous, the challenge from climate change can be viewed as exogenous. How to manage these two dimensions has proved to be a formidable task for Yangtze water managers. Thus, the ultimate objective of this research is to promote sustainable water development in the Yangtze River Basin (YRB) in the context of climate change by improving the adaptive capacity of the water-related legal and institutional frameworks in responding to climate change impacts.

In order to achieve that goal, it is constructive to improve the capacity of the Yangtze water management regime in delivering sustainable development outcomes. Based on existing literature, this could be achieved by improving the legal and institutional frameworks and implementing the IWRM regime. As a contribution to sustainable water development, IWRM is able to reduce the vulnerability of human societies to climate change stressors and uncertainties in most cases. The crucial question here is whether IWRM-related legislation and institutional arrangements could cope with the requirements of adaptation and whether the IWRM regime is able to develop and adapt to uncertain climate change impacts.

At the same time, it is crucial to mainstream climate change adaptation in those improved Yangtze water management strategies – this approach could contribute to water-centred adaptation directly.

Both of them are in line with the ‘no (low)-regrets’ strategy and the principle of sustainable development, meaning that they are likely still working for the benefit of
sustainable water development and climate change adaptation even after recognising
the uncertainties of climate change. Therefore, this research will endeavour to
integrate these two aspects within one process: mainstreaming adaptation in the
improved legal and institutional frameworks on the Yangtze IWRM.

Specifically, in order to achieve the research objective, following concrete questions
should be answered:

(1) What are the current policies, legislation and institutional arrangements
underpinning Yangtze water management? To what extent could they
deliver sustainable water management outcomes?

(2) What are the climate change impacts on Yangtze water resources in the
past 50 years?

(3) What are the policies, legislation and institution arrangements undertaken
by Chinese government to adapt to above climate change impacts? Are
they adequate and effective enough to support and facilitate adaptation in
the water sector?

(4) In terms of mainstreaming adaptation, what are the theoretical and
practical challenges to the existing water management framework posed
by climate change adaptation, including underlying legal assumptions,
institutional arrangements and management approaches?

(5) What is the likelihood of overcoming these challenges and integrating
climate change adaptation with the IWRM-related legal and institutional
frameworks?

(6) How could existing legal and institutional frameworks be improved and
reformed in order to provide a meaningful enabling environment for
adaptation mainstreaming in the Yangtze water resources management?

(7) With this enabling environment, what are the main entry points of the
mainstreaming process?

C Research Scopes and Key Definitions
This topic touches on two important but broad issues: water management and climate change adaptation. In fact, there are many approaches to adapt to water-related climate change impacts, such as technological adaptation solutions (e.g. coastal fortification, building standards and dam construction), critical attitudinal and behavioural changes (e.g., reducing water consumption), managerial modification (e.g., adopting integrated water management), and legal development and institutional reform (e.g. drafting climate change law).\(^21\) While it is impossible to draw a clear boundary among those different approaches, a successful adaptation portfolio will demand a combination of various approaches. However, there has been a tendency in adaptation research to view adaptation as a pure techno-rationalist term.\(^22\) By contrast, the role of social, political and legal factors and processes in defining responses to adaptation has been ignored.\(^23\) It has been recognised in recent times that policies, legislation and institutional arrangements are at the heart of water management and climate change adaptation.\(^24\) Therefore, a legal and institutional perspective will be adopted by this research to investigate the role of water-related policies, laws and institutional settings in facilitating climate change adaptation in the YRB. How to analyse the connection between climate change adaptation and water resource management will depend on which perceptions are adopted. Therefore, the first step to narrow the research scope will begin with analysing some key definitions.

### Water resources management vs. water governance

Water resources management refers to the actions required to manage, control, regulate, allocate and conserve freshwater (both ground water and surface water) to meet human and environmental needs.\(^25\) Such actions consist of water-related infrastructures construction, water conservation promotion, flood control and various other management measures.\(^26\) In Chinese literature, the term ‘governance’ and ‘management’ are very easily mixed up. However, their differences are apparent. Xie argued that ‘It (governance) is related to the broader social system of governing as

\(^{21}\) McDonald, above n 15, 2.  
\(^{23}\) Tim Bonyhady, Andrew Macintosh and Jan McDonald, Adaptation to Climate Change: Law and Policy (Federation Press, 2010) Preface.  
\(^{24}\) National Water Commission, Australia Government, Water Policy and Climate Change in Australia (2012) 82.  
\(^{26}\) Ibid 127-8.
opposed to the narrower perspective of government as the main decision-making political entity.’ 27 Gu and Wong also discussed their differences from various perspectives. They argue that ‘governance’ is a ‘self-organizing network’ that organisations from both the public sector and private sector form the autonomous managing network, in which social factors such as NGOs, communities and interested individuals are involved in this coordination process and the collective decision-making process.28 ‘Management’, on the other hand, is regarded as either the subset of governance or a part of a dynamic, complex and diverse social-political governance process.29

According to the United Nations Development Program (UNDP), good governance should be able to ensure that the political, economic, social and administrative aspects of a particular affair are appropriately balanced.30 The UNDP summarises nine characteristics or elements of good governance: participation, rule of law, transparency, accountability, consensus orientation, equity, effectiveness and efficiency, responsiveness and strategic vision.31 In the water sector, good water governance implies that more sustainable, productive, equitable and integrated management of water resources should be in progress to enable all water users to meet their basic needs.32 While no society could be able to achieve all of them, they are good objectives for future water management. Societies should identify the core elements most important and feasible for them.33 More importantly, these elements can serve as criteria to assess to what extent current water management practices are delivering good water governance. As it is often acknowledged that water crises are mainly due to poor water governance, and there is a consensus that good governance

29 Ibid.
31 Ibid.
33 United Nations Development Programme, above n 30.
of water resources is necessary. In some of the literature, water governance is even advocated as a new regime in managing water resources.

Xie summarised three main pillars of water governance: legal framework, institutional arrangements and civil society. Among them, well-designed legislation and well-arranged institutions are the crucial parameters for the effective water management, and civil society involvement distinguishes water governance from traditional government-dominated water management. Compared to traditional water management, this research argues that the term ‘water governance’ implies a different decision-making structure and procedure, water management paradigm and approaches. However, there is no clear boundary between water management and water governance – to achieve good water governance, current legal and institutional frameworks on water management must be improved constantly. Bearing in mind their differences, this research regards good water governance as a goal to achieve through the constant improvement of water management towards the objective of sustainable development.

Institutions and institutional arrangement

As a key element of water governance, defining the term ‘institution’ is crucial to set the research scope. There is no single standard definition of institution, and this research will adopt the definition given by Ostrom, the 2009 Nobel Prize winner in economic science. In her book, she defined ‘institutions’ as

sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregations rules will be used, what procedures must be followed, what information must be or must not be provided, and what payoffs will be assigned to individuals dependent on their actions. All rules contain prescriptions that forbid, permit, or require some action or outcome.

They include the decision-making structure, along with decision-making approaches, rules, procedures and outcomes. According to this definition, institutional

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36 Xie, above n 27.
arrangements (setting) place more emphasis on decision-making structures and procedures compared to ‘legal institutions’ which focus on decision-making rules and outcomes. The umbrella term ‘institutional framework’, however, could cover both the procedural term ‘institutional arrangement’ and the substantive term ‘legal institutions’. In many cases, ‘institutional framework’ and ‘institutional arrangements’ are used alternatively in this thesis. A well-designed institutional framework is expected to deal with spillover effects, externalities and free rider problems.  

In linking climate change with water resources management, this research will specifically focus on adaptation rather than mitigation. Therefore, key definitions about and around adaptation issues must be clarified. An explicit explanation and discussion will be helpful to understand adaptation strategies, especially given the undeveloped research on climate change adaptation in China.  

Climate variability vs. 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’.  

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. 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’, or ‘climate variability and change’.  

Nevertheless, it is necessary to investigate the differences between them in order to understand the additional challenges and complexity brought by climate change.

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40 Eelco van Beek, ‘Managing Water under Current Climate Variability’ in Fulco Ludwig et al. (eds), Climate Change Adaptation in the Water Sector (Earthscan, 2009) 51, 51.
41 Ibid 61.
43 Parry et al., above n 10, 727.
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.\textsuperscript{44} 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).\textsuperscript{45} 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.\textsuperscript{46} In addition, 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 research will not specifically analyse the approaches to manage climate variability but rather focus on the ways to respond to incremental challenges brought by climate change.

\textit{Adaptation}

Adaptation is a term originated in the natural sciences, particularly evolutionary biology.\textsuperscript{47} Anthropologist and cultural ecologist, Julian Steward, expanded its application to human systems by using ‘cultural adaptation’ to describe the adjustment of ‘cultural cores’ to natural environment through subsistence activities.\textsuperscript{48} Both natural and social adaptation are regarded as a process and consequence of a selection of acts (such as adjustment, development and practice) to cope with environmental variation or changes in order to survive, reproduce or develop.\textsuperscript{49}

Adaptation in the context of human-induced climate change was introduced along with the growing awareness of climate change and yet has not resulted in a

\textsuperscript{45} Ibid.
\textsuperscript{48} Karl W. Butzer, ‘Cultural Ecology’ in Gail, G. L., Willmott, C.J. (eds), \textit{Geography in America} (Merrill, 1989).
universally satisfactory definition. Various scholars and institutions provide their own definitions from different perspectives – some focus on systematic adjustment, some on vulnerability reduction and others on adaptive capacity improvement. For example, Smit et al. regard adaptation as ‘adjustments in ecological-socio-economic systems in response to actual or expected climatic stimuli, their effects or impacts’. Pielke defines adaptations as the ‘adjustments in individual groups and institutional behaviour in order to reduce society’s vulnerability to climate’. Brooks describes adaptation as ‘adjustments in a system’s behaviour and characteristics that enhance its ability to cope with external stress.’ In the Fourth IPCC Assessment Report, adaptation to climate change is defined 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’. The UNDP offers a very similar definition: ‘adaptation is a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented’.

The UNFCCC, at its Cancun Meeting in 2010, set up the Cancun Adaptation Framework, which stresses the need for action in this area based on international cooperation. In this framework, adaptation is supposed to reduce vulnerability and build resilience in developing countries by taking into account their urgent and immediate needs.

Though varying in descriptions and focus, most of these definitions have reached a consensus that: (1) adaptation can never be completed; (2) existing systems have to make adjustments or transformations; (3) it is an ongoing and iterative process responding to uncertain climate change impacts. Based on the perspective this research adopts, climate change adaptation in this thesis will refer to the resistance,

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50 Smit and Wandel, above 47.
54 IPCC, above n 3, 6.
adjustment, and transformation of human economic, social and environmental institutions to better respond to actual, expected or even unexpected climate change impacts. To understand adaptation, the following key elements of adaptation will be examined and clarified:

*Who or what adapts:* Both natural systems and human systems need to adapt to climate change. While the research on natural system adaptation is important, human intervention like policies and laws can do little to advance its progress, thus natural systems adaptation will not be included in this study. The adaptation of human systems, which is mainly conducted, by groups, communities and public bodies will be the focus of this study.\(^{58}\)

*Adapt to what:* Broadly speaking, what the human systems need to adapt to include actual, expected and unexpected climatic stimuli and their effects, such as changes in average annual conditions, variability and associated extremes and risks.

*When to adapt:* Adaptation can either happen before actual climatic impacts by undertaking planned or anticipatory actions, such as risk management to reduce possible risks and harms, or respond to specific climate change impacts reactively and autonomously.

*How to adapt:* Any measure or strategy which could contribute to either building adaptive capacity or delivering adaptation actions are regarded as adaptation responses or actions. Building adaptive capacity refers to ‘creating the information and establishing the supportive social structures and supportive governance that are needed as a foundation for delivering adaptation actions’.\(^{59}\)

Delivering adaptation actions are those that contribute either to reduce climate change vulnerability or to exploit opportunities. They mainly consist of: (1) the avoidance of, or resistance to, the effects of climate change to maintain and protect the status quo; (2) the adjustment or transformation of social, economic or environmental mechanisms to minimise or absorb adverse climate change impacts; (3) the movement away from, or retreat, in order to escape climate change impacts and reduce vulnerability and; (4) the exploration of new opportunities in response to the changing

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\(^{59}\) Brisley et al., above n 57, 11.
Adaptation can be divided into different categories: anticipatory or reactive (by timing), planned or autonomous (by purposefulness), public or private (by subject), local or widespread (by spatial scale) and long-term or short-term (by temporal scale). An adaptation strategy or measure usually cuts across several classifications. For example, a national emergency plan that is about how to respond to risky floods is anticipatory, planned and public adaptation, while the adoption of a new pesticide by farmers to control pest proliferation is reactive, autonomous and private adaptation. There is no absolute boundary between each division. In the example of pesticide adoption, if a whole community decides to adopt the pesticide, it is hard to discern whether it is planned or autonomous, public or private. Given the research scope of this thesis, water management policies and laws are more involved with anticipatory, planned and public adaptation strategies.

**Vulnerability, resilience and adaptive capacity**

Another three key concepts closely related with adaptation are vulnerability, resilience and adaptive capacity, which also have several definitions. ‘Vulnerability’ is broadly defined as the capacity to be harmed. 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.’ 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’.  

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.

Resilience is another concept frequently combined with vulnerability, especially in the description that ‘reduce vulnerability and enhance resilience’. Like vulnerability, there is no single definition of resilience. Originally adopted to describe ‘the ability to absorb change and disturbance and still maintain the same relationships between populations or state variables’, 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.

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. If vulnerability is the ability to be harmed, resilience is the ability to recover.

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66 Ibid.


Based on the definition of climate change adaptation, vulnerability and resilience, ‘adaptive capacity’ in the IPCC is described as: ‘the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behaviour and in resources and technologies.’ A higher adaptive capacity enables the society to prepare for, respond to, and recover from, climate change impacts quickly. Adaptive capacity could, to a large extent, influences the vulnerability of communities to climate change effects and hazards. Analogous to vulnerability, determinants of adaptive capacity are widely identified as economic wealth, technology, information and skills, infrastructure, institutions and equity. There has not yet been a consensus on the relationship among vulnerability, resilience and adaptive capacity. Some argue that resilience is an integral part of adaptive capacity. Others assert that adaptive capacity is a main component of resilience. Having realised their correlativity among each other, this thesis argues that there is a negative correlation between vulnerability and resilience (adaptive capacity): the higher the vulnerability is, the lower resilience (adaptive capacity) will be.

D Research Methodology and Methods

Mainly lying in legal and social science areas, the dominant methodology employed in this proposed research is qualitative methodology, which aims to gather an in-depth understanding of human-behaviour and the reasons that govern such behaviour. Comparative research is also undertaken in this thesis to provide insights and lessons for mainstreaming climate change adaptation, both theoretically and practically, in the proposals for improved Yangtze water management. Given the context-specific nature of climate change adaptation and the limited public information available on

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74 Ibid.
76 Burton et al., above n 14.
adaptation in China, field visits and interviews have been conducted to obtain first-hand information. Explanations relating to the use of these main methodologies are set out below.

1 Qualitative Research

This research is a problem-based analysis, which starts from identifying the problems and then developing suggested solutions to these problems. Yangtze water management is facing severe water challenges such as water shortages, water pollution and flooding. These water problems are further exaggerated by unpredictable, uncontrollable and irreversible climate change impacts. Therefore, how to manage Yangtze water sustainably in the face of climate change has become one of the pressing challenges for various levels of Yangtze water management. This is not only because of the failure of the existing Yangtze water management regime in delivering sustainable outcomes which then operates as a barrier to climate change adaptation, but also because of the new challenges brought by climate change. The IWRM regime has been recognised as a key ongoing process to achieve sustainable water development by Yangtze water managers. However, it is also criticised for not being fully implemented in China and for not specifically dealing with uncertainties associated with climate change. Given these problems and challenges, the crucial question in this research is: (1) do IWRM-related legal and institutional frameworks have the potential capacity to manage uncertain and complex water-related climate change impacts? (2) If the answer is yes, how are adaptation considerations mainstreamed in the IWRM in a legal and institutional context? Answering the first question needs to investigate and reflect the underlying paradigms of the legislation and institutional arrangements on the IWRM and adaptation to identify their distinctions and common points. The second question focuses on what instruments and approaches within the legal and institutional frameworks could be employed and developed to bridge the gaps between them.

Due to the uncertainty inherent with adaptation as well as the high cost of undertaking specific adaptation measures, this research proposes that mainstreaming adaptation within Yangtze water management regime (IWRM) is one of the cost-effective
approaches to deliver sustainable water management outcomes in the context of climate change. Adaptation mainstreaming in this research refers to the integration of climate change adaptation considerations in the water-related planning or decision-making process. 78 However, climate change impacts and adaptation distinguish themselves from traditional water problems in various ways such as inherent uncertainty, specific context and the urgent need for good governance. Thus, we cannot just embrace adaptation with existing water-related legal and institutional frameworks. For example, uncertainty has overturned the prevailing ‘stationarity’ – the assumption of the current legal and institutional frameworks regulating water resources in place for decades – which has been declared ‘dead’ due to climate change. 79 The acknowledgement that climate change uncertainty will exist for a long time and we need to live with it is the starting point of following analysis of mainstreaming adaptation. To rationalise the proposal on mainstreaming adaptation in the IWRM, the questions ‘why has adaptation to be mainstreamed in IWRM?’ or ‘why does IWRM have to mainstream adaptation?’ and ‘why and how can it be mainstreamed?’ will be examined.

In terms of how to implement adaptation mainstreaming, this research will provide recommendations from two different levels: (1) establishing the legal and institutional enabling environment for adaptation mainstreaming; and (2) identifying specific key entry points of adaptation mainstreaming. First, the complexity of any mainstreaming process, which involves multi-dimensions of values and tradeoffs, determines that it is necessary to set specific criteria to assess the effectiveness of the mainstreaming process. Although it is acknowledged that there is no panacea, some key environmental law principles will be proposed and applied in a mainstreaming process to deliver sustainable and adaptive water management strategies through proper legal and institutional frameworks. Second, a good enabling environment does not necessarily result in adaptation considerations in the water management. Key entry points have to be provided and analysed to illustrate how to identify adaptation requirements and integrate them in the Yangtze water resources planning and implementation process.

The analysis of qualitative methodology is principally developed by reviewing a range of literature, from international documents to national policies, laws and regulations. This will provide vital insights with respect to the current development in water management and climate change adaptation. Theoretical articles and books are also very important secondary sources to understand problems and identify potential solutions. The literature involved in this review includes the following:

(1) International laws or documents related to climate change

(2) Agreements or framework documents made at international conferences

(3) Books, law reviews, journal articles and other relevant materials on water management and climate change adaptation

(4) Policies, laws, regulations, rules and other doctrines relevant to Yangtze water management and climate change adaptation in China

2 Comparative Research Approach

Both the research and practices of mainstreaming adaptation in the Yangtze water management regime are very new for national and international water communities. It is essential to get some insights from the experiences of other basins or countries through the approach of comparative research. At the same time, it is important to realise and acknowledge that no basin or country could provide overall references from both legal and institutional dimensions. The reality is some countries have done very well in arranging adaptive basin institutions (for example Australia), while some may be the front-runners in integrating climate change impacts in existing environment management tools (such as Canada). As a result, the comparative research in this research is not manifested by one single country. Instead, different examples will be analysed to provide insights from different perspectives.

Among these cases, the Murray-Darling Basin (MDB) in Australia is studied in more details. One of the important reasons is that water problems in the MDB and the YRB share much in common, such as water shortage, water over-allocation, water conflicts
among different administrative jurisdictions and deteriorating ecosystem.\textsuperscript{80} Although water management in the MDB has its own problems, it has relative success in adopting and implementing the IWRM regime, especially due to its basin-related legislation and institutional arrangements. Examining their approaches of regulating basin-related issues and arranging institutions from state to federal level could benefit Yangtze water management which is suffering from weak legal enforcement and institutional fragmentation. These references also enable a higher adaptive capacity to water-related climate change impacts. Many Chinese scholars have widely acknowledged that Yangtze water management should learn from the IWRM in the MDB.\textsuperscript{81} Nonetheless, any recommendation for the YRB must take into account China’s unique political system, governance structure, legal system and cultural traditions.

3 Field Visit and Semi-structured Interview

There is usually a gap between the provision of legislation and its implementation. This gap is apparent with regard to Yangtze water management, mainly due to the lack of a clear legal framework and well-defined institutional arrangements. Therefore, it is necessary to visit relevant water management authorities in order to identify this gap. Furthermore, although Yangtze water management have dealt with climate variability for a long time, it is not clear whether they are aware of the increasing challenges from climate change. Climate change adaptation is labelled site-specific, which means responses to climate change largely depend on local government’s understanding of climate change impacts and adaptation. Unfortunately, not enough information and data on climate change adaptation plans and practices has been published through the public media. This is mainly because adaptation in China is identified as a sensitive issue relating to foreign policy and thus most information is kept as confidential. Based on the above reasons, focused and selective field visits to concerned areas and


\textsuperscript{81} See e.g. 于秀波[Yu Xiubo], 《澳大利亚墨累——达令流域管理的经验》[The Lessons Learned from River Basin Management of Murray Darling Basin Australia] (2003) 21 (3) 江西科学 Jiangxi Science 151, 151-5.
interviews with relevant decision makers are essential to obtain valuable and credible information.

The first field visits took place in Beijing, where national departments in charge of water resources and climate change issues are located, mainly including the Ministry of Water Resources (MWR), the Ministry of Environmental Protection (MEP), National Reform and Development Commission (NRDC) and National Climate Centre (NCC). Hubei, Jiangxi and Jiangsu Provinces, which are key riparian provinces with various adaptation and water management policies and strategies, were visited to obtain reliable first-hand information.

Face to face semi-structured interviews with national governmental officials from the MWR, NRDC, NCC, MEP, Changjiang Water Resources Committee (CWRC) and relevant local government officials of field visit provinces were conducted to assess government’s role, responsibility, strategies and plans in adapting to various water-related climate change impacts. In order to keep up to date with the research progress with respect to climate change and water management, interviews with academicians from the Chinese Academy of Science (CAS), China University of Political Science and Law (CUPSL), Wuhan University and Nanjing University of Information Science and Technology were also undertaken. Non-governmental organisations (NGOs) such as the Greenpeace and World Wildlife Fund (WWF) have played an important role in facilitating climate change negotiations and raising the awareness of climate change adaptation. Since the WWF has been very active in promoting Yangtze sustainable development and researching on climate change impacts and vulnerability of the Yangtze River, selective semi-structured interviews with WWF staffs were also conducted to understand NGOs’ role in facilitating adaptation. Farmers and fishermen are key stakeholders who are vulnerable to climate change impacts because of their interaction with agriculture and water resources on a daily basis. Thus, interviews with them were undertaken to obtain their understanding of climate change impacts, their response and even their participation in decision-making process. For the sake of protecting and respecting all participants, their names will not be specifically identified. Only their affiliation will be provided in references to discern their different understandings and viewpoints.
Based on the questions brought out earlier, this thesis is divided into three main parts. Part one begins with an introduction of Yangtze water resources and the confronting water problems in Chapter 2. This provides the background under which the water-related legal and institutional frameworks are established and developed in China and the YRB. After that, this chapter then focuses on analysing and assessing the capacity of these legal and institutional frameworks in delivering sustainable water management outcomes. This assessment is important since these are the frameworks where adaptation is mainstreamed. More importantly, this capacity, to a large extent, determines the capacity to deal with the impacts of climate change.

Part two mainly aims to respond to the question of whether water-related climate change impacts can be mainstreamed in the IWRM related legal and institutional frameworks. It commences with Chapter 3, which screens Yangtze water-related climate change impacts and illustrate adaptation-related policies, legislation and institutional arrangements. This chapter also provides the assessment of this adaptation framework in generating or supporting effective adaptation strategies. Chapter 4 attempts to clarify the challenges to IWRM regime and framework posed by adaptation requirements from a legal and institutional perspective. It then analyses the possibility of mainstreaming adaptation considerations in IWRM by making use of their common points and bridging their differences.

Part three of this research devotes itself to answering the question ‘how could adaptation be mainstreamed in the IWRM?’ It explores recommendations for establishing a good legal and institutional enabling environment where adaptation mainstreaming in the IWRM takes place. Legal principles, legal instruments and institutional settings are recommended to develop and improve in this chapter. After setting an effective enabling environment, Chapter 6 then identifies two important entry points of mainstreaming adaptation in the IWRM: integrated water planning and environmental impacts assessment. Through these two entry points, this chapter illustrates how the above developed legal principles, approaches and institutional settings are employed to deliver adaptive and resilient water management strategies and outcomes. Lastly, Chapter 7 provides the conclusions and recommendations.
To manage Yangtze water resources in the context of climate change, the overarching question ‘to what extent does related legal and institutional frameworks on water management contribute to climate change adaptation?’ must be answered. Effective and sustainable water management is the precondition of reducing vulnerability and improving adaptive capacity to climate change impacts. Thus, this chapter focuses on the examination of the capacity of the Yangtze water resources management regime in delivering sustainable water management outcomes through assessing current water-related policies, legislation and institutional arrangements. Understanding and assessing this capacity is very significant because it further determines the capacity in the first instance, of the regime to adapt to water-related climate change impacts.

This chapter is divided into six parts:

Part A of this chapter begins with the introduction of the water problems of the Yangtze River Basin (YRB). This is essential since these water problems determine the setting and development of water-related legislation and institutional arrangements. In addition, they also could provide the basic parameters for analysing additional climate change impacts on the Yangtze water resources.

Part B of this chapter gives a theoretical introduction of the Integrated Water and Resource Management (IWRM), which is regarded as a key regime of managing water resources in Chinese legislation and by Yangtze water managers.

Part C and Part D analyse related legislation and institutional arrangements on Yangtze water management respectively to assess its capacity in delivering sustainable outcomes.

Part E investigates the practices and implementation of the IWRM in the YRB, especially its transitions underway.

Part F provides conclusions in the way of proposing some key recommendations on the legal and institutional framework of Yangtze water management.
A Water Resources and Water Problems of the Yangtze River Basin (YRB)

1 The Overview of the YRB

China is a country of vast and varied territories, complex topography and diverse climate and water systems. Water is the basic resource both for humans and for the ecosystem. Being the lifeblood for agriculture and the lifeline for China’s national economy, water resources have a close relationship with Chinese civilisation. Human settlements are usually developed along rivers. At the same time, the history of Chinese civilization is the history of contending with water disasters and generating benefits for people.¹ Water-related issues have always been at the centre of governing the country. The Yellow and Yangtze Rivers are well known to every Chinese for their roles in feeding the nation.

The Yangtze River (Changjiang in Chinese, which means a long river) is commonly referred as the cradle of the Chinese civilisation and the water tower of Asia. Fed by snow and ice melt from surrounding mountains, it is the longest river in China and Asia and the third longest river in the world. Running 6,300 km from the Tibetan Plateau to the East China Sea, the river system drains an area of 1,800,000 km² (about 19 per cent of the nation’s total land area) in 19 provinces of China with about 700 tributaries, and over 400 million people (one third of the nation’s total population) live in the basin (Figure 2 1). Its average runoff is about 996 billion m³, accounting for about 36.5 per cent of China’s freshwater resources.² The basin area is rich in lakes, which cover an area of more than 15,200 km², with most of them located in the middle and lower reaches of the river. The two largest freshwater lakes in China, Poyang Lake and Dongting Lake are linked with the Yangtze River and largely enrich Yangtze’s freshwater resources.³

The relatively rich freshwater resources of the Yangtze River provide major sources for agricultural irrigation, fisheries, hydropower and environmental flows. Its agricultural area delivers near half the country’s total crop harvest and contributes

about a third of the nation’s grain and accounts for 40 per cent of China’s Gross Domestic Product (GDP). More than 70 per cent of the fishery production is from this river. With 17 hydroelectricity dams, including the Three Gorges Dam, the Yangtze River has an estimated annual power output of more than 100 TWh, equivalent to 49 per cent of the nation’s totals. The Yangtze River has the richest biodiversity in Asia with over 340 species of fish alone, and supports diverse flora and fauna that are well adapted to constantly changing water levels and flow. This basin is also China’s treasure house of rare and precious aquatic wildlife, justifying its international significance in biodiversity and wetland protection.

Located in the centre of China and with numerous tributaries, the Yangtze River has served as a transportation and commercial thoroughfare through the heart of some of the most densely populated and economically important areas in China, and steamers can navigate as far as Yichang, 1,600 km from the sea. It is also the major inland navigation waterway with a navigation channel adding up to 57,000 km, of which 2837 km is mainstream, 52.5 per cent of the nation’s total, with the shipping capacity equivalent to four to six railways. Because of its capacity and role in transporting, it is not surprising that it is known as the ‘Golden Waterway’ connecting upstream, middle stream and downstream. Along the river, there are metropolises like Chengdu, Chongqing, Wuhan, Nanjing and Shanghai, which play an important role in connecting the west, central and east China geographically, economically, socially, environmentally and culturally. These statistics show that the Yangtze River has an extremely significant strategic position in China’s national development map.

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5 Ibid.
Figure 2. 1: The location of Yangtze River Basin
Source: The World Wildlife Fund (WWF)

2 Water Problems Associated with the Yangtze River

Accounting for nearly 40 per cent of the nation’s freshwater resources, the Yangtze River has the most abundant water resources among China’s seven major rivers. With around one third of the county’s population, it is supposed to provide sufficient clean water for people living upon this river. However, the Yangtze River is listed in the top 10 endangered rivers by the WWF, facing severe water problems, such as water over-exploitation, biodiversity reduction and adverse impacts of water infrastructure construction, soil erosion, water pollution and floods.\(^9\) This research will focus on the most severe and acknowledged water problems: soil erosion, water pollution and

floods to illustrate the pressing water crisis.\textsuperscript{10} As another important emerging pressure, climate change will be examined in more detail in Chapter 3 of this thesis.

\textit{Soil erosion}

In former times a clean river, with banks covered with green plants, the Yangtze River is now suffering its worst ever soil erosion problem and is the fourth largest sediment carrier in the world.\textsuperscript{11} The upper reaches of the Yangtze River, from the river’s origin and extends to Yichang of Hubei Province, suffers most from soil erosion. Within this area, about 90 per cent or more of the landforms are mountains and plateaus, which imply that the ecosystem is very fragile and easily subjected to soil erosion.\textsuperscript{12} Increasingly intensive, inappropriate and unsustainable land use practices, such as reclaiming land by destroying forests, farming on steep slopes and overgrazing, are all common in this area, leading to severe soil erosion and eco-environmental degradation.\textsuperscript{13} Accelerated soil erosion in the upper and middle reaches of the Yangtze River severely affects water quality and flooding intensity of the lower stream, being a major obstacle for sustainable land use, water use and basin development.

\textit{Water pollution}

The Yangtze River faces unprecedented pollution because of rapid, large-scale industrialisation, domestic economic development and increasing agricultural runoff.\textsuperscript{14} For example, water bloom outbreaks occur quite frequently in tributaries, of which the Tai Lake water contamination incident, which affected more than two million people in Wuxi, shocked the world in 2007. According to the 2010 Environmental Bulletin, water quality in the Yangtze mainstream is favourable with less than 20 per cent Grades IV, V and V\textsuperscript{+} (according to the water quality classification system in China, there are six categories of water quality from Grade I to Grade V\textsuperscript{+}. Based on purpose of water use and protection target, Grade I is the cleanest while Grade V\textsuperscript{+} is essentially useless.), which is relatively good compared with rivers in

\textsuperscript{14} Wong et al., above n 9, 42.
Northern China. However, in comparison with the water quality 20 years ago, the Yangtze River water quality has deteriorated significantly. If the water quality of basin lakes (such as Tai Lake, Chao Lake and Dianchi) is taken into account, which is assessed with Grades V and V+, the water quality in the Yangtze River is seriously under threat. Over the last 50 years, there has been 73 per cent increase in pollution level from hundreds of cities along the mainstream of the Yangtze River. The annual discharge of sewage and industrial waste in the river has reached approximately 25 billion tons, accounting for 42 per cent of the country’s total sewage discharge, and 45 per cent of its total industrial discharge. In addition to industrial waste, increasing agriculture, domestic and shipping discharges also contribute to the severe pollution situation.

Besides discharges from industry, agriculture, households and transportation, drivers of water pollution also include extensive loss of floodplain to agriculture that reduces the river’s capacity to decontaminate pollutants, and the increasing sediment due to deforestation, agriculture reclamation and dam construction. For example, the Three Gorges Dam further exacerbates Yangtze water pollution through eutrophication due to the reduction of the water velocity, the increase of water depth, the trap of sediments, and the alteration of natural flow regime. The pollution in the Yangtze River has resulted in ‘water shortages due to low water quality’, which is different from the Yellow River’s ‘water shortages due to insufficient water quantity’. To some extent, water pollution in the Yangtze River has turned an advantage of abundant water resources to a disadvantage, blocking further water-related development. Not only does pollution threaten the surface and underground water quality, restrain people’s access to safe drinking water, but it also acts as limiting factor in facilitating a sustainable water development.

18 Ibid.
20 Wong et al., above n 9, 42.
21 Wong et al., above n 9, 42.
Floods

Historically, the Yangtze River is notorious for its frequent and large-scale floods, especially in its middle and lower reaches. A great deal of effort has gone to reducing the threats of floods through the construction of series of projects like dams, reservoirs and dikes. The frequency and annual peak water level of major floods in the YRB has increased in the last few decades due to variety of factors. Uneven precipitation in this area due to the monsoonal climate, which has 70-80 per cent of the rainfall in summer, is one of the reasons leading to severe and frequent floods. More importantly, in past decades, lakes, natural wetlands and flood retention areas, which functioned as giant reservoirs and moderated extreme high or low water discharges, have been reduced and disconnected due to anthropogenic factors (e.g. over the last 50 years, 800 lakes disappeared due to reclamation in the river basin). Sediment generated from soil erosion in the upper reaches has been silted in the middle and lower reaches, which also leads to what has been attributed to human-induced floods. All these different aspects of ecosystem degradation resulting from human activities undermine the resilience of the Yangtze River ecosystem and increase the vulnerability to frequent and intense floods.

Besides these traditional water crises, new problems like droughts and water shortages in areas abundant in water resources, serious conflicts between water supply and water demand, sea level rises and seawater invasion in the Yangtze Delta zone are also emerging, bringing new challenges to current water management regime. For instance, with regard to the South-to-North Water Diversion (SNWD) project, which attempts to alleviate the dry situation in Northern China, the droughts and water shortages emerging in the YRB in recent years is undermining the validity and availability of this project. Chinese water managers have recognised the emerging drought problem in this basin. In 2007, the Changjing Flood Control Headquarter was re-named the Changjiang Flood Control and Drought Relief Headquarter (CFDH), reflecting the increasing need to tackle droughts along the Yangtze River. 

These water problems and challenges in the YRB have hampered China’s economic, social and environmental sustainable development dramatically. They are partly the result of the unchangeable natural condition of Yangtze water resources, such as the fragile ecosystem in the upper stream (prone to soil erosion) and the concentrated precipitation in the middle and lower streams (prone to floods), but more importantly, they are due to poor water governance. 25 While the natural condition of water resources like uneven distribution is hard to change and represents the physical limit to which Yangtze water managers need to adapt, water managers should put more focus on the improvement of water resources management in order to achieve good water governance. 26 More often, it is a country’s capacity to manage water resources that impacts economic and social development rather than the natural condition of water resources. 27

The rapid and ongoing economic and social development in China will most likely exacerbate existing water problems and present series of challenges to the current water management regime. For instance, the improvement of people’s living standards poses a dilemma for water resources management to curtail the increasing discharge of untreated household wastewater, and to meet the strong demand for a higher quality of water. Furthermore, emerging climate change impacts on water resources also pose additional challenges to water management. All these challenges require Yangtze water managers to assess the present water management regime and improve it to better manage these crises and risks in order to achieve a sustainable water development future. A constantly improving water resources management regime not only contributes to sustainable development but also enables itself a capacity to respond effectively to emerging climate change impacts. 28 The following part will analyse the Yangtze water management practices and related legal and institutional frameworks to assess to what extent it contributes to sustainable outcomes.

26 Ibid.
28 Ibid.
Under the backdrop of immense pressure to alleviate poverty and develop its economy in the first twenty 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. This paradigm has been criticised widely due to its negative effects on water utilisation 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. Before analysing the legal and institutional frameworks on IWRM, this part will provide a theoretical introduction of IWRM to illustrate its conception, principles, features and criticisms.

The concept 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 organisations, for example the International Conference on Water and Environment, at which the well-known Dublin Principles were formulated. The Dublin Principles were later consolidated into Chapter 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). It was not until 2002 at the World Summit on Sustainable Development in Johannesburg, South Africa, that IWRM was recognised as one of the key components to achieve sustainable development. Now it is being implemented in

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30 Jiang, above n 25.
32 Ibid.
many countries, expecting to achieve the best balance among social equity, economic development and environmental sustainability.\textsuperscript{33}

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.’\textsuperscript{34} This integrated approach requires developing water policy options that recognise 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).\textsuperscript{35} It describes IWRM as

\begin{quote}
A process that enables the co-ordinated management of water, land and related resources within the limits of a basin so as to optimise and equitably share the resulting socio-economic well-being in an equitable manner without compromising the long-term health of vital ecosystems.\textsuperscript{36}
\end{quote}

Although there are other definitions given, by various organisations and, at conferences, most of them are based on the Dublin Principles: (1) water has an economic value and should be recognised 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 and 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 decentralised 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.\textsuperscript{37} The Dublin Principles have, to a large extent, extended our understanding of water resources and water management.

Mitchell encapsulated IWRM into three key elements: coordination, stakeholder participation and the existence of a different level of decision-making at which

\begin{footnotesize}
\textsuperscript{33} Lenton and Muller, above n 27.
\textsuperscript{37} Vasudha Pangare et al., Global Perspectives on Integrated Water Resources Management (Academic Foundation and World Water Institute, 2006) 79.
\end{footnotesize}
integrated resource management can be pursued. His understanding has more procedural and institutional applications, which distinguish IWRM from traditional fragmented and sectoral water management approaches. It is important to note that IWRM is not a simple amalgamation of the existing management of water, land and other related resources. On the contrary, it reflects a paradigm shift in water management, both from a substantive perspective and a procedural perspective.

Some key principles of IWRM, such as basin-level management, public participation, good governance and information sharing, have been widely recognised 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 reflect that country’s specific condition and needs. 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. Even within one country, various levels of government (national, regional and local) should 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.

Not surprisingly, the IWRM concept and implementation also encounters some scepticism. 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.

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40 Lenton and Muller, above n 27.
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.\textsuperscript{42} It is true that there has never been a clear definition of ‘integration’ due to the complicated crosscutting nature of water resources. Nonetheless, this research 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 management that can adapt to diverse national and local contexts.’\textsuperscript{43} 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.’\textsuperscript{44}

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.\textsuperscript{45} 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.\textsuperscript{46} 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.\textsuperscript{47} 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

\begin{itemize}
\item \textsuperscript{42} Ibid 251-2.
\item \textsuperscript{43} Danka J. Thalmeinerov, \textit{Introduction to IWRM} Global Water Partnership <www.gwpforum.org>.
\item \textsuperscript{46} Lenton and Muller, above n 27, 12.
\item \textsuperscript{47} Pangare et al., above n 37, 48.
\end{itemize}
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.\(^{48}\) 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.\(^{49}\) 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:\(^{50}\)

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 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 generally 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’ (Figure 2.2).\(^{51}\) These three pillars provide a relatively comprehensive vision of effective IWRM – from the existence of well-functioning institutions to an enabling policy and

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\(^{49}\) Lenton and Muller, above n 27, 8.

\(^{50}\) Lenton and Muller, above n 27, 8-9.

\(^{51}\) Hassing et al., above n 44.
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 thesis, only the policy and legislative framework of the first pillar, institutional arrangements of the second pillar and management instruments of third pillar will be discussed in detail.

Figure 2.2: The three pillars of IWRM – enabling environment, institutional framework and management instruments


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. 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. In China, the priority of water reforms is focusing on ‘efficiency’ without considering human rights with respect to water. Water is an economic good, but at the same time, it is also a social good. 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. 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. Water development initiative could only be sustainable and successful when it is based on the equitable and efficient management.

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 organisations, and among different related authorities; and (3) mechanisms should be devised wisely to enable the participation of stakeholders in the decision-making process.

C Legal Framework with Respect to the Yangtze Water Resources Management

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52 Lenton and Muller, above n 48, 213.
55 Ibid 72.
57 Pangare et al., above n 37.
58 Rahaman and Varis, above n 31.
59 Lenton and Muller, above n 48, 214.
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 related legislation in supporting and implementing IWRM. This task is approached by analysing related legislation at the national level and the YRB level respectively. Along with this analysis, the capacity of water legislation in facilitating sustainable water management will be assessed.

1 Legal Framework for Water Resources Management at the National Level

(a) Understanding China’s Legal Framework with Respect to Water Resources

The Chinese government realises 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.60

With a centralised and unified administrative and political system, the Chinese government has developed an approach of having policies and laws set centrally but implemented locally.61 Meanwhile, local legislative departments conserve certain powers in formulating legislation on local issues. In the water sector, 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 build up a comparative legal framework on water resources at the national and local

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level, which covers majority aspects of water resources including water resources development, utilisation and protection, water and soil conservation, flood and drought prevention and control, engineering project management and protection.

Water laws and regulations in China are generally classified into the four categories, according to their legal validity and the legislatures enacting them: (1) laws enacted by the National People’s Congress (jiben fa) and its Standing Committee (jalv); (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 higher-level ones supersede those of lower level. Category (1) has the highest legal validity and is applicable around the nation, while category (4) is the lowest and only is 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.62

Until now, there are no laws addressing water utilisation, water pollution control, water disaster prevention and control, and ecological conservation in an integrated way. At the national level, four laws – ‘Water Law’, ‘Water and Soil Conservation Law’, ‘Water Pollution Prevention and Control Law’ and ‘Flood Control Law’ are regarded as the ‘Four Basic Laws’ (sibu jiben fa) regulating national water resources management. From their titles, it is readily apparent that the ‘Four Basic Laws’ mainly devote themselves to the four prominent water problems in China: water shortage, water pollution, soil erosion and floods. Aiming to resolve serious water crises and facilitate good water governance, these laws are supposed to provide the basic legal foundation for various levels water management. 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 regulatory framework for water management activities.

(b) An Assessment of the Legal Framework Regarding Water Resources

Compared to past water management practices from 1949 to 1978, especially during the Great Leap Forward and Cultural Revolution periods, which were characterised 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 behaviour. 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 the fragmented legislative mentality, the 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 problems. Furthermore, even though some amendments were subsequently undertaken to reflect the new perceptions of water resources, they do not change the ideology, mentality and approaches 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: utilitarianism and anthropocentrism, dominant command-and-control approach and end-of-pipe treatment. For example, the emphasis of most water laws has been on securing water resources, developing hydropower and controlling floods. 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, too often, is manipulated at the local level by economy-oriented government, resulting in the prevailing water crises such as water overexploitation and water pollution. Understanding that, this part will examine the

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63 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.
2002 Water Law as an example to investigate to what extent existing water legislation is a contributor or barrier to 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 (of People’s Republic of China) developed from the 1988 Water Law indicates a significant step in China’s water management history. First, it emphasises the saving, protection and rational allocation of water resources, trying to balance water’s economic and environmental value as well as contributing to a water-saving society. Furthermore, it encourages the adoption and implementation of 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.

According to this law, RBCs have been established on rivers and lakes that are of national significance to implement IWRM. It is the first time that RBCs have been given formal legal status. The requirement that national strategic water resources planning and river basin (regional) planning (comprehensive planning and specific planning), water supply and demand planning etc. should be conducted provides water resources planning with a clear legal position and a good start for IWRM.

This law also set up a water rights 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.

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, helping to alleviate pressing water shortages in some cities. Other important mechanisms such as water-function-zone system, total

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pollutant discharge and combined total-quantity control and quota-based control were also established to promote water quality and sustainable water use. After ten 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 criticised for its low capacity of curbing deteriorating water shortage, water pollution and delivering good water governance. First, it only provides general principles and framework for water management, lacking clear definitions, mechanisms and procedures for implementation. For example, the vague language frequently employed in this law has led to various conflicted explanations and difficulties in implementation. The unclear definitions on the responsibilities and duties of local government, different water authorities and RBCs have also created a number of vacuums and overlaps.\(^73\)

Second, this law is sector-based, representing sectoral interests and lacking sufficient coordination with other relevant water laws. In some cases, these are even contradicting provisions among different sectoral laws. For example, provisions on water utilisation and development in the 2002 Water Law sometimes are not compatible with those on water protection in the Water Pollution Prevention and Control Law. This is partially due to China’s ‘sector-based’ legislative process, in which a ministry or administrative authority of the central government is entrusted with the power of drafting a law or regulation within its jurisdiction.\(^74\) Even though a consultation process to other line authorities such as the Ministry of Environmental Protection (MEP) is required in the legislative process to avoid conflicts, it does not influence the result substantively given the dominant power of the Ministry of Water Resources (MWR) when drafting the Water Law.

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.\(^75\) In practice, certain incidents (especially water pollution incidents) could speed up the legislative process, with a special intention to resolve related water problems. For example, the enforcement of ‘Temporary Regulation on Public Participation in

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\(^{75}\) Wouters et al., above n 73, 301.
Environmental Impact Assessment’ was largely due to the Songhuajiang Pollution Incident and Nujiang Dam Construction Dispute, while Wuxi Water Incident catalysed the formulation of ‘The Tai Lake Basin Management Regulation’. This sometimes inevitably results in inconsistency with other laws.

Comparing the progress with the deficiencies of the 2002 Water Law, it is obvious that this legislation is the combination of a traditional fragmented management regime and advanced IWRM paradigm. This is mainly because China’s water resource management is in its transitional stage, which will be analysed later. A transitional period is very common for many developed counties in water management history, but China complicates this process by its weak legal traditions and powerful administrative system. While it is unrealistic to accomplish the transition in a short period, what water legislation can contribute towards good water governance is to be IWRM-oriented and to be updated with the new perceptions on water resources.

In addition to the 2002 Water Law which specifically focuses upon water quantity and water distribution, the ‘Water Pollution Prevention and Control Law’ has played a vital role in preventing and controlling water pollution, protecting the aquatic environment and improving the effectiveness of water resources management. The ‘Water and Soil Conservation Law’ is for the prevention and control of soil erosion, the protection and rational use of water and soil resources, the mitigation of disasters of flood, drought, windstorm and the improvement of the ecological environment. The ‘Flood Control Law’ is promulgated to prevent and control floods, take precautions to alleviate calamities of floods and related waterlogging and to protect the safety of people’s lives and property. This thesis will not reiterate their progress and shortcoming in addressing water problems and facilitating good water governance, but argue that most of them share the same features with the 2002 Water Law.

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77 Yang and Griffiths, above n 65, 745-61.
National water laws and regulations underpin the Yangtze water management. Due to the significance of the Yangtze water resources in China, some administrative regulations enacted by the State Council and ministerial regulations released by the MWR have been issued specifically. The ‘Yangtze River Channel Sand-mining Regulation’ issued by the State Council is one of such examples. Apart from these, there are also some specific enforcement regulations, rules, methods or standards issued by the Changjiang Water Resources Committee (CWRC). 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 organisations 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 CWRC promulgated its enforcement regulation on ‘Methods’ to supervise and manage related activities in the YRB. ‘Rules tend to be more administrative and methods more technical, while standards provide numerical bases for compliance.’ For the CWRC, which is only entrusted with very limited legislative power on certain issues, rules, methods and standards are common tools for Yangtze water managers to manage Yangtze water resources.

Compared to the development of laws and regulations at the national and local level, legislative progress at the basin level has been far behind. The absence of comprehensive basin level legislation has been a barrier for IWRM implementation and for the CWRC to play its role. There has been a strong appeal for a ‘river basin law’ on seven major river basins to improve water-related technical cooperation and coordination.

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83 Zhang, Mu and Shao, above n 62.
This idea has been widely advocated by legal scholars and water managers due to its advantage in facilitating basin-wide water management and improving coordination among different jurisdictions along the same river. As a result, the CWRC proposed to establish a macro legal system for the YRB, which was centred with ‘Yangtze River Basin Law’. The CWRC and other researchers also have carried out a number of YRB-related research projects in the past few years, such as the one ‘Regulation of Water Resource Protection on the Yangtze Basin’.

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 future of the ‘Yangtze River Basin Law’, some laws or regulations on a sub-basin level in the YRB have made substantive progress.

As a sub-basin of the YRB, the Tai Lake Basin (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 per cent land and 4.3 per cent population, the TB generated 10.8 per cent of the GDP in 2010.

Due to the intensive population and rapid economy development, it has long been overwhelmed by the pressures of severe water pollution, water scarcity and floods. The Wuxi Water Incident in 2007 shocked both the central and local governments, which, as a result, catalysed 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.

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.\(^{91}\) Compared to the counterpart in the 2002 Water Law, which only requires water infrastructure construction to be enhanced by local government above county level and to be integrated in local economic and social development plan,\(^{92}\) 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 recognised.\(^{93}\) This is significantly different from the understanding of water resources in the 2002 Water Law which regards water only 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,\(^{94}\) while in the TBRM, economic structure and industry distribution is required to readjust to adapt to water resources.\(^{95}\) This reflects a shift from water-supply management to water-demand management, an essential transformation towards IWRM. Although this new regulation retains the much criticised IRBM and administrative combination management regime, it clearly recommends building a more collaborative mechanism.\(^{96}\) For instance, it requires that the plans made by local water authority and those of environmental authority must be

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the subject of collaboration and consistency. 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.

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 Yangtze water resources. 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, to a large extent, encourage and facilitate the legislative process of the Yangtze River Basin Law.

### D Institutional Arrangements of Yangtze Water Resources Management

As the second pillar of IWRM, a well-arranged institutional framework could largely assist with the implementation of IWRM in the context of laws and regulations and the overall legal system. An effective and robust institutional structure is also important in the sense of responding to unexpected events and surprises. This part will illustrate how key related institutions are arranged to manage Yangtze water resources and to what extent these arrangements could facilitate effective implementation.

The 2002 Water Law stipulates that water resources in China are public goods and state-owned. The MWR is the department responsible for the management and supervision of water resources at the national level. RBCs are dispatched institutions of the MWR to undertake corresponding responsibilities and powers authorised by laws, regulations and the MWR. Combined with various levels of local water

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authorities (provincial, prefecture and county), a complicated multi-level institutional framework with a river basin-based approach has been formed in China.\textsuperscript{101} 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 arrangements on water management are characterised by being ‘vertically fragmented and subject to primarily sectoral management’. This part will expound how the vertical and horizontal institutional arrangements operate on Yangtze water resources and to what extent they remain as barriers to effective IWRM implementation (Figure 2.3).\textsuperscript{102}

\begin{figure}[h]
    \centering
    \includegraphics[width=\textwidth]{diagram.png}
    \caption{The institutional arrangements on the Yangtze water resources management}
\end{figure}

1 \textit{Vertical Institutional Arrangements with Respect to Yangtze Water Management}

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Vertical institutional arrangements deal with the responsibility distribution among different levels of water authorities and organisations, from central to regional (basin) and to local level. China has developed a powerful centralised 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 Yangtze water plan preparation and extraction permit management to balance water demand and supply. The CWRC is the RBC responsible for implementing Yangtze plans and laws, and coordinating conflicts at the basin level. It is also empowered with certain power of organising the planning process and determining key plan elements for trans-provinces tributaries or sub-basins, together with provincial water departments. 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 deliver good water governance. Policies, plans and laws made by the powerful central government have often encountered resistance or ignorance by local governments that are responsible for their implementation. Furthermore, 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. In addition, the CWRC complicates this administrative structure due to its ambiguous legal status. Based on the regime of IRBM in conjunction with jurisdictional management, CWRC and local government play key roles in Yangtze water management. Therefore, this part will mainly focus on the role of the CWRC and local water authorities in managing Yangtze water resources.

**The Role of the CWRC in Yangtze Water Resources Management**

There are actually another four managers of the YRB except the CWRC: the Changjiang Water Resources Protection Bureau (affiliated to the MWR and the MEP), the Changjiang Fishery Resources Management Committee (affiliated to the MOA), the Changjiang River Administration of Navigational Affairs (affiliated to the MOT)
and the Changjiang Water and Land Sustaining Committee. Different from those four managers focusing on specific basin interests, the CWRC is empowered with comprehensive responsibility of managing the Yangtze water resources through water planning, providing guidance, supervising water management activities, coordinating conflicted interests and implementing related water laws. More importantly, it is the CWRC responsible for the development and implementation of the IWRM regime in the YRB, although it has a focus on water infrastructure construction and flood control in practice. As clarified in the first chapter, this thesis mainly focuses on the integrated management of the Yangtze water resources through implementing the IWRM regime. As a result, this thesis mainly illustrates the relationship between the CWRC and other various levels of related water management authorities.

A credible RBC 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. Using these three lenses to measure the powers and responsibilities entrusted to the CWRC, it is evident that the CWRC has not yet developed into a mature and credible RBC.

According to the Article 12 of the 2002 Water Law, the CWRC is directed by the MWR to undertake administrative water management responsibility for the YRB. However, due to the ambiguous language in the Water Law, there are no clear stipulations with respect to the powers and responsibilities given to the CWRC. In practice, the CWRC has proceeded in accordance with the following missions:

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 authorised by the MWR

2. To organise the preparation of basin master plan and speciality plans, and oversee their implementation

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106 Yang and Muller, above n 7, 148.
(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
(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 organise 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 ‘organise’, ‘prepare’, ‘coordinate’ ‘supervise’ and ‘guide’ etc are employed very frequently. These words indicate that the CWRC has been entrusted with more procedural rather than substantive powers. From a substantive perspective, although CWRC has certain powers such as distributing water among provinces, making certain regulations and operating water projects, it only has very limited power in allocating water resources, managing water resources exploration and conservation and making water resource planning at the basin level. 109 From a procedural perspective, supervising the implementation of laws and plans, coordinating conflicting interests and providing scientific guidance have been the main responsibilities of the CWRC. For example, in the ‘Water Prevention and Control Law’, responsibilities of the CWRC 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 the CWRC to mediate conflicting interests, but without appropriate substantive power, it is not able to function as a real RBC for the interests of the whole basin.

In addition to the limited power on substantive water issues, the affiliated position to the MWR also restrains the CWRC from being an effective RBC. As an extension of the MWR, CWRC manages Yangtze water resources within the responsibility and

109 Jiang, above n 25.
scope of the MWR in a very narrow way. For example, it has authority on related water quantity issues, but does not have the same authority for water quality. In addition, being defined by the responsibility scope of the MWR, the CWRC has a single focus on water resources, without giving enough consideration to other sectors such as land and forest. Its affiliated status also determines that the CWRC will follow the approaches of the MWR in managing water resources. As a result, the CWRC is intended to provide technical support, preferring a technology and engineer-oriented approach rather than an integrated technical, economic and legal approach. It is very weak in investigating and punishing those illegal water activities in this basin. In general, the CWRC has been mainly functioned as the principal scientifically administrative, advisory and consulting agency within the YRB.

Furthermore, although using the term ‘commission’, the CWRC does not work like those in the U.S., Europe, Australia and Japan, which have wide representatives from various levels of governments, water users and interested public. There is no institutionalised procedure or platform for other related departments (e.g. the MEP) and local governments to participate, which inevitably impairs the CWRC’s ability in managing water resources comprehensively. As a crucial part of being a real RBC, 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 Yangtze water management are administration-driven rather than stakeholder-driven.

Being aware of the problems, the CWRC is undergoing a systematic reform of its management system to develop itself to be a proper basin commission. For instance, there has been an increasing role of CWRC in strategic planning of those significant provincial watersheds or lakes that are used to being predominated by provincial water departments. Nonetheless, its fully-fledged status cannot be established just through CWRC’s self-reform. In the above case, the CWRC still lacks power over

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111 He and Chen, above n 105.
113 Song et al., above n 102, 503.
114蔡其华 [Cai Qihua], above n 87.
plan enforcement, which too often leads to incompatibilities between a plan on paper and in practice. To be a real RBC, CWRC needs the empowerment from relevant laws to clearly stipulate its substantive responsibilities. More importantly, it requires a paradigm shift to include the public participation as an integral part of the CWRC and the decision-making process.

Local Government and Local Water Authorities

In the 2002 Water Law, the CWRC is 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 local water authority.116 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 CWRC with provincial water authority, which is hard for the CWRC to get involved in local water affairs. In that case, the function of the IRBM in conjunction with jurisdictional management regime, to a large extent, depends on the collaborative mechanism among them. While local governments prefer to manage water resources from its own local interests,117 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 CWRC and local (especially provincial) water authorities.

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.118 They have technical skills, but their internal incentives are not well matched with current institutional missions.119 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.120 Since water authorities are part of the corresponding local governments, they are influenced

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117He and Chen, above n 105.
118Shen and Bin, above n 101.
119Varley, above n 10, 4.
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, nonetheless, local governments are very often sponsors or stakeholders of polluting enterprises, considering environmental regulations incompatible with economic growth. Based on local protectionism, they are very likely to ignore or minimise 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 Yangtze water resources are managed in ways that maximise local interests and ignoring the basin-level benefits.

In recent years, there has been some significant progress in urging local government to take responsibility of achieving sustainable water development. In the 2008 ‘Water Pollution Prevention and Control law’, the success of water protection measures has been regarded as one of criterion of assessing the performance of local government officials. More importantly, an environmental protection responsibility system and evaluation system has been proposed to assess lower government officials and officials of environmental authorities by the draft amendments to the Environmental Protection Law.

The Stakeholders and Public Participation in the CWRC

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 maximise the social welfare and utility of resources use, and to protect vulnerable groups.’ 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 analysed,
the CWRC is not yet developed into a fully-fledged RBC where stakeholders and the
public are an inherent and integral part of the CWRC. From a legal perspective,
current regulations are not effective in enabling them to participate in the Yangtze
planning and decision-making process.

Despite the fact that water laws in China have provided a simplified system for public
participation,127 most of these provisions exist only in principle and are very weak in
practice.128 The insufficiency of stakeholder and public participation has resulted
from a couple of factors. First, China has a long history of centralised 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),129 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 institutionalised participation.130 This too often leads to distorted
implementation. Third, there is lack of transparency in the publication of information,
which is a crucial precondition of public participation. Fourth, as Easter and Dixon
have noted, ‘planning for water resource management has often been approached
from an engineering perspective’.131 The high reliance on experts such as scientists
and engineers,132 provide a ‘sound’ excuse to exclude stakeholders and the public
from water related decision-making. The public are tended to be regarded as having a

127 See e.g. 《中华人民共和国水污染防治法》[Water Pollution Prevention and Control Law of
People’s Republic of China] (People’s Republic of China) National People’s Congress, Order No 87,
128 Wouters et al., above n 73, 307.
129 《水行政许可听证规定》[Regulation on Public Hearings for Administrative Permits in Water
130 Yong Geng et al., ‘Perspectives on Small Watershed Management in China: the Case of Biliu’
131 K.William Easter and John A. Dixon, ‘Implications for Integrated Watershed Management’ in
K.William Easter, John A. Dixon and Maynard M. Hufschmidt (eds), Watershed Resources
Management: an Integrated Framework with Studies from Asia and the Pacific (Institute of Southeast
132 Yong Jiao, The Revision of Yangtze River Basin Plan Should Reflect Its Own Basin Characteristic
lack of interest and professional knowledge of water resources management, therefore a lack of qualification to participate. 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’. ¹³³

The absence of public representatives in the CWRC 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 Horizontal Institutional Arrangements with Respect to Yangtze Water Management

From a horizontal perspective, institutional arrangements on the Yangtze River also show a complicated intersecting picture, which is dubbed as the ‘Nine Dragons Governing the Water’.¹³⁴ These ‘nine dragons’ (not literally mean nine authorities) from different sectors and with different interests of water resources, as a result, lead to sectoral and fragmented institutional settings. The original objective of this institutional arrangement is to improve water management efficiency and effectiveness from different aspects. However, due to a lack of clear responsibility distribution and coordination mechanisms, this institutional arrangement 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 Table 2.1, 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.¹³⁵ According to sectoral laws and regulations (e.g. ‘Water Law’,

¹³³ Geng et al., above n 130.
¹³⁵ Ibid.
‘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; the MOA has the responsibility for agricultural non-point source pollution control and protection of 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.

<table>
<thead>
<tr>
<th>Main water-related departments</th>
<th>Main water management responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Water Resources</td>
<td>Surface and ground water management, river basin management, flood control, water and soil conservation, designation of water function regionalisation, national water planning and policy making; supervision lower level implementation</td>
</tr>
<tr>
<td>Ministry of Environmental Protection</td>
<td>Aquatic environmental protection, water environmental function regionalisation/zoning, establishing national water quality standards and national pollutant discharge standards, water pollution prevention and control,</td>
</tr>
</tbody>
</table>

136 Shen and Liu, above n 101.
Table 2.1: Main water-related departments and their responsibilities on water management

<table>
<thead>
<tr>
<th>Department</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Agriculture</td>
<td>Supervision the implementation Non-point source pollution control, protection of fishery water environment and aquatic environmental conservation, irrigation water protection</td>
</tr>
<tr>
<td>Ministry of Transportation</td>
<td>Pollution prevention and control of navigation of ships on rivers</td>
</tr>
<tr>
<td>Ministry of Construction</td>
<td>Planning, construction and management of water supply projects, drainage and sewage treatment projects, urban and industrial water use and urban water supply and drainage</td>
</tr>
<tr>
<td>State Forest Bureau</td>
<td>Forest protection and management for protecting watershed ecology and water resources</td>
</tr>
<tr>
<td>State Electric Power Company</td>
<td>Construction and management of large and mid-scale hydropower projects</td>
</tr>
<tr>
<td>Ministry of Health</td>
<td>Supervision and management of the drinking water standard</td>
</tr>
</tbody>
</table>

Given the crosscutting nature of water resources, involving different authorities provides a balance to different aspects and values of water resources, but their responsibilities must be clearly defined in water legislation. As illustrated in the previous Part C, existing water legislation is developed according to sectors, which too often results in conflicting legal provisions due to lack of coordination. Furthermore, the absence of clear responsibility distribution in this water legislation is likely leading to overlaps and conflicts when undertaking specific water management actions.\(^\text{137}\) For example, while the MWR is responsible for monitoring and regulating

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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 water pollution control laws and total pollution discharge control plans. In addition, both of them are involved in designating and 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 arrangements 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, but institutions are also organised differently. The main agencies involving in flood control and drought relief are China Meteorological Administration (CMA), State Flood Control and Drought Relief Headquarters (SFDH), 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 mobilise 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, the CFDH is responsible for the flood control and drought resistance in the YRB. Although lead by the SFDH, it is an administrative body of the CWRC. At the provincial, prefectural and county levels, the Flood Control and Drought Relief Office (FDO) under corresponding local water authorities are in charge of local floods and droughts. A complicated nexus exists among the MWR, MCA, SFDH, CWRC, CFDH and local FDOs, resulting in conflicts when clear responsibility allocation is absent. For example, the SFDH, MCA and other relevant government departments have their own schemes for declaring an emergency status, but with completely

138 Feng, He and Kinne, above n 134.
139 Jiang, above n 25.
different criteria.\textsuperscript{141} 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 Yangtze 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’.\textsuperscript{142} Unless significant progress is made to establish integrated, efficient and effective institutional arrangements, IWRM could not be implemented effectively in the YRB.

\section*{E The Practice of IWRM in the YRB}

Part C and D have illustrated the legal and institutional frameworks on Yangtze water management and their capacity in supporting IWRM. Due to the gap between what is on paper and what is in practice, an investigation of IWRM implementation is important to understand its practices in the YRB.\textsuperscript{143} 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.\textsuperscript{144} 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 YRB still exhibit the coexistence of tradition and modern water management regimes. This part starts with the investigation of IWRM.

\textsuperscript{141} Tao Ye, ‘China’s Drought Disaster Risk Management: Perspective of Severe Droughts in 2009–2010’ (2012) 3 (2) \textit{International Journal of Disaster Risk Science} 84, 94.
\textsuperscript{142} Cosier and Shen, above n 61.
\textsuperscript{143} Xia and Pahl-Wostl, above n 115, 69.
\textsuperscript{144} Elizabeth C. Economy, \textit{River Runs Black: The Environmental Challenge to China’s Future} (Cornell University Press, 2\textsuperscript{nd} ed, 2010) 237.
implementation in the YRB, following with the analysis of the water management regime transition taking place.

1 Understanding the Status of IWRM in the YRB

Given the 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 achieving good water governance. Chief engineer of the MWR, Liu Ning, notes that ‘without IWRM, China’s total annual water supply will reach 800 to 900 billion cubic metres in the next 25 years or hit the limit of the country’s total water supply’.\(^{145}\) 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.\(^{146}\) 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 in the YRB.\(^{147}\) 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.\(^{148}\) An expert from the GWP has commented that:

> it 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.\(^ {149}\)

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


\(^{147}\) Ibid 125.

\(^{148}\) Ibid 123.

\(^{149}\) Liang, above n 145.
adopted with a view to sustainable water resources management. The adoption and implementation of IWRM is particularly facilitated by amendments to the Water Law in 2002. Some important features of IWRM in China and the Yangtze River can be seen from this 2002 Water Law and can be demonstrated as follows: (1) the Chinese State Council holds the ownership on behalf of the Central Government; (2) IRBM and administrative management are combined to manage the Yangtze River; (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; (4) integrated planning should be undertaken by using a river basin as a basic unit of management; (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; (6) the plan for a region within a river basin should be subordinated to the comprehensive river basin plan etc.

The above provisions clearly indicate that some key elements of IWRM have been written into current water legislation, laying important foundations for integrated Yangtze water management, 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: (1) adopting a

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151 Song et al., above n 102, 501.
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. 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. Nonetheless, not all of these initiatives cover all that is necessary to properly develop and implement IWRM. First, while China is moving towards an IWRM regime and taking the entire river basin into account when planning and allocating water resources, the use of IWRM is presented in the Chinese literature as more developed than it seems to be in reality. Although cautious and progressive steps on developing legal framework and institutional arrangements have been taken to keep pace with the requirements of IWRM, 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 fully embrace an IWRM paradigm: the laws are poorly developed, institutions are fragmented and stakeholders’ participation is severely curtailed. These impediments are not conducive to widespread and effective implementation of IWRM.

160Zhang, Chang and Jiao, above n 146, 125-6.
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 participatory mechanisms to solve conflicts and compromise among competing water users, and the balance among economic, social and environmental aspirations. The international community has recognised 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’; 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’. In China, IRBM has also been provided with legal status in the 2002 Water Law through the provisions about river basin planning and river basin management. It has been recognised 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 harmonisation between people and nature, urban and rural areas, economic and social development. Nonetheless, 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

167 CCICED Taskforce on Integrated River Basin Management, above n 163.
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.169

There is a considerable political commitment to implementing IRBM in the YRB. One of the prominent examples is the formulation of more comprehensive plans in the context of the YRB. At the end of 2012, after a long revision process conducted by the MWR, CWRC, other ministries and 19 riparian provinces, the State Council approved the ‘Integrated Yangtze River Basin Planning (2012-2030)’. This new plan sets Yangtze ecosystem health as a key target in order to manage the YRB comprehensively and sustainably through river basin planning, integrated management and balancing different interests. It focuses on flood and disaster prevention, river basin management approaches, aquatic environment protection and the improvement of water use efficiency, reflecting the transformation in both water management mentality and approach.

Compared to the progress of IRBM on 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 WWF on various Yangtze tributaries to implement IRBM. 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).

172 Turner, above n 110.
The CCICED has also proposed to introduce IRBM governance in the Chishui River and the Tai Lake Basin (TB), which are important tributaries of the YRB with natural and cultural values.\textsuperscript{173} 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.\textsuperscript{174} These pilot programs are part of the integrated Yangtze water management, and more importantly, the experiences and capacity building through them could contribute to a wider level of IRBM at the YRB.

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

(a) Building Collaborative Mechanisms among Local Government and CWRC

Collaboration among CWRC and different provinces of various interests is always one of the most challenging tasks for Yangtze 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 in Part C and D). 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 resources in the middle line of the SNWD project.\textsuperscript{175} It is a significant innovation over current ‘IRBM in conjunction with the jurisdiction management regime’. In 2009, the Yangtze water protection institution affiliated with CWRC – The Yangtze River Water Resource Protection Bureau (WRPB) organised a conference ‘The Joint Meeting on Water Protection and Pollution Prevention in Water Source
Areas’ with participation from five prefectures: Hanzhong, Ankang and Shangluo of Shaanxi Province, Nanyang of Henan Province and Shiyan of Hubei Province. The document ‘Shangluo Declaration’ generated at the meeting proposed to establish a 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. This ‘Five plus One’ model, which means five local governments plus the WRPB, could break through the fence existing among jurisdictions and sectors, promoting more coordinated and harmonious water usage, protection and development. It was not only successful in exploring the approaches of combining river basin management and administrative management, but can provide a model for future YRB management.

(b) Setting up Institutions to Integrate Water Quantity and Quality Management

In practice, several highly industrialised 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 (only Shanghai and Taizhou are located in the YRB). 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. Although these water authorities are not strictly recognised 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.
To sum up, Chinese water managers have been aware of the necessity of implementing IWRM and IRBM. However, given the complicated circumstances of the YRB, which involves 19 provinces with different levels of development, from the impoverished Tibetan Autonomous Region to prosperous Shanghai, the variety and escalating gaps among them makes IRBM implementation very challenging. 182 Fortunately, considerable progress has been made at the tributary or local levels on a number of different water management fronts. More importantly, water managers need to realise that no matter at which level IRBM is implemented, a comprehensive mindset and regime must replace the current fragmented and localised thinking and paradigm.

3 The Transition from an Engineering Mentality to a Resource-oriented Mentality

(a) The Dominance of the Engineering Mentality in Yangtze Water Management

China has a long history of managing water resources through project construction, river diversion and canalisation, mainly due to the requirements of agriculture and flood 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 dams. 183

In addition to the legacy from China’s thousands of years of history, China’s Marxist ideology also imposes a profound influence on China’s approaches to managing water resources. Due to Marxism’s perception on nature, water resources management in

182 Varis and Vakkilainen, above n 29.
183 Wouters et al, above n 73, 247.
China has been dominated by an ‘engineering’ (gongcheng shuili) mentality, which focuses on human economic interests and his 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. Most of the top leaders in Chinese central government are trained as engineers, and water agencies are staffed exclusively with water professionals. This is also the same case with various local water authorities. The economic visibility and certainty of hydraulic projects also contributes to their wide adoption. As a result, both central and local water authorities prefer to respond to water problems by investing in massive new infrastructures rather than new management approaches.

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 flood protection infrastructure. On the Yangtze River alone, there are an estimated 50,000 dams, including the largest one in the world – the Three Gorges Dam. Due to the great economic benefits from building dams in 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 optimised allocation of water resources must rely on four approaches: the hydraulic, administrative, economic and scientific approaches.’ 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

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184 Boxer, above n 86, 335-41.
186 Ibid.
188 Gleick, above n185.
inappropriate expensive approach which requires evaluation and public acceptance.\textsuperscript{190} 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.\textsuperscript{191} The deterioration of aquatic environment and land habitat, the loss of biodiversity and the drying up of the river-system are examples of the 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.\textsuperscript{192} 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.\textsuperscript{193} This may be challenged by climate change impacts that are with high uncertainty and unpredictability.

\textit{(b) The Transition to a Resource-oriented 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 water infrastructure and the investment in better water management regimes has also been conducted.\textsuperscript{194} This debate argues that: first, the benefits and costs of hydraulic projects must be re-evaluated. For example, not only should the economic cost of a project be assessed, but also its environmental and social cost should be recalculated; second,
other water management choices such as water efficiency improvement, water rights adjudication and water market development should be given equal consideration. According to a study conducted at the country level, developed countries typically require improving water management regimes while those less developed prefer dam and reservoir construction.\textsuperscript{195} Nonetheless, it is important for less developed countries to realise that improving water management regimes 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, thanks to the influence from western countries, a new ‘resource’ concept and ideology to ‘integrate engineer intervention, economic assumption and management strategies to achieve interrelated water quality, water supply, and water conservation goals’ has been widely acknowledged by Chinese water managers.\textsuperscript{196} In 1999, the MWR introduced a distinctive perspective to Chinese water management – ‘resource-oriented’ concept (\textit{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 its inherent natural, ecological and social values. On the other hand, water management is recognised 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. For example, market instruments such as water right licensing systems along with the water resource fee systems have been adopted and implemented in the 2002 Water Law.\textsuperscript{197} Since China is on a transition stage economically, politically, socially and legally,\textsuperscript{198} this ‘resource’ mentality will take some time to be fully implemented in practice. Contradictory messages may be manifested in China’s water management community in a short time.

\textsuperscript{195} Ibid 308, 315.
\textsuperscript{196} Boxer, above n 86.
\textsuperscript{198} Ming Gu and Poh Poh Wong, ‘Coastal Zone Management Focusing on Coastal Tourism in A Transitional Period of China’ (2008) 51 (1) \textit{Ocean and Coastal Management} 1, 6-7.
4 The Transition from Water Supply Management to Water Demand Management

(a) The Dominance of Supply-driven Approach in Yangtze Water Management

Population growth, urbanisation 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.\(^{199}\) 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 complex than ever before.\(^{200}\)

As a legacy of planned economy and engineering-centred water management, China’s water resources management are largely supply-driven. Wherever there is a water shortage issue, water managers would resort to the investment in supply system to meet the increasing water demand. Recent data has shown an increasing trend in water investment in the past few years.\(^{201}\) This supply-driven approach emphasises the importance of enlarging regional water resources to resolve water shortages and strengthening the water infrastructures.\(^{202}\) Therefore, most supply-driven water resources policies and management practices have put intensive efforts on accessing new water resources, capturing a greater percentage of available surface or ground water and increasing total water storage via infrastructure building.\(^{203}\) Water infrastructure such as dams and reservoirs, water transfers such as the SNWD project are apparent examples of this supply-driven water management approach to meet socio-economic needs for water.

Furthermore, solely focusing on maximising the quantity of water availability for direct use, water managers do not consider the water demand from aquatic ecosystem. While supply-driven management paradigm through large scale infrastructure projects have provided effective solutions for chronic water crises and increasing water


\(^{200}\) Xiaojun Wang et al., ‘Climate Change and Water Management Adaptation for China’ (Paper presented at Xth Kovacs Colloquium, Paris, France, July 2010) 258-60.

\(^{201}\) Ibid 6.

\(^{202}\) Cheng and Hu, above n 137, 272.

\(^{203}\) Cheng, Hu and Zhao, above n 193.
demand in the past, it has come at expensive, irreversible and delayed ecological, economic and social costs.\textsuperscript{204} Freshwater resources are finite and cannot be explored endlessly to fulfil the infinite human desire for water. Examples of the negative effects of this approach are low water use efficiency, water over-withdrawal, uneven water distribution and severe water pollution. For instance, water transfer by the SNWD project could alleviate Northern China’s thirst for water in a short time, but it is not conducive to the resolution of the water crisis in the long run. Thus, it is obvious that this supply-driven approach is not a sustainable way of addressing water management. Being aware of these adverse impacts and the conflicts between water supply and water demand, the Chinese government has started to shift the focus of water management from water-supply based management to demand based management.

\textit{(b) Implementing Water Demand Management}

Water demand management is an integral part of IWRM. It is usually approached through implementing a wide range of technical, planning, economic, regulatory and participatory instruments, in order to influence water demand, and to improve the efficiency and effectiveness of water utilisation.\textsuperscript{205} Its preference to non-structural approaches is also in line with the transition from engineering-oriented mentality to a resources-oriented mentality discussed previously. Different from supply management, which focuses on finding new water resources, water demand management focuses on strengthening water resources allocation, conservation and protection, and the regulation of industrial structures according to the water resources availability to increase overall water-use efficiency and benefits.\textsuperscript{206}

Nevertheless, there are some misunderstandings of water demand management among water managers and researchers. They mainly consist of: (1) water demand will

\textsuperscript{204} Xiaojun Wang et al., ‘A Strategy to Deal with Water Crisis under Climate Change for Mainstream in the Middle Reaches of Yellow River’ (2011) 16 (5) Mitigation and Adaptation Strategies for Global Change 555, 555.
\textsuperscript{205} Bekithemba Gumbo, Laura Forster and Jaap Arntzen, ‘Capacity Building in Water Demand Management as A Key Component for Attaining Millennium Development Goals’ (2005) 30 Physics and Chemistry of the Earth 984, 984.
certainly continue to increase along with economic development, industrialisation and urbanisation; (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.\textsuperscript{207}

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 (Figure 2.4).\textsuperscript{208} 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. China will not be able to resolve the gap between increasing water demand and comparatively stable water resources unless it shifts its water management from supply driven to demand driven (C→D).

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 stabilise total water demand by changing water demand structures and increasing water use efficiency.\textsuperscript{209} The stabilisation of water demand on the other hand will also benefit water planning by reducing the risks and difficulties of water utilisation forecast in the future.

\textsuperscript{207} 钱正英, 陈家琦, 冯杰\[Qian Zhengying, Chen Jiaqi, Feng Jie\], above n 191.
\textsuperscript{208} Wang et al., above n 199, 8-9.
\textsuperscript{209} 钱正英, 陈家琦, 冯杰\[Qian Zhengying, Chen Jiaqi, Feng Jie\], above n 191.
In order to rectify the misunderstandings surrounding water demand management, the way of thinking must be shifted: (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. Chen and Hu proposed three methods to realise effective water demand management: (1) increasing water use efficiency by setting appropriate water prices, establishing water rights and tradable permits markets and evaluating water services. A preliminary framework of water right administration has been established in China, covering water allocation, water withdrawal and water transfer; (2) more effective distribution through well-defined water rights, water trades and proper water planning;
and; (3) effective regulation enforcement via improving current policy, legal and institutional frameworks.\textsuperscript{210}

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.\textsuperscript{211} It is apparent that the proposals of these two articles 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 could 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 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 strictest water resources management system’ (SWRM) was adopted to address current water problems and promote sustainable water use.\textsuperscript{212} Three approaches (so-called ‘three red lines’) – a water volume control approach which requires to consider the availability of total water volume; a water efficiency improvement approach to improve water use efficiency to save water; and a water-functional-zone pollution control approach which sets aquatic environment as a high priority, are identified as the keys to implement SWRM. According to its content, SWRM actually requires a demand management approach through water availability considerations, water efficiency improvement and water pollution prevention.

The requirement to implement SWRM has been set out in the 12th FYP as an approach to realise a water-saving society.\textsuperscript{213} In January 2012, the State Council
released the ‘Proposal on How to Implement SWRM’.\(^{214}\) It not only sets the general principles and goals of water utilisation, but also puts forward corresponding measures of managing those ‘three red lines’. Safeguarding measures are also brought out as a significant part of this proposal, mainly including responsibility and assessment mechanism, water monitoring, water legislation and institutional arrangements as well as the financial support. In January 2013, the ‘Assessment Methods of Implementing SWRM’ (Methods) was released by the State Council to set the goal of total water volume control, water use efficiency control and water quality control of each province by 2030.\(^{215}\) 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.\(^{216}\) This implies that water security has been recognised as strategically important to national security as is food security.\(^{217}\) While it is important to implement a stricter management regime on water resources, this policy should combine with and be complemented by a sound market mechanism.\(^{218}\) Furthermore, the SWRM must be implemented in the context of water management regime improvement. Otherwise, it will be only another political slogan or movement that fails to address current water crises.

F Conclusions and Recommendations

1 Conclusions

The above analysis shows that Yangtze water managers have been aware of the importance of managing water in a holistic and preventative way and have started the


\(^{218}\) Ibid.
transition towards the IWRM regime through a series of water-related policies, legislation and institutional arrangements. Nevertheless, we have to acknowledge that the whole transition takes time to complete. Existing water management framework is strongly influenced by the historical legacy of the planned economy, strong administrative control and weak civil society. As a result, Yangtze water policies, legislation and institutional settings are largely engineering-based, supply-driven, fragmented and usually have limited involvement of stakeholders.\textsuperscript{219} 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 Yangtze water crises.\textsuperscript{220} Current water framework is insufficient to optimise water utilisation and conflicts resolution in a socially, environmentally and economically optimal way.\textsuperscript{221}

Implementing the IWRM regime is a long-term, progressive and innovative process. It requires an improvement or even a shift in current legal and institutional thinking and settings to provide an effective enabling environment. Unfortunately, revising legislation and reforming institutions are embedded in the social and political landscape, making it difficult to keep pace with the requirement of IWRM. The IWRM regime in the YRB has undergone a different evolutionary path from other countries where enforceable legal and institutional frameworks have been established and where IWRM has been better implemented.

Take the Murray-Darling Basin (MDB) in Australia for example. It first initiated the IWRM by negotiating the ‘Murray-Darling Basin Agreement’ between federal and 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).

\textsuperscript{219} Cheng and Hu, above n 137, 272.
\textsuperscript{221} Varley, above n 10, 4.
mechanisms for implementing IWRM. 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 the community. Firstly framing the water problems and then establishing related policy, legal and institutional frameworks, this path could minimise 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 the existing legal and institutional frameworks that are not oriented by an integrated 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 amending water legislation and readjusting institutional arrangements to eliminate conflicts and promote IWRM. Compared to Australia, this path of implementing IWRM is more likely to lead to conflicts and inconsistencies. It can be attributed, in part, to the extraordinary transition in China’s politics, economy and social development. Progress will undoubtedly be inhibited, to some extent, during a transition stage. However, if Yangtze 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 the different political, economic and social differences between Australia and China complicates the efforts to draw useful experiences and lessons, understanding these different evolving paths could help China and Yangtze water managers better understand the reasons of the current IWRM failure and reorient future focus and development.

Research in this chapter reveals that IWRM in the YRB has made some progress, but it is by no means ambitious enough. By contrast, some lower level pilot programs


223 Ibid.
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 will be a feasible and promising approach for the YRB. 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 or undertaken by the CWRC. 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.

These 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, decentralisation of management responsibility to local governments is the key to successful IRBM.\textsuperscript{224} 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 \textbf{Recommendations}

To achieve the sustainable management of Yangtze water resources, implementing IWRM, improving existing legal framework and reforming institutions are regarded as three fundamental priorities. To be more specific, as previously emphasised, the effective implementation of IWRM is determined by an integrated legal framework, strong institutional capacity, systematic planning and effective coordination as well as institutionalised public participation.\textsuperscript{225} For the YRB, streamlining the move to an IWRM regime requires a range of legal, policy, 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. Therefore, this part will propose some recommendations on

\textsuperscript{224} CCICED Taskforce on Integrated River Basin Management, above n 163.
\textsuperscript{225} Song et al., above n 102, 504.
coordinating existing and conflicting legislation, building collaborative mechanisms and establishing a viable platform for public participation.

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 changed as well. For example, most water laws enacted in the last century have been stipulated and implemented on 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 the preservation of ecosystems has been recognised. Although existing water laws have taken some modern water management approaches, they are still steered by a traditional water management mentality.

Furthermore, definitions often have a decisive impact on the quality of legislation. Therefore, 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 IWRM. Legislation related to the YRB needs to be reviewed to reduce cross-institutional or cross-sectoral contradictions and to provide the CWRC with the necessary legal power to operate effectively at the basin level. Different authorities 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 all relevant authorities on a consensus basis before it is submitted to the legislature for deliberation and approval. This approach could significantly minimise conflicts and improve law enforcement.

Reforming institutional arrangements

According to the analysis and assessment of exiting vertical and horizontal institutional arrangements in the previous parts, an integrated, efficient and effective institutional arrangement must be formulated to facilitate IWRM implementation.

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226 Xie, above n 74, 46.
This can be approached through two different paths: (1) reforming current institutional arrangements to develop a super-ministry for Yangtze 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.\(^{227}\) 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 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 standardise administrative approval procedures and improve management efficiency.\(^ {228}\) 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,\(^ {229}\) they eventually were not approved by the recent institutional reform plan. Nonetheless, it is important to emphasise that the super-ministry reform should not simply merge these departments, but more importantly, it should clarify the relationships and responsibilities between departments. Clear responsibility allocation could contribute to the coordination, consistency and balance between planning and implementation, as well as between river basin interests and local interests. This is also a crucial opportunity to transform government’s role from ‘controlling and administering’ to that of ‘regulating and serving’. If this reform can be undertaken and implemented in a progressive manner, it could contribute to establishing an integrated, efficient and effective institutional arrangement.

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Another option feasible in the short term is to improve 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. While some scholars advocate the establishment of a unified coordination institution or commission for Yangtze water management, this thesis 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 regulatory framework on how this meeting operates. In practice, it is usually dominated by the ministry that initiates the meeting while the participation of other ministries is often pro forma.

In the future, it should be improved by institutionalising coordination procedures and mechanisms to deliberate basin-level policies, plans and regulations. Through these procedures and mechanisms, information and knowledge should be shared, coordinative Yangtze 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 Yangtze water resources. At the basin level, the CWRC 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 entities, the CWRC 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 CWRC to be a fully-fledged RBC is crucial to build an institutional structure to coordinate basin interests and local interests.

231 Feng, He and Kinne, above n 134.
The CWRC 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. It 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. Contrary to the suggestion of establishing a completely new institution like a Water Resources Management Committee, this thesis argues that the CWRC is able to provide a good platform for integrated planning, effective coordination and public engagement if it is authorised 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’ organised by the CWRC has been established to bring together national and provincial officials and non-government experts to discuss coordinated management of the YRB. To make better use of the Yangtze Forum, it needs to be improved in the following aspects:

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

Another quasi-government platform, the CCICED, could also play a greater role in facilitating IWRM. On the one hand, it has the position 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 experiences into the China’s context. These mechanisms and platforms should assist related governments,

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234 Song et al, above n 102, 504.
departments and water users to develop a common vision of sustainable Yangtze management as well as to formulate a consensus plan of action.  

Lastly, successful implementation of IWRM relies on participatory 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 analysed in Chapter 5.

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 improved continuously.  

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.  

This ultimately will determine the capacity this regime to adequately respond to external challenges, of which climate change is an emerging one.

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239 Ibid.
III THE LEGAL AND INSTITUTIONAL FRAMEWORKS OF YANGTZE WATER-RELATED CLIMATE CHANGE ADAPTATION

A poorly managed ecosystem will exacerbate vulnerabilities to a changing climate while a well-managed ecosystem will reduce related risks and increase resilience. Healthy and fully functional ecosystems are more robust and resilient to external stressors and with greater flexibility in adaptation responses.\(^1\) In contrast, a degrading ecosystem has a very low capacity in defending against negative climate change impacts. Current water crises in the Yangtze River Basin (YRB) due to poor water management have been exacerbated by water-related climate change impacts. Although Chapter 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.

The current water management regime no doubt will shape our way of adapting to water-related climate change impacts. Meanwhile, it is important to realise that climate change adaptation frameworks and regimes will challenge and influence water management paradigms. For example, if the 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 information communication and exchange, it will more likely promote the same improvement in the context of water management. Adaptation related policies, legal and institutional frameworks are continuing to develop in China, and they will influence the paths and approaches of adapting to water-related climate change impacts in the YRB.

In light of above analysis, there are two main objectives in this chapter: (1) to identify and discuss the national adaptation framework from a legal and institutional perspective; and (2) to assess to what extent this framework contributes to effective adaptation to Yangtze water-related climate change impacts. To achieve these objectives, this chapter can be divided into four parts. Part A begins with identifying

\(^1\) Richard Tingem Munang, Ibrahim Thiaw and Mike Rivington, ‘Ecosystem Management: Tomorrow’s Approach to Enhancing Food Security under a Changing Climate’ (2011) 3 Sustainability 937,940.
and outlining the impacts of climate change on Yangtze water resources to provide a basic picture of water-related climate change impacts to which water managers need to adapt. Following that is the analysis of the necessity of establishing adaptation-oriented legal and institutional frameworks. After explaining the importance of legislation for adaptation, Part B will expound the policies, legislation and institutional arrangements on adaptation through which the status of adaptation could be detected. Part C will assess the capacity of this adaptation framework in managing adverse climate change impacts. Lastly, Part D will provide a short conclusion in terms of the past efforts, present capacity and future development of Yangtze water-related adaptation framework.

A Adapting to Yangtze Water-related Climate Change Impacts

1 Screening Climate Change Impacts on Yangtze Water Resources

As the centre of human activities and ecosystems, water resources interact with a wide range of environmental and socio-economic sectors such as agriculture, energy, biodiversity and public health. Water ecosystem is among the most important ones for providing vital services for society and the ecosystem, but it is also the primary media through which climate change influences the planet’s ecosystem and people. It has been identified as one of the most vulnerable systems by the Intergovernmental Panel on Climate Change (IPCC), and this is also recognised in China’s national climate change policy – China’s National Climate Change Programme (CNCCP).

Changes in climatic variables such as temperature and precipitation will have significant impacts on water resources and hence on other related systems. Although climate change models are riddled with great uncertainty, their conclusions are

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4 Bryson Bates et al., Climate Change and Water (IPCC Technical Paper VI, IPCC, 2008) 32.
overwhelmingly consistent – climate change will have an effect on temperatures, precipitation patterns and sea level rise due to thermal expansion of the oceans and glacial melt.\(^7\) As a result, these will affect flood and drought patterns, land uses, other interrelated ecosystems and ultimately influence socio-economic system.\(^8\) Furthermore, climate change will likely increase the already severe water problems, making the management of water resources more challenging and urgent.

Water-related climatic impacts in the YRB have their peculiarities while at the same time replicating similar problems in other river basins. Articles such as ‘The Impacts of Climate Change on Water Resources and Agriculture’ and ‘Impact of Climate Change on Water Security in China’ have generally discussed water-related climate change impacts in China.\(^9\) The scientific report ‘Yangtze River Basin Climate Change Vulnerability and Adaptation Report’ (YRB Report) has investigated and elaborated in detail how climate change affects and will affect Yangtze water resources from a scientific perspective.\(^10\) This chapter will not devote too much space in explaining water-related climate change impacts in detail. Instead, it will provide a general picture of climate change impacts on Yangtze water resources to understand their challenges to water management. Some of them are incremental impacts to those water problems identified in Chapter 2, while some are emerging ones.

\(a\) Rising Temperatures

Although there are still many unresolved questions and debate on the causality between anthropogenic factors and climate change, the observed data on rising temperatures in the YRB by international and domestic scientists are quite consistent. Field data showed that there had been a trend of significantly increasing of annual

\(^10\) 徐明，马超德 [Xu Ming, Ma Chaode], 《长江流域气候变化脆弱性与适应性研究》 [Yangtze River Basin Climate Change Vulnerability and Adaptation Report] (中国水利水电出版社 [China Waterpower Press], 2009).
average temperature in the whole YRB from 1961 to 2005, with temperature increases being the most conspicuous since 1991.\(^{11}\) Compared with the years from 1961 to 1990, the average temperature in 1990s increased by \(0.3\)\(^\circ\)C while from 2001 to 2005, it went up by \(0.7\)\(^\circ\)C.\(^{12}\) Based on related IPCC climate model, it is predicted that there will be a tendency of notable rise in the annual average temperature in the YRB in the coming 50 years and the rate of temperature rise may reach 1.5-2.0\(^\circ\)C by the year 2050.\(^{13}\) The rising temperatures will increase the frequency of floods, droughts, heatwaves, storms and other natural disasters.\(^{14}\)

\(\textit{(b) Changes in Water Quantity and Water Quality}\)

From a water supply perspective, according to the YRB Report, climate change has had little effect on the total amount of water resources in the YRB over the past 50 years.\(^{15}\) Yet, various IPCC greenhouse gases (GHG) scenarios all agree that climate change has altered and will continue to influence the spatial and temporal distribution of water resources through accelerating the atmospheric circulation and the hydrological cycle.\(^{16}\) For example, the middle and lower Yangtze reaches have a positive runoff due to increasing summer precipitation, 50 per cent of which is in the form of rainstorm water.\(^{17}\) By altering precipitation patterns, climate change affects water quantity and distribution over the YRB. During the years from 1991 to 2005, the annual average amount of precipitation in the central and lower Yangtze was higher than that in 1961-1990, while lower in other areas, especially in Jialingjiang Basin and Sichuan Basin.\(^{18}\) In addition, different GHG emission scenarios from 2001

\(^{11}\) Ibid 11.
\(^{13}\) Ibid.
\(^{15}\) 徐明, 马超德 [Xu Ming, Ma Chaode], above n 10.
\(^{16}\) 徐明, 马超德 [Xu Ming, Ma Chaode], above n 10, 29-32.
\(^{17}\) Piao et al., above n 9, 46.
\(^{18}\) 徐明, 马超德 [Xu Ming, Ma Chaode], above n 10, 13-14.
to 2050 all reveal that there will be different flood and drought patterns in different sub-basin areas, increasing the variability of water distribution in the YRB.

From the demand side, the rising temperature due to climate change may affect the potential evaporation during the crop-growing season, increasing the demand of agricultural irrigation water. Water consumption in other areas such as people’s daily life will also increase because of the higher temperature. As a result, the increase in water consumption and the changing water distribution exaggerates the gap between water supply and water demand. 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 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 an increase in water pollution from sedimentation, nutrients, agricultural chemicals, and dissolved organised substances. This makes the water pollution in Yangtze River 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.

\[(c)\ \textit{The Shrinking and Melting of Glacial Areas}\]

China ranks fourth in the world in terms of both area and ice volume of glaciers by its approximately 60,000 square kilometres coverage and 5590 cubic kilometres

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19 Xu Ming, Ma Chaode, [Xu Ming, Ma Chaode], above n 10, 48-52.
21 Bates et al, above n 4, 53.
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. 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. This region, which is also known as the Qinghai-Tibetan Plateau, provides 25 per cent of the water flowing down the Yangtze River. It is predicted that glacial areas in this region will reduce by 11.6 per cent until 2060 compared with that in 1970, increasing runoff by 28.5 per cent in the same period and with the zero-balance line of glaciers will go up by about 50m. Increased glacial melting would mean more water in the Yangtze River over the short term. Yet, after the glaciers are gone – and with them the source of the Yangtze River – available water resources will decline, driving the ecosystem at its source to be more drought and desertification.

The changes in the flow of Yangtze River could amount to 28 per cent due to climate change. Lakes that depend on glaciers have already show signs of shrinkage or are drying up as a result of the massive water shortages in headwater regions. These changes will affect the livelihoods of 500 million people who rely on the Yangtze River 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 to water shortage. 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.

27 徐明, 马超德 [Xu Ming, Ma Chaode], above n 10.
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 the Yangtze region.\(^{32}\) The temporary abundance of water resources and the potential drought conditions in the long run will present Yangtze 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.\(^{33}\) 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.\(^{34}\) The melting glaciers and the secondary disasters caused by it have severely affected people in the YRB, especially those located in upper reach area. Many local residents have been forced to migrate due to worsening environment conditions, which is partly the result of climate change-induced impacts.\(^{35}\)

(d) 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.\(^{36}\) 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.”\(^{37}\) Data shows that since the 1990s, there has been an obvious increase in flood frequency in the YRB due to the heavy precipitation


\(^{34}\) 王欣[Wang Xin], 《我国喜马拉雅山区冰碛湖溃决危险性评价》[Hazard Assessment of Moraine-dammed Lake Outburst Floods in the Himalayas, China] (2009) 64(7) 地理学报 Acta Geographica Sinica 782, 782-90.

\(^{35}\) 中国环保网[China Environment], above n 33.


affected by climate change.\textsuperscript{38} Drought has become a common phenomenon in the basin in recent years, with an increase in frequency and severity, especially in the upper and central stream.\textsuperscript{39} The impacts of climate change are self-evident after the extreme events in the past few years have been investigated.

From 2006 to 2010, the YRB experienced a series of rarely seen cases of extreme climatic events. In the summer of 2006, Chongqing suffered an unusual and extraordinary heat wave in late summer while Sichuan Province suffered the most serious dry season since 1951. The next year, Sichuan Basin experienced severe rainstorms and Chongqing experienced a hundred year flood. In January 2008, the majority of the areas in Southern China including the central and lower Yangtze Basin were hit by an exceptionally severe freezing rain and snow while August of the same year saw the river basin suffering sustained strong rainstorms. The year 2010 witnessed a shocking drought in five southwestern provinces, affecting 50 million people, of which 20 million could not get access to enough drinking water. In 2011, many provinces in the upper and middle stream of Yangtze Basin were inundated by extreme rainfalls, which led to hundreds of people losing their lives and nearly 2 billion dollars direct economic loss. While northern river basins such as Huaihe and Haihe are the traditional arid basins, the frequent droughts in the YRB reflect the impacts of climate change and may experience a much different scenario in the future.

In addition to droughts and floods, other extreme weather events such as typhoons have also increased significantly, resulting in other secondary disasters.\textsuperscript{40} Climate change is widely acknowledged to aggravate the frequency, intensity and damage degree of those disasters through these extreme events.\textsuperscript{41} Not only have they caused great economic damage and had a severe impact on social economic development, but also have negatively affected people’s livelihood.

\textit{(e) Impacts on Water Infrastructures}

\textsuperscript{38} 徐明, 马超德 [Xu Ming, Ma Chaode], above n 10, 44.
\textsuperscript{40} Zhang et al., above n 20, 35.
\textsuperscript{41} 杨桂山等 [Yang Guishan et al.], above n 12.
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 river basin water facilities. Given the assumption that water infrastructure construction is the best solution to water problems such as floods and water scarcity, the Chinese government has developed an integrated system of hydraulic structures. These engineering initiatives have benefited the nation’s water resource management tremendously in the past 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 prediction, 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 facilities 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 Diversion (SNWD) project is uncertain and demands urgent investigation. Due to the frequency of severe droughts in the central portion of the Yangtze River, the success of the middle line of the SNWD project from the tributary Han River to Beijing and Tianjin depends on a further diversion project from the

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43 Yang Guishan et al., above n 12; Wang, above n 39.
45 Xu Ming, Ma Chaode, above n 10, 56.
46 Xu Ming, Ma Chaode, above n 10, 57.
Yangtze River to the Han River. This not only exacerbates the conflicts among these cities and regions, but also questions the legitimacy of the SNWD project in a changing climate. In addition, sea level rise, storm surges and floods in Yangtze River estuary will endanger sea walls and other coastal defence engineering structures.

(f) Impacts on Other Water-related Ecosystems

Due to the interaction between water resources and other systems such as land, grassland and forest, climate change also affects agriculture, pasture, fishery and forestry. For example, declining glaciers compound with earlier spring snowmelt are likely to reduce water availability for irrigated agriculture in the upper and middle Yangtze River. Damage to watershed forests due to climatic stress could have impacts throughout the entire river basin, causing soil erosion and altering the amount, timing, and succession of downstream flows. Rising sea levels in low-lying areas in the eastern coast of Yangtze River would cause the loss of coastal wetlands and river estuaries, and the contamination of underground water due to salt-water intrusion. Salt-water intrusion not only interferes with the supply of freshwater in the estuary region, but also causes soil salinisation in coastal areas, affecting agriculture and forest. Changes in these ecosystems will also alter the distribution and quantity of living creatures depending on them, resulting in biodiversity reduction.

(g) 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 the increasing water variability due to climate change affects economic development significantly, 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.

48 Zhang et al., above n 20, 38.
For instance, changes in water quantity and distribution will severely affect electricity generation along the Yangtze River. Accounting for nearly half of the country’s crop harvest, food security is another concern in the YRB because of climate change impacts on irrigation water and farming structure. It is anticipated that food production may be cut by 14 to 23 per cent by 2050 due to temperature rise, water scarcity and loss of arable land.50

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.51 Another crisis that needs to be mentioned is the emerging climate change displaced persons,52 which could again deepen tensions and conflicts, particularly in regions with large numbers of internally displaced persons and refugees,53 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.

To sum up, 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.54

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50 Wen, above n 31, 11.
53 Ban, above n 51.
54 Cannon and Müller-Mahn, above n 36.
As a result, Yangtze water managers must reflect, improve or transform the current management regime in order to adapt to these incremental and emerging climate change impacts.

2 Establishing an Adaptation-oriented Framework in the Water Sector

China has actively engaged in international negotiations after climate change became a hot topic on the international stage. The engagement in the international community has been reflected in China’s domestic policy circles, primarily through developing climate change policies and restructuring institutions.\textsuperscript{55} 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,\textsuperscript{56} which may result in an improved mitigation-oriented legal and institutional system. Prominent examples are the ‘Energy Conservation Law’, the ‘Renewable Energy Law’, and various special medium and long-term plans for energy development, conservation and renewable energy development. They have a dominant position in China’s current climate change discussions and initiatives.

It should be noted, however, that no specific law or plan targeting on adaptation has been put in place. Although it is recognised that these mitigation-oriented efforts are essential to reduce climate change risks and the urgency of adaptation, adapting to the climate change impacts that are already ‘locked in’ is also crucial, especially for vulnerable sectors like water resources.\textsuperscript{57} In the water sector, mitigation is necessary to reduce adverse climate change impacts on water resources, but adapting to the changing precipitation, distribution and extreme events is even more important for water managers. In its various climate change policies, government documents and laws, the Chinese government requires that adaptation should be treated equivalently


\textsuperscript{56} Scott Moore, ‘Strategic Imperative? Reading China’s Climate Policy in terms of Core Interests’ (2011) 23(2) \textit{Global Change, Peace and Security} 147, 147-57.

with mitigation.\textsuperscript{58} 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.

There is some literature arguing that mitigation and adaptation should be integrated with each other in the long-term given their complementarity.\textsuperscript{59} This research does agree with this proposal in terms of undertaking concrete measures. In some cases, mitigation and adaptation measures may coincide 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 and institutional requirements, this thesis argues that adaptation is so different from mitigation that it is better to be managed differently.

Adaptation is different from mitigation in many aspects, such as the causes and effects, sectors involved, spatial-temporal scales, approaches and assessment criteria.\textsuperscript{60} Mitigation mainly involves economic sectors such as energy, transportation and domestic building, while adaptation is more likely to be concerned with agriculture, water resources and fisheries vulnerable to changes.\textsuperscript{61} The former is realised mainly through approaches such as energy reform and technology improvement, whereas the latter usually by ecosystem protection, 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 establishing viable carbon markets. Efficiency is the main concern in reducing GHG emissions. By contrast, administrative measures (such as 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 and without tailoring measures to local conditions will not be effective for adaptation. Ecosystem protection, equity and social justice will be the main concerns of adaptation measures.

\begin{itemize}
  \item \textsuperscript{58} See, e.g., 《中国应对气候变化国家方案》 [China’s National Climate Change Programme] (People’s Republic of China) National Development and Reform Commission, Order No 17, June 2007.
  \item \textsuperscript{59} See e.g., Mata and Budhooram, above n 6, 799-807.
  \item \textsuperscript{60} Rob Swart and Frank Raes, ‘Making Integration of Adaptation and Mitigation Work: Mainstreaming into Sustainable Development Policies?’ (2007) 7(4) Climate Policy 288, 291.
  \item \textsuperscript{61} Ibid 292.
\end{itemize}
Different sectors involved with mitigation and adaptation are also managed by different competent departments. Economic development authorities and the departments of energy, transportation and construction will mainly take charge of mitigating GHG while departments of water resources, civil affairs and environmental protection will place more emphasis on adapting and responding to adverse climate change impacts. From a vertical perspective, central government is an important player in mitigation through direct top to down command, whereas local governments will respond to adaptation based on local climate change impacts and interests. 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.

The basic elements of legislation generally include the structure (e.g., the division of powers and the distribution of responsibilities), processes (e.g., the decision-making procedures) and behavioural outcomes. According to China’s historical legislative practices, the content of climate change-centred laws should at least include: (1) general provisions (including aims, principles and guidelines); (2) rights and responsibility 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. Different configurations of structure and process could produce different behavioural outcomes in response to endogenous and exogenous conditions. The previous analysis on the differences between mitigation and adaptation reveals that their power division, approaches and institutional settings are distinguished – existing mitigation-oriented 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

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64 Ruhl, above n 62.
is to adapt to a changing climate. To adapt to climate change effectively, this thesis argues that an adaptation-oriented legal and institutional frameworks 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. Yet, it requires that the differences between adaptation and mitigation must be recognised, identified and reflected in future climate change policies, legislation and institutional arrangements.

China to this point in time has managed adaptation and mitigation together in the context of the same climate change policies, laws and with the same institutional arrangements. In addition, this approach is assumed to continue in a short time. In that case, this thesis argues that the differences between adaptation and mitigation should be considered and reflected in future climate change strategies and actions. Otherwise, not only is adaptation likely to be overshadowed by the attention and efforts given to mitigation, but also is it likely to be managed by entrenched mitigation mentality and approaches.

The next part will examine current legal and institutional frameworks related to adaptation and assess its capacity in delivering effective adaptive measures.

B China’s Policies, Laws and Institutional Arrangements Regarding Climate Change Adaptation

1 Adaptation in the Context of Plans and Polices

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. 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

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planning economic measures, constructing large-scale infrastructure and projects. The adaptive capacity in responding to extreme climatic events and natural disasters is also mentioned to minimise adverse climate change impacts. The integration of climate change adaptation in strategic FYP represents the Chinese government’s first step to take adaptation seriously.

The United Nations Framework Convention on Climate Change (UNFCCC) requires all the parties to formulate, implement, publish and regularly update national programmes to mitigate climate change and facilitate adaptation. As one of the important measures to carry out this obligation, the State Council of China promulgated its first national programme on climate change – China’s National Climate Change Programme (the CNCCP) on 30 May 2007. It signals 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. It also indicates that 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. In line with the 12th FYP, it states the equal importance of adaptation and mitigation, as well as the necessity to integrate adaptation with other related policies and programs. The importance of reducing vulnerability and enhancing adaptive capacity has also been recognised. Water resources are 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.

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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. Since then, progress reports are released annually to estimate the progress of the CNCCP. The recently published 2012 annual report in November 2012 summarises the efforts that were made in the past year. Compared to the report of 2011, one of the highlights on adaptation is the increasing attention to disaster prevention and mitigation. The Ministry of Civil Affairs has promulgated the National Disaster Prevention and Mitigation Plan (2011-2015) and other related regulations on disaster relief. 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. 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.

Due to the localised 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 programs. As of November 2011, all of the 31 provinces (this includes autonomous regions and municipalities) have released provincial level climate change programs and have proceeded to implement them. Based on their different climate change impacts, ecosystem vulnerability and natural endowment, these programs identify the key areas and the focus 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 YRB, climate change has worsen the water problems of Hubei Province which has already been distracted by vanishing

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lakes, water pollution and flooding.\footnote{《湖北省应对气候变化行动方案》 [Climate Change Action Plan in Hubei Province] (People’s Republic of China) Hubei Province, January 2010.} Thus, in its provincial program, Hubei Province decided to improve its ability to responding to water disasters through improving its water management regime, preventing water pollution and conserving water ecosystems.\footnote{《湖北省应对气候变化行动方案》 [Climate Change Action Plan in Hubei Province] (People’s Republic of China) Hubei Province, January 2010.}

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’.\footnote{曹格丽，姜彤 [Cao Geli and Jiang Tong], above n 68.} 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 to climate change, they could contribute to reducing vulnerabilities and increasing resilience. For example, the CPNWR was approved by the State Council in 2010, with the goal of resolving water problems, ensuring the nation’s water security and facilitating sustainable water use.\footnote{水利部 [The Ministry of Water Resources], 国务院批复《全国水资源规划》 [State Council Approves ‘Comprehensive Plan of National Water Resources’] (25 November 2010) <http://www.mwr.gov.cn/slx/slyw/201011/t20101125_246091.html>.} By providing strategic guidelines for water utilisation, allocation, conservation and management, this plan could largely reduce the vulnerability to changing situations.

2 Adaptation in the Context of a Legal Framework

(a) Understanding the Role of Legislation in Dealing with Adaptation

As two different approaches of addressing challenges, policy and legislation are interactive and complementary. On the one hand, policy is a very important precursor
for making related legislation or taking any legal action, especially in those less-developed areas; on the other hand, legislation can provide guarantees for the implementation of public policies. Therefore, both policy and legislation should be used 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 institutionalised mechanism to regulate and rationalise different relationships has not been widely employed by Chinese decision makers. This part will begin with illustrating the role of legislation in adapting to climate change impacts.

Much of the literature has reached a consensus that the determinants of adaptive capacity relate to the economic, social, institutional, and technological conditions, which either facilitate or constrain the adoption and development of adaptive measures.79 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 around adaptation. As an indispensable determinant of adaptive capacity, the potential of legislation in contributing to adaptation should be recognised 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.80 It is also the major vehicle for government decisions to be translated into requirements, prohibitions and procedures through utilising information from other disciplines.81 As a crucial element of a society’s adaptive capacity, it can have positive or negative impacts on adaptation.82 Adaptive and responsive legislation is able to contribute to flexible adaptation measures, effective implementation of adaptation policies and quick response to new knowledge

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80 Organization for Economic Cooperation and Development, above n 57, 74.
82 Jan McDonald, ‘Mapping the Legal Landscape of Climate Change Adaptation’ in Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), *Adaptation to Climate Change: Law and Policy* (Federation Press, 2010) 11.
and information. In addition, a well-developed legal system, associated with effective institutional arrangements could facilitate the integration of climate change adaptation in related policies, plans and activities, increasing the adaptive capacity to climate change. Vice versa, if the legal framework does not clarify responsibilities on adaptation, ignores climate change factors or encourages activities in vulnerable areas, it could operate as a barrier to effective adaptation.

Although legislation is characterised as rigid and slow to update with new information and scenarios, it could ‘give expression to institutional rules, shape processes of policy formulation, regulate behaviours, define liabilities and responsibilities, and determine access to decision-making process.’

First, laws and regulations could set power boundaries, distribute responsibilities and stipulate liability for decision makers. In that case, decisions about integrating adaptation in longer-term planning, investment and large-scale infrastructures are likely to be more scientific and democratic, reducing the risk of policy failure. In the 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, but also are able to prevent power-holders from abusing their power under the guise of the public interests.

Second, laws and regulations 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 responses to losses after the event are provided. More importantly, clear risk assignment and responsibility distribution could enable problems and conflicts to be managed in a legitimate, rational and peaceful way, minimising the risk of ‘organised irresponsibility’ and social conflicts. A just system

85 McDonald, above n 82, 12-13.
86 Jan McDonald, ‘Creating Legislative Frameworks for Adaptation’ in Jean Palutikof et al. (eds), *Climate Adaptation Futures* (John Wiley and Sons, 2013) 126, 128.
87 McDonald, above n 82, 12-13.
to allocate future risks is conducive in preventing socially disadvantaged groups from continuing to be vulnerable to 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. They are 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 behavioural changes.

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 institutionalised and long lasting. 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 people’s behaviour, which could be achieved through creating a public participation mechanism, disseminating information or through direct behavioural encouragement. By setting rules and models for the whole society, laws and regulations are able to raise people’s awareness, improve their behaviour and advance adaptive capacity.

Recognising 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. It sets the legal framework for carbon trading and adaptation in UK. In 2009, the U.S. House of Representatives passed the American Clean Energy and Security Act of 2009. It is ‘a comprehensive national climate and energy legislation that would establish an economy-wide, GHG cap-and-

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89 McDonald, above n 82, 16-19.
90 McDonald, above n 87.
92 McDonald, above n 87, 127.
94 However, this legislation did not get through the US Senate and never became law.
trade system and critical complementary measures to help address climate change and build a clean energy economy.  

China is establishing its climate change legal framework through drafting a Climate Change Law and other provincial regulations. 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 regulatory framework for both public institutions and private actors. Nonetheless, the role of legislation in adaptation should not be over-emphasised. It could only function well along with proper institutional arrangements, flexible policies and an innovative litigation system.

(b) Adaptive Laws

Even though the development of climate change policies shows the Chinese government’s increasing attention and determination on adaptation, it is acknowledged that this development is still in its infancy. With regard to adaptation legislation which requires more rigid procedures, it is even much less developed. There has not yet been any ‘adaptation law’ whose substantive regulatory objectives include adaptation and explicitly states 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 or improving adaptive capacity. In order to deal with climate change uncertainties and reflect the new requirements of adaptation, related ‘adaptive law’ should be developed to reduce vulnerability and increase adaptive capacity. Climate change is primarily framed as an environmental issue by the Chinese government, indicating that the current environmental legal framework will be more applicable for 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

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96 McDonald, above n 87, 131.

97 McDonald, above n 82, 36.
environmental law and natural resources management areas. In this case, adapting to climate change risks may be profoundly influenced by the legal mentality and institutions of environmental laws. 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 laws can be generally categorised into three types: (1) laws to prevent environmental disruption when utilising 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, utilising, and protecting the water resources, they could serve the purpose of water sustainability, reducing 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.98 The analysis in Chapter 2 has concluded, unfortunately, that current legal and institutional frameworks of water management are not capable of 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 laws, these laws have not explicitly addressed climate change. Adaptation considerations have not been taken into account when making water plans and implementing specific water management activities. For example, in the Flood Control Law, meteorological, hydraulic and oceanic authorities are required to

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98 Smit and Pilifosova, above n 79, 897.
provide relevant information to flood prevention authorities, but it does not explicitly require that related climate change information should be taken into consideration. Most of these laws were enacted in the 1980s and 1990s, long before climate change became a hot topic in China and they have not been updated to reflect the increasing attention paid to climate change issues. 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 Yangtze 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.

(c) 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’), the first resolution adopted by the top legislature of China 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. It also requires the amendment and improvement of existing laws relevant to climate change over time 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.

100 《全国人大常委会关于积极应对气候变化的决议》[The Resolution of the Standing Committee of the National People’s Congress on Making Active Responses to Climate Change] (People’s Republic of China) Standing Committee of National People’s Congress, 2 August 2009.
101 《全国人大常委会关于积极应对气候变化的决议》[The Resolution of the Standing Committee of the National People’s Congress on Making Active Responses to Climate Change] (People’s Republic of China) Standing Committee of National People’s Congress, 2 August 2009.
According to this ‘Resolution’ and with the aim to build a comprehensive and theoretical regulatory 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 institutes translate it to ‘Act on Addressing Climate Change’). Its draft was published in March 2012 and was under consultation until the end of April. This law was drafted 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 consultation. If the CCL is promulgated, it will be China’s first regulatory framework 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.

The regulatory scope of this draft is very broad and comprehensive, including general principles and concrete measures. According to this draft, the CCL will distribute the responsibilities among related authorities, and establish legal institutions on mitigating climate change (such as total volume control mechanisms, eco-compensation and emission trading schemes) and adapting to climate change in vulnerable sectors. With regard to adaptation, it stipulates that both central and local governments shall include climate change adaptation as part of their national and specialised planning for economic and social development with all factors taken into consideration. This is the first time to legally require that adaptation should be integrated into the planning process, although it does not clarify how this should be undertaken.

There are some meaningful improvements in institutional arrangements. First, it proposes to introduce a targeted responsibility and assessment system, taking into account GHG reductions as an important part of assessing local governments and

105 China. org, above n 103.
officials. The introduction of an assessment system could provide great motivation for local governments to undertake actions to combat climate change. Second, this law appreciates the important role of environmental authorities 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 for enterprise, industries, social organisations and citizens, CCL expects to shape the climate change-related behaviours of the whole society.

Unfortunately, this law inherits the inherent deficiencies of the Chinese legal system, such as a lack of clear definitions, ambiguous language and abstract provisions. First, even though adaptation is listed as an independent chapter, it is still very unclear in terms of implementation and taking concrete measures, leaving much discretion for local government. Second, this law has retained a utilitarianism philosophy. The first provision of this law sets addressing climate change, reducing GHG and sustainable development as the objectives. The reality, too often is, when there is a conflict between climate change and development, development will win. 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 mentioned either. Fourth, with the aims to reduce GHG and facilitate sustainable economic and social development, the CCL carries on the mitigation-dominated paradigm. Adaptation is much less developed in this law. For example, the aforementioned progress in institutional arrangements (the introduction of a targeted responsibility and assessment system, and the empowerment of environmental authorities) does not extend to adaptation issues. Last, but not least, although labelled as ‘practice-oriented’ law, 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 implementation in China. All of the above shortcomings challenge the effectiveness of this law in responding to negative climate change impacts.

107 Ibid.
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 localisation: ‘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 localisation of climate change impacts and their different priorities. Shanxi is famous for its abundant coal resources and therefore the ‘Shanxi Measures’ attaches much attention to energy conservation, energy efficiency improvements, carbon sinks and low-carbon development. 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. Therefore, the focus of its provincial legislation has been on adaptation. 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. In Qinghai’s provincial regulation, the provincial government and its various departments have also been delegated with different adaptation responsibilities within their own scopes.

Although these two regulations lack strict liability provisions and effective market mechanisms, their implementation could provide valuable experience for legislative initiatives in other provinces. Recently, a project entitled ‘Studies on Provincial Legislation on Climate Change: A Case Study of Jiangsu Province’ was initiated to promote provincial legislation on addressing climate change and gain experience for

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111《青海省应对气候变化办法》 [Measures of Responding to Climate Change in Qinghai Province] (People’s Republic of China) Qinghai Province, Order 75, 23 July 2010.
113《青海省应对气候变化办法》 [Measures of Responding to Climate Change in Qinghai Province] (People’s Republic of China) Qinghai Province, Order 75, 23 July 2010, art 6-13.
legislation work throughout the country. 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 legislation 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 initiating 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, such as the Province of British Columbia in Canada and the State of Victoria in Australia. On the other hand, some other countries have initiated climate change legislation from the national level to shape local practices, such as Britain’s Climate Change Act 2008 and Mexico’s climate change law. It is difficult to say which approach is more effective because every country has its different climate change focus, political commitment and legislative system. China is establishing its climate change legal framework from both the national and local levels at the same time. What really matters for China is to what extent these laws and regulations could be implemented, which is, to some extent, determined by relevant institutional arrangements.

3 Institutional Arrangements on Climate Change Adaptation

(a) Institutional Arrangements on Adaptation at the National Level

116 Carbon Tax Act, SBC 2008; Climate Change Act 2010 (Vic).
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 which has a strong bearing on economic growth and energy security.  

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:

- analysing the economic and social impacts of climate change;
- drawing up strategies to address climate change;
- updating and implementing national climate change programme;
- 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.

This description of its responsibilities shows very strong focus of its work on international negotiations and GHG reduction. This is mainly driven and shaped by both the international regime that centres on economic cooperation and mitigation, and the domestic policy priority on energy issues. In addition, as illustrated in the following schematic diagram (Figure 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.

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. The key point is the availability of

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118 Ho Ching Lee, ‘China and the Climate Change Agreements: Science, Development and Diplomacy’ in Paul G. Harris (ed), Confronting Environmental Change in East and Southeast Asia: Eco-politics, Foreign Policy and Sustainable Development (Earthscan, 2005) 135, 149.


adaptation funds, such as the Kyoto Protocol Adaptation Fund, Global Environment Facility and World Bank Pilot Program on Climate Resilience.\textsuperscript{122} National policy and strategy are neither static nor determined in isolation, the international regime or focus will to a large extent influence China’s domestic policy priorities and institutional arrangements.\textsuperscript{123} 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.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{diagram.png}
\caption{The institutional arrangements on climate change issues at the central level}
\end{figure}

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 crosscutting climate change issues. Its main responsibility was to discuss the major issues involved


in the climate change area, sector coordination on climate change policy and activities, organise negotiation, and make decision on the general cross-sectoral issues relating to climate change. 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.

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. It is headed by the Premier, 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 policy-making process. In addition, 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 role in the NLGCC. While climate change is first 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 of UNFCCC countries, which manage climate change issues through their environmental agencies or ministries (Table 3.1), China administrate climate change issues through national development authorities. As a result, there are two different administrative frameworks dealing with climate change issues and environmental issues.

<table>
<thead>
<tr>
<th>Environmental agency or ministry</th>
<th>72%</th>
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<tbody>
<tr>
<td>Foreign affairs ministry or embassy</td>
<td>14%</td>
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<tr>
<td>Meteorological agency or ministry</td>
<td>8%</td>
</tr>
<tr>
<td>National development agency and others</td>
<td>6%</td>
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</table>

124 Qi, Ma and Zhang, above n 120, 9.
127 Ibid.
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 authorities of various sectors. 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 fulfil increasing water demand. Nonetheless, as analysed 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 governments.

(b) Institutional Arrangements on Adaptation at the Local Level

China is a highly centralised country, where local governments are supposed to implement decisions made by the central government. To what extent and how local government responds to the 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. When there is a lack of clear compulsory requirements from the 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 to superior governments. 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.

128 Interview with interviewee 1, staff of the Development and Reform Commission of Jiangxi Province (Nanchang, China, 24 October 2011).
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 authorities. Most of these leading groups, however, are engaged with energy saving and emission reduction, which shows a clear focus on both mitigation and the energy sector. 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) have established new departments to manage climate change issues (including mitigation and adaptation) while some provinces integrate climate change issues within established administrative and institutional structures. 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. This may be because local governments, especially those at prefecture and county level so far have shown little interest or awareness of climate change issues, not to mention to establish an independent department. In fact, they do not have adequate financial and personnel resources for a new department. A feasible approach for them to fulfil 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. 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

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130 Ibid 382-4.
131 For instance, Jiangxi, Qinghai and Hubei Province are the former cases while Shandong and Henan Province are the latter cases.
132 There are four levels of government which set-up the Development and Reform Commission: central, provincial, city, and county level.
133 Qi, Ma and Zhang, above n 120, 11.
134 Interview with Interviewee 2, staff of the Meteorological Bureau, Jiangxi Province (Nanchang, China, 24 October 2011); Ye Qi et al., above n 129, 392.
the implications on local economies and social development, they will have a greater motivation to adapt to climate change.

4 Adaptation Policies and Strategies on Yangtze Water Resources

In addition to the YRB Report, there has been a dramatic increase in research articles and research outcomes on assessing and projecting climate change impacts on Yangtze water resources in the past decade. By contrast, research on water 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 Yangtze water resources management. Adaptation considerations have not been taken into account in Yangtze water plans or decision-making process. Fortunately, from a micro-perspective, some concrete measures have been undertaken to reduce the vulnerability of ecosystems, improve its adaptive capacity and promote a sustainable river basin.

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 water systems to climatic events by restoring the connectivity between the river and lakes. In 2002, the World Wildlife Fund (WWF) commenced a program to reconnect lakes (Zhangdu (40 km²), Hong (348 km²) and Tian Zhou (20 km²)) in Hubei Province to the Yangtze River through opening the sluice gates and facilitating sustainable lake management. This ecosystem-based adaptation strategy not only reduces the vulnerability to flooding,

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136 Interview with interviewee 3, staff of the Changjiang Water Resources Commission, Hubei Province (Wuhan, China, 11 October 2011).
but also helps Yangtze ecosystems become more climate-resilient. Third, Yangtze water managers have promoted and initiated technological innovation and engineering projects to cope with the changes in the precipitation patterns induced by climate change. The operation of under-performing water infrastructure and agricultural water infrastructure has required upgrading in order to improve the adjustment and storage capacity of the YRB. Inter-basin water transfer projects, such as the SNWD have been accelerated to adapt to the increasingly uneven water distribution. Several large-scale hydropower dams in the upper Yangtze River have been approved for construction. Other water infrastructures, such as reservoirs, dikes and detention zones are proposed as well to prevent and mitigate natural disasters.

Given the broad territory, complex ecosystems and various economic and social development levels of the YRB, the site-specific nature of adaptation cannot be emphasised more. Some adaptation practices have been carried out on a sub-basin level or regional level. Up until 2012, the CMA had completed a comprehensive climate change assessment report for eight regions such as the Three Gorges Dam (TGD) area and Poyang Lake Basin. In 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 for extreme events, launching ecosystem protection projects and developing natural disaster response mechanisms have been formulated to enhance adaptive capacity. 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 launched to develop a sustainable lake basin. Under this program, adaptation strategies covering water resources, agriculture,
ecosystems, transportation and human health are being used to promote adaptive capacity.143

Although all the provinces along the Yangtze River 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 perception and awareness of climate change.144 For example, Qinghai, Hubei and Jiangxi Provinces take adaptation more seriously than other riparian provinces.145 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 levels, some questions arise. For instance, is it necessary and effective to require every province to formulate and implement its own programme 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 programmes is based on the provincial level?146 If the community input is important for making effective adaptation strategies, how could they engage in the decision-making process? Most of the adaptation needs 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.


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

145 Interview with interviewee 2, staff of the Meteorological Bureau, Jiangxi Province (Nanchang, China, 24 October 2011).

146 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.
According to the previous study, the development of China’s climate change policy, legislation and institutional arrangements has shown some prominent features of the trend in responding to climate change:\textsuperscript{147} (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 institutionalised; (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 United States.\textsuperscript{148} 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 paradigm 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.\textsuperscript{149} Given the legal and institutional dimension of this thesis, it 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 arrangements.

\begin{footnotesize}
\begin{enumerate}
\item\textsuperscript{147} Peng Benli, above n 101, 89-91.
\item\textsuperscript{148} Peng Benli, above n 101, 89-91.
\end{enumerate}
\end{footnotesize}
Generally, both the central and local governments have approached climate change issues through conflating energy issues, environmental protection and climate change. 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. 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-centred programme 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, there has been no explicit goal set on 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. To date, adaptation considerations are merely limited to moral encouragement, lacking in legally binding requirements. This way of

151 Lewis, above n 55.
153 Qi, Ma and Zhang, above n 120.
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 the lack of attention on adaptation 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 sluggish, mainly in response to policy directions issued by the central government.154 The misalignment between central directives and local government incentives could also undermine the implementation of relevant policies. Interviews conducted for this thesis 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.155

2 The Over-reliance on Engineering and Technological Approaches

Pan et al. proposed three different types of tools for adaptation to climate change: engineering (by strengthening engineering constructions), technological (by enhancing scientific research and technological innovation) and institutional (by setting up and improving policy, legislation and institutional framework).156 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

154 Lin, above n 150, 300.
155 Interview with a village committee leader, Dangyang City, Hubei Province (Dangyang, China, 13 October 2011).
reveal that the first two categories are more frequently employed than the third one.\textsuperscript{157} 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.\textsuperscript{158} ‘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.\textsuperscript{159} According to the data collected by Gemmer et al., only 13 per cent of the recommendations are related to legal instruments in the White Paper, compared to 32 per cent of technology and infrastructure.\textsuperscript{160} At the local level, it is even less. 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 per cent.\textsuperscript{161}

Based on the analysis in Part A of this chapter, due to the absence of adaptation-dominated framework, adaptation approaches and preference in the water sector could be 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.\textsuperscript{162} For example, given the climate change impacts on water quantity and distribution, the Chinese government has accelerated the progress of the SNWD project rather than reflecting on its feasibility under the impacts of

\textsuperscript{157} Gemmer, Su and Jiang, above n 135, 90.
\textsuperscript{160} Marco Gemmer, Andreas Wilkes and Lucie M. Vaucel, ‘Governing Climate Change Adaptation in the EU and China: An Analysis of Formal Institutions’ (2011) 2 (1) Advance in Climate Change Research 1, 9.
\textsuperscript{161} Ibid.
climate change. Recently, the government has decided to increase its national investment in water conservancy projects to 4 trillion Yuan ($612 billion) by 2020. 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.

The investment in infrastructure and technology is crucial to reduce ‘adaptation deficit’ through managing uneven water distribution and improving flood and drought management capacity. However, building more and more infrastructures, in turn, may disturb the delicate balance upon which the ecosystem depends and may consequently lead to more frequent extreme events. Consequently, a vicious circle may be established 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. 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 large-scale infrastructure.

As discussed in the previous Chapter 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 research suggests that more research on adaptation should be conducted from a legal, social

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165. Interview with interviewee 2, staff of the Meteorological Bureau, Jiangxi Province (Nanchang, China, 24 October 2011).
166. Pan, Zheng and Markandya, above n 156, 102.
168. Ibid.
and cultural perspective to reduce the underlying vulnerability to climate change rather than placing an over-emphasis on its impacts.

3 The Marginal Role of Environmental Authorities in Adaptation

Previous analysis illustrates that climate change issues and environmental issues are managed by two different legal and institutional frameworks. 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 of the climate change related policies and laws do not refer to their responsibilities. With regard to the institutional arrangements 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 very passive and they are not entrusted with bargaining power to inform climate change-related decision-making.

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 NDRs to play an overarching role in addressing climate change. Nevertheless, this does mean that climate change should be separated from traditional environmental problems, or that environmental authorities should be marginalised on climate change discourses. Although climate change is ultimately framed as a development issue, it is primarily an environmental issue. Overemphasising 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 have strong implications on environmental and natural resources protection. Thus, effective responses to climate change will rely heavily on effective environmental policies, laws and institutional arrangements. 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/proothing environmental policies. Otherwise, measures undertaken by them to protect the environment may contribute to 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 also may 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.169 Third, environmental authorities (especially the MEP) have been the most enthusiastic authorities working on reducing GHG by promoting alternative energies and promoting adaptation by improving environmental quality.170 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 recently 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 climate change is integrated and regulated by the Clean Air Act,171 CO₂ as a key GHG element is not regarded as an ‘air pollutant’ in China. Therefore, this provision 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

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169 As a tool to address climate change, mainstreaming climate change adaptation in EIA will be analysed in Chapter 6 part B.
vulnerability reduction and adaptive capacity improvement. It again excludes environmental authorities from engaging in key climate change decisions, losing the best chance to adapt to climate change. At the central level, although the MEP has been given full ministerial status, it continues to lack political influence, as well as financial and personnel resources to manage environmental issues, let alone 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.

4 Lack of Institutionalised Governance at the Local Level

Due to the devolution of significant authority and responsibility for environmental protection to local governments, environmental protection and environmental circumstances in China differ significantly from one region to another. The weak enforcement of environmental laws and the absence of institutionalised governance have resulted that environmental protection is highly dependent on local officials’ attitudes, visions and leadership toward environment. 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.172 Prominent examples are Dalian, Shanghai and Xiamen. These cities have been recognised 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.173 Vice versa, where the officials are economic oriented, local environments are likely to be less well protected.

The absence of institutionalised governance from legal and institutional frameworks at the local level is the main reason resulting in various levels of environmental performance – few are considered to have well-protected environment while most

173 Ibid.
jurisdictions have very severe environmental problems. Although climate change is not managed as a traditional environmental issue in China, this paradigm has been also reflected in climate change adaptation to which has been attached less importance than environmental protection. In the absence of clear responsibility allocation on adaptation issues, field visits and interviews about climate change adaptation reveal the same characteristics as environmental issues – whether climate change adaptation is put on decision-making agendas depends on related officials’ awareness and understanding of adaptation; and whether adaptation is managed in a holistic and integrated approach depends on related officials’ background and predisposition. As illustrated earlier in this chapter, climate change issues are left to local governments, mainly provincial governments. Thus whether adaptation is given a reasonable emphasis depends on provincial governments’ perceptions concerning adaptation. Some provinces take climate change adaptation very seriously and devote sufficient effort 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 measures to adapt to climate change on various levels. Effective strategies also have been taken in Jiangxi Province to increase the resilience of vulnerable sectors such as water resources and agriculture.

The different attitudes towards adaptation, to some extent, are consistent with the nature of adaptation, which should be viewed and addressed in a local context. However, its negative impacts are also apparent. This high reliance on personal leadership rather than institutionalised governance not only result in policy inconsistency on climate change adaptation when next officer charges the office, but also increase uncertainty to adaptation-related investment or action. Sometimes, the 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.

D Conclusion

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174 Interview with interviewee 2, staff of the Meteorological Bureau, Jiangxi Province (Nanchang, China, 24 October 2011).
175 Interview with interviewee 1, staff of the Development and Reform Commission of Jiangxi Province (Nanchang, China, 24 October 2011).
176 Chun Xia and Claudia Pahl-Wostl, ‘Understanding the Development of Flood Management in the Middle Yangtze River’ (2012) 5 Environmental Innovation and Societal Transitions 60, 73.
Climate change has great potential to influence China’s water security through various means, for example, through changing water supply and demand, and the intensity and frequency of floods. The Chinese government and Yangtze water managers have been aware of the urgency and importance to combat climate change and its adverse impacts. A great deal of effort has been made through 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 centred with, mitigation. After analysing 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 able to manage adaptation issues effectively.

Although there is no ‘adaptation law’ in China, this thesis reveals that ‘adaptive laws’ have been in place to regulate adaptation issues, after examining relevant laws and regulations on climate change and environmental management. Nonetheless, this thesis also finds that these ‘adaptive laws’ have a very low capacity in delivering effective adaptation strategies due to lack of purpose-built and explicit regulatory requirements and instruments.

Adaptation does take place in vacuum – it will need to consider the 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 and shaped by China’s traditional mentality, paradigm and approach in dealing with economic development and environmental protection: less developed legislation, over-reliance on ‘hard’ approaches, marginalised environmental authorities and lack of institutionalised governance. Although adaptation is required to be treated equally as mitigation, it is still not the priority of both central and local governments. In the water sector, Yangtze 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, to a large extent, influence the paradigms and
approaches undertaken by Yangtze water managers in managing water-related climate change impacts.

More importantly, it is crucial to realise that the substantial challenges from climate change impacts bring significant challenges to the legal values, perceptions and institutions of Yangtze water management. In that case, not only should the awareness of adaptation be improved, Yangtze water-related laws, regulations and institutional arrangements should also be shifted or upgraded to respond to these challenges. The next chapter will analyse how the requirements of adaptation challenge current legal and institutional frameworks regarding Yangtze water resources management, and then discuss the possibility of mainstreaming adaptation issues in the legal and institutional frameworks of Yangtze water management.
Chapter 2 has illustrated the challenges to Yangtze water managers because of ill-designed legislation and fragmented institutional arrangements. These challenges are further aggravated because of uncertain and complicated climate change impacts. After analysing and assessing the effectiveness of related adaptation-related policy, legal and institutional framework, Chapter 3 concludes that this framework is not adequate to deliver proactive and resilient decision-making. To manage these dual challenges, this thesis proposes that mainstreaming climate change adaptation by improving IWRM regime and related 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 rationalise this proposal, two crucial questions, as listed in Chapter 1, must be answered: (1) why should the legal and institutional framework of IWRM mainstream climate change adaptation? Or, in other words, why should climate change adaptation be mainstreamed in IWRM framework? (2) Is IWRM able to mainstream climate change adaptation? Or, can adaptation be mainstreamed in IWRM?

The first question will be examined in Part A. 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. The third section of Part A will analyse the status of mainstreaming in China by examining its political and legal environment. Question (2) implies that a thorough comparison between IWRM and adaptation is essential to identify their synergies and trade-offs. Therefore, Part B will mainly demonstrate their differences through identifying and analysing the challenges to water-related legislation, institutional arrangements and the IWRM per se presented by climate change adaptation. Based on those challenges, Part C will provide an in-depth study on the possibilities and rationales of integrating IWRM with adaptation.
1 Aligning Climate Change Adaptation with Sustainable Development

The concept Sustainable Development (SD) was articulated in the ‘Our Common Future’ by the Brundtland Commission in 1987 and further supported by the Rio Summit in 1992 and the United Nations 2005 World Summit Outcome document. While recognising the importance of analysing the origin and development of the concept, this thesis will not dwell on it. 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’. More specifically, it is 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’. It calls for a convergence between the three pillars of economic development, social equity and environmental protection. From above statements, it is apparent that this is a helpful ‘principle approach which is both substantive and procedural’. Its elements mainly focus on a sustainable utilisation 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. Some of the key principles and procedural mechanisms widely acknowledged are derived from the principle of SD, such as public participation, access to information and justice, good governance and environmental

1 For those who are interested in the development of SD, this paper could be very helpful: John Drexhage and Deborah Murphy, ‘Sustainable Development: From Brundtland to Rio 2012’ (Background Paper, United Nation Secretary-General’s High-level Panel on Global Sustainability, 2012).


4 John Drexhage and Deborah Murphy, ‘Sustainable Development: From Brundtland to Rio 2012’ (Background Paper, United Nation Secretary-General’s High-level Panel on Global Sustainability, 2012) 2.


impact assessment. By 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.

At the domestic level, it has become the purpose and principle of managing natural resources, developing economy and protecting environment. In China, ever since the 9th National Five-year Plan (FYP) (1996-2000), SD has become 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, SD has been widely accepted as one of the objectives or management principles of Chinese water policy and legislation. The 10th FYP regarded the sustainable water use as a strategic issue in China’s development. Article 1 of China’s 2002 Water Law stipulates that ‘this law is enacted for the purpose of…bringing sustainable utilisation of water resources’. 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. 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 effective outcomes. It has not been effectively harnessed by national governments as an instrument for implementation. Recently, some scholars argue that SD has found a de facto ‘home’ in climate change. This implies that: first, the current concerns for climate change could be used to stimulate more work on the larger envelope of challenges to SD,

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7 Fisher, above n 3, 28-9.
8 Fisher, above n 3, 27.
12 Drexhage and Murphy, above n 4, 15.
13 Drexhage and Murphy, above n 4, 13.
14 Thomas J. Wilbanks, ‘Integrating Climate Change and Sustainable Development in a Place-based Context’ (2003) 3 (S1) Climate Policy S147, 149.
secondly, many other development concerns and challenges need to be addressed in order to cope with climate change effectively. With regard to Yangtze water resources, SD requires that current water crises must be resolved to reduce the vulnerability to climate change. In other words, climate change provides a stage 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 the principles of SD through the lens of climate change, the relationship between climate change (and adaptation) and SD should be identified first.

There is a close relationship 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. SD can reduce the vulnerability to climate change, while responses to climate change are very likely to increase nations’ abilities to achieve SD outcomes. With regard to adaptation, SD can reduce the vulnerability to climate change impacts, which in turn eventually facilitates adaptation. Climate change adaptation, on the other hand, will reduce adverse climate change impacts, which denotes a reduction of threats to SD. Their relationship could be explained in the following two aspects:

First, the development choices made and pathways chosen will largely determine the vulnerability and adaptive capacity of countries or regions to the forthcoming climate change impacts. 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 restrain it. 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 reduce the greenhouse gases (GHG) emissions and the vulnerability to climate change but will also enable mitigation and adaptation much easier.

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15 Drexhage and Murphy, above n 4, 9.
manner, 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 impacts. Taking a further step, whether risks associated with climate change and variability are considered in development decisions, actions and programs also play a significant role in determining adaptive capacity. In addition, the capacity to adapt depends clearly on the state of development. 19 Underdevelopment and unsustainable development fundamentally constrain the adaptive capacity of a society, especially when lack of resources to hedge climate change impacts. 20 It is also true that the adaptation options in the future will inevitably be affected by the development activities chosen today. 21 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, jeopardise development outcomes and affect the efficiency with which development resources are invested. The Organisation 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, infrastructure and labour productivity. 22 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

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is often the most important factor that creates a hotspot of human vulnerability.\textsuperscript{23} Therefore, in order to achieve the goal of SD, adaptation must be defined and institutionalised in the development process. For instance, in the 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 threats 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.\textsuperscript{24} 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.\textsuperscript{25} In this sense, adaptation to climate change can be regarded as part of broader sense of the SD.\textsuperscript{26}

From the above discussion on the relationship between SD and adaptation, this thesis 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.\textsuperscript{27} It is one of the six principles guiding China’s responses to climate change both domestically and internationally.\textsuperscript{28} By setting climate change issues within the framework of SD, the Chinese government expects to facilitate adaptation through economic development, poverty reduction and environmental conservation.

\textsuperscript{23} IPCC, ‘Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability’ in M.L. Parry et al. (eds), Working Group II Contribution to the Fourth Assessment Report of Intergovernmental Panel on Climate Change (Cambridge University Press, 2007) 317.
\textsuperscript{24} W. Neil Adger et al., ‘Are There Social Limits to Adaptation to Climate Change?’ (2009) 93 Climatic Change 335, 340.
\textsuperscript{25} Barry Smit and Olga Pilifosova, Adaptation to Climate Change in the Context of Sustainable Development and Equity (Cambridge University Press, 2001) 877, 877-912.
\textsuperscript{27} 《中国应对气候变化国家方案》[China’s National Climate Change Programme] (People’s Republic of China) National Development and Reform Commission, June 2007.
\textsuperscript{28} 《中国应对气候变化国家方案》[China’s National Climate Change Programme] (People’s Republic of China) National Development and Reform Commission, June 2007.
There are two different approaches or responses towards adaptation and SD: impact-oriented approach and vulnerability reduction approach (Table 4.1). The former targets specific adverse impacts associated with climate change through creating responsive mechanisms while the latter focuses on the underlying factors causing vulnerability. The United Nations Framework Convention on Climate Change (UNFCCC) and most national governments have adopted an impact-oriented approach to undertake adaptation research and policy discussion in the past decades. 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.

<table>
<thead>
<tr>
<th>Impact-oriented approach</th>
<th>Adaptation to climate change impacts $\rightarrow$ loss reduction and climate change impacts reduction $\rightarrow$ sustainable development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerability reduction approach</td>
<td>Sustainable development $\rightarrow$ vulnerability reduction $\rightarrow$ impacts reduction $\rightarrow$ adaptation</td>
</tr>
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</table>

**Table 4.1:** Two different approaches towards adaptation in the context of sustainable development

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Recently, much of the literature has revealed that the primary cause for the growing damage from climate change impacts is the vulnerability of human and environmental systems to climate variability and change, not the changes in climate per se.\textsuperscript{31} A study conducted by some Chinese scholars also demonstrates that the measures to reduce sensitivity and vulnerability and those to increase resilience could enable affected communities to adapt to climate change-induced droughts in a cost-effective way.\textsuperscript{32} In view of this, the vulnerability reduction approach, which focuses on reducing climate sensitivity and human vulnerability, should be widely advocated by the Chinese government.\textsuperscript{33}

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 which 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.\textsuperscript{34} In terms of 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 research 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.

According to the IPCC, the term ‘mainstreaming’ in a climate change context originally

\begin{quote}
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
\end{quote}

\textsuperscript{34} Heather McGraw et al., Weathering the Storm: Options for Framing Adaptation and Development (World Resources Institute, 2007) 20.
well as to reduce the sensitivity of development activities to both today’s and tomorrow’s climate.\(^{35}\)

Generally, ‘mainstreaming’ adaptation in the climate change area could be approached from different aspects: (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.\(^{36}\) Conversely, there are also opposing opinions. For example, after analysing 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.\(^{37}\) Being aware of the interplay between climate change and development, they suggest that the links between adaptation, mitigation and development are better developed separately.\(^{38}\) As analysed in the previous chapter, current mitigation-oriented frameworks are unable to manage adaptation issues due to the distinctions between mitigation and adaptation. Therefore, this thesis will only advocate the third type of mainstreaming – mainstreaming adaptation in the development process.

Based on the definition 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.\(^{39}\) Compared to the widely used ‘integrating’, the term

\(^{35}\)Richard J. T. Klein et al., ‘Inter-relationships Between Adaptation and Mitigation’ in M.L. Parry et al. (eds), *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability, Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report* (Cambridge University, 2007) 745, 768.


‘mainstreaming’ recognises the marginal status of adaptation in current policy and planning, and emphasises 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 in most developing countries. It could also minimise policy conflicts and trade-offs, maximise 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. 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. Climate change should not be overemphasised 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 that is characterised by economic growth, population increase and technology development, thus it is better to be resolved in the development process. Second, it is clear that climate change policies cannot and will not be implemented in isolation with other environmental or economic policies. 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. Third, given the uncertainties surrounding climate change risks and impacts, adaptation, in most cases, has to be and will be implemented within present development strategies and process. The water management community has always needed to address climate variability and

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41 Shardul Agrawala, Bridge over Troubled Waters: Linking Climate Change and Development (OECD, 2005) 142.
42 Smit and Pilifosova, above n 25.
43 OECD Environment-Development Task Team, above n 16, 4.
44 Klein, Schipper and Dessai, above n 38, 582.
45 Tan, above n 30, 137-8.
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 which could resort to quantitative criteria like setting specific reduction goal, there is no single metric to measure adaptation and compare different adaptive strategies. All these factors contribute to the advocacy of a mainstreaming approach.

3 Examining the Status of Adaptation Mainstreaming in China and the Yangtze River Basin

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. 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. Thanks to the help of international organisations (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 centred 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 Northern China. Its experiences in mainstreaming climate change adaptation

46 Klein, Schipper and Dessai, above n 38, 581.
49 Adaptation Learning Mechanism, Explore the Adaptation Learning Mechanism <http://www.adaptationlearning.net/explore>.
50 World Resources Institute, China: Mainstreaming Adaptation to Climate Change into Water Resources Management and Rural Development (21 November 2007)
within national Comprehensive Agricultural Development Programmes and institutional strengthening could provide invaluable insights for the mainstreaming process in other river basins including the Yangtze River Basin (YRB).

At the national level, the Chinese government mandates addressing climate change within a SD framework. While SD is significant to guide adaptation measures, the Chinese government also signals that climate change mitigation and adaptation should not take priority over national development objectives, especially economic development – the governments 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 Chapter 3. In this case, it is better that adaptation is integrated with policies and practices which address other development issues or promote China’s core interests.\(^{52}\) Mainstreaming will be an effective approach to putting adaptation into practice.\(^{53}\) 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 Programme (CNCCP) has identified ‘integrating climate change policies with other interrelated policies’ as a principle to tackle climate change.\(^{54}\) Lately, China’s 12\(^{th}\) 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’ analysed above do not reach the level of national policy and planning which have more

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\(^{51}\) Paul G. Harris, ‘Climate and Climate Change: From Copenhagen to Cancun’ (2010) 40 (9) Environmental Law Reporter 10858, 10859.


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 realised this gap, the following chapter of this thesis 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 in the YRB 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. Climate-proofing strategies will be delivered if climate change impacts and adaptation factors are mainstreamed in routine development, such as the IWRM. Through linking adaptation, water resources management and SD, 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 IWRM. In the next part, this research will approach this question by analysing the barriers of implementing mainstreaming adaptation in IWRM – that is, to understand the challenges of adaptation to those established water-related legal and institutional frameworks.

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Climate change adaptation is a continuous stream of attitudes, decisions and actions that could inform existing legal procedures and decisions. Existing water-related legislation and institutional arrangements should be reviewed to identify and address the challenges presented by adaptation. 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 institutions have been formed and developed in order to adapt our social practices to the variable climates, such as our irrigation system and insurance mechanism. 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. As a result, our water management regime has developed certain capacities to responding to these changes.

In terms of dealing with climate change impacts, 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. On the contrary, others claim that our business-as-usual water management framework is challenged fundamentally by climate change and is not able to manage water-related climate change impacts. Thus the crucial question here is: does adaptation challenge our established legislation, institutional arrangements and regime on water resources management.

In addition, a clear point has been repetitively made in this thesis is that the water management framework and adaptation framework will interact with each other to together shape the mechanisms and approaches of water-related adaptation. The previous chapter elaborated China’s adaptation-related legal and institutional

57 Adger et al., above n 24, 336.
58 M.L. Parry et al., Working Group II Contribution to the Fourth Assessment Report of Intergovernmental Panel on Climate Change (Cambridge University Press, 2007) 196.
59 Eelco van Beek, ‘Managing Water under Current Climate Variability’ in Fulco Ludwig et al. (eds), Climate Change Adaptation in the Water Sector (Earthscan, 2009) 51, 51.
frameworks where water-related adaptation takes place. To what extent these frameworks deliver effective adaptation strategies Yangtze water management not only depends on the design and implementation of these frameworks but also relies on how much synergy there is between them and the existing legal and institutional frameworks on water management. Therefore, this part will investigate the distinguishing features of adaptation and its incremental challenges to existing Yangtze water-related legal and institutional frameworks, which are often designed and implemented without considering the emerging climate change impacts.

1 Challenges to the Assumption of Legislation – Stationarity is Dead, Uncertainty is Pervasive

It is essential to reflect and re-evaluate current management paradigms when transitioning from the first modernity to the second modernity society. While the fundamental idea of controllability, certainty or security of the first modernity collapses, 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 which could shape and determine the paradigm a society adopts: centripetal culture and centrifugal culture. 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

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60 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 pluralisation 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 on <http://sociologicaldiagnoses.wordpress.com/>.
certain bounds but not eliminated. The governance challenge then becomes to devise structures that can operate flexibility within those bounds.  

Different cultural patterns not only influence decision makers’ strategies but also have an effect on the behaviours of those who are affected by the 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 usually chooses to either repress or ignore them. A slogan ‘harmonious society’ put forward recently by the central government has been widely shared by the society as its cognitive orientation and objective. While this culture is significant to enable a secure and stable society, centrifugal culture should be valued as well. A centrifugal culture will be conductive to facilitate current paradigms to adapt to new changes, especially given the uncertainty and conflicts induced by climate change.

(a) Stationarity is ‘Dead’ as an Assumption of Water Laws

Up until now, the premise underpinning natural resources management is an equilibrium-based understanding of ecosystems, which assumes the stability of ecosystems. Relying on the predictability of future changes, it prefers to resort to a return to equilibrium following disturbance. It reflects a homeostatic view which attempts to pervert or restore (if necessary and possible) natural resources to some previous state through various approaches. 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.
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 behaviour. 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. Traditionally, the concept of stationarity has underpinned the water-related legislation, water management regime and approaches.

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. This is tantamount to the principle that the past is the key to the future. It influences the preference of water management approaches profoundly – water managers tend to favour structures such as dams, diversions and dikes over non-structure measures. Structure measures are also the priority choice for water managers to respond to emerging pressures of climate change. This argument has been adequately discussed in Chapter 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.

However, after 1970, the equilibrium theory was questioned and the so-called non-equilibrium theory is introduced to understand and explain how ecosystem functions. The climate change impacts speed up the reflection of current management paradigms. Preserving and returning to previous conditions would not be possible due to the irreversible large-scale climate change impacts. This means that water-related laws need to provide frameworks, guides, rules and even procedures for

70 Milly et al., above n 68.
71 Jan McDonald, ‘Mapping the Legal Landscape of Climate Change Adaptation’ in Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), Adaptation to Climate Change: Law and Policy (Federation Press, 2010) 1, 28.
72 Jeroen Aerts and Peter Droogers, ‘Adapting to Climate Change in the Water Sector’ in Fulco Ludwig et al. (eds), Climate Change Adaptation in the Water Sector (Earthscan, 2009) 87, 88.
73 Z.W. Kundzewicz et al., ‘Freshwater Resources and Their Management’ in M.L. Parry et al. (eds), Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability, Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report (Cambridge University, 2007) 196.
74 Mattews and Wickel, above n 69, 272.
75 Godden and Peel, above n 66.
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.\(^{76}\) In much of the literature, stationarity has been declared ‘dead’ because of human-induced climate change and its unpredictability and variability.\(^{77}\) Thus, many scholars assert that stationarity ‘should no longer serve as a central and default assumption in water resources management’.\(^{78}\) The past has lost its power to determine the present and indicate the future.\(^{79}\) 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 legislation 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.\(^{80}\)

(b) **Uncertainty is Pervasive and Challenging Water-related Legal Framework**

Meanwhile, almost all of the researchers agree that uncertainty pervades the whole process of adaptation – from decision-making to implementation – and we will live with uncertainty for a long time.\(^{81}\) While uncertainty is very common for water management, the ‘cascading’, ‘exploding’ and ‘pervasive’ uncertainties presented by climate change bring unprecedented challenges to the current water regulatory

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\(^{76}\) Beek, above n 59, 76.

\(^{77}\) Milly et al., above n 68.

\(^{78}\) Milly et al., above n 68, 573-4.

\(^{79}\) Beck, above n 61, 137.


framework. These uncertainties must be acknowledged and managed because they have great tendency to cause the paralysis of legal and institutional frameworks.

Climate change uncertainty generally means our human systems cannot predict and make thorough preparation for future climate change impacts due to the imperfect knowledge of the probability, magnitude, timing and location of climate change impacts. Pertinent scientific uncertainties associated with climate change are climate change itself, its associated extremes, their effects, the vulnerability of systems and regions, conditions that influence vulnerability. For example, General Circulation Models (GCMs) are powerful tools accounting for the complex set of processes which will produce future climate change. However, GCMs projections are subject to significant uncertainties in the modelling process. Uncertainties also exist in GHG emission scenarios and the downscaling of the models.

Not only do these scientific uncertainties exist, but also epistemological uncertainty (who should be involved in decision-making and whose values count), 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. The epistemological, ethical and scale (EES) uncertainties are related to the decision-making process and behavioural rules that try to describe and respond to the dynamic uncertain socio-economic system. Deriving from them is the uncertainty of the cost, implementability and effectiveness of any anticipatory adaptation response, which is also an important aspect of uncertainty and should be counted.

82 McDonald, above n 71, 27.
83 McDonald, above n 71, 27.
84 Anne Leitch, Ben Harman and Marcus B Lane, ‘From Blueprint to Footprint: Climate Change and the Challenge for Planning’ in Tim Bonyhady, Andrew Macintosh, Jan McDonald (eds), Adaptation to Climate Change: Law and Policy (Federation Press, 2010) 63, 68-9.
88 Leitch, Harman and Lane, above n 84, 69-71.
These uncertainties associated with adaptation have significant effects for water-related legal and institutional frameworks, from legislative objectives to information sharing and from the decision-making structure to management approaches. It brings a series of challenges for approaching adaptation from a legal dimension. Legislation should be based on certain degree of scientific certainty to provide the best information and knowledge for water planning and policy-making. Otherwise, it would be very difficult to translate uncertain scientific information to legal requirements, prohibitions and procedures. Unfortunately, uncertainty implies that there is great information gap where the demands of law exceed the supply of science.\(^9\) While the information gap is very common in the area of water laws, climate change has no doubt exacerbated this gap and raised the urgency to close or bridge this gap. In addition to the improvement of scientific research and monitoring, legal reform to reduce the information sensitivity or demand of decision-making is also essential to bridge this gap.\(^2\)

While it is naïve to expect a significant reduction in scientific uncertainty within climate projections, many researchers argue that more can be done to facilitate communication and cooperation between scientific community and policy makers.\(^3\) The existing gap between scientific community and policy makers should be bridged so as to reduce uncertainties related to the decision-making process. 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 rather than shaping the decision-making outcomes – ‘decision-making supporting research’ named by Dr. Yu, a Chinese scientist and environmentalist.\(^4\) That means ‘government has already made the decision. You do research to support the decision. You never do something that changes the decision.’ \(^5\) 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 Division (SNWD)

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\(^{9}\) Fischman and Rountree, above n 67, 25.

\(^{2}\) Fischman and Rountree, above n 67, 25.

\(^{3}\) Agrawala and Van Aalst, above n 21, 190.


\(^{5}\) Ibid.
project based on their investigation of water flow in upper Yangtze River. Their research outcome of seven billion m³ annual average water flow in upper Yangtze indicates that the government’s plan to transfer eight to nine billion m³ to the North will not work.\textsuperscript{96} If the impacts on water resources due to climate change induced glaciers melt are counted in, the adverse impacts of this colossal project will be much greater. Unfortunately, due to the lack of institutionalised 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.

In addition, 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. Furthermore, climate change-related risks, losses and damages should be clarified across society in the context of legal framework. However, climate change uncertainty challenges this entrenched perception. The pervasive EES uncertainties imply that questions like ‘who takes adaptation measures?’ and ‘who pay the costs of adaptation initiatives?’ should be flexible, not ‘locked’. A legal reform to enable policy makers to make decisions in the context of unmet information is necessary but also challenging. 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.

\textbf{2 \textit{Challenges to the Institutional Framework – the Context Specific Nature of Adaptation}}

Institutional challenges can be understood from both a scale aspect and power relation aspect. First, Chapter 2 discussed the implementation of Integrated River Basin Management (IRBM) in the YRB and concluded that sub-basin or tributary level will be more applicable for the YRB management. However, adaptation issues are mainly delegated to local government, which brings challenges to the water-based adaptation.

\textsuperscript{96} Ibid.
Second, localised adaptation demands more initiatives and powers be delegated to local governments, which challenges current power relationships between the central and local governments. In addition, effective adaptation is dependent on a central-local (upper-lower) cooperation and coordination framework to arrive management strategies acceptable at the local, regional and national levels. This part first illustrates the reasons of taking adaptation measures locally and then analyses its challenges to current water management institutional arrangement.

(a) 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. They are often developed and employed at a regional, local and community level. There are no panaceas or one-size-fits-all approaches 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. Adaptation strategies and actions will only be effective on the ground that they fit local realities, including climatic characters, physical landscapes, cultural traditions and local knowledge.

The OECD gives three reasons about why adaptation should be based at the specific local level. First, climate change impacts are manifested locally, affecting local livelihood activities. Although climate change is most often discussed and understood as a global issue, the various impacts of climate change 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 characterised by frequent floods. The highly

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98 Agrawala, above n 41, 40.
101 OECD Environment-Development Task Team, above n 16, 140-1.
localised nature of climate change impacts implies that adaptation actions must be tailored to specific local conditions.  

Second, vulnerability and adaptive capacity are determined by local conditions. Vulnerability and adaptive capacity are determined by ecological factors like the sensitivity and exposure to climate change impacts and socio-economic factors like institutions, education and technology, infrastructures, health and income. For example, the people living in the downstream of the Yangtze 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.

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

(b) Challenges to Current Hierarchical Central-Local Power Relations

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

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102 McDonald, above n 71, 23.
103 Tan, above n 30, 138.
104 OECD Environment-Development Task Team, above n16, 141-2.
The division of functions and powers between the central and local governments 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 governments by allocating goals, introducing a cadre responsibility system and providing directives. As a result, a hierarchical system which favours command-and-control regulations has been established among various levels of government (from the top down, it is mainly central-provincial-prefectural-county). 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 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.

The picture provided in Chapter 2 is that there is a top-down institutional arrangement in the YRB where the MWR and its dispatched CWRC 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 basin’s 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 localised responses.

The Chinese government has supported localised 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. Unfortunately, in reality, most of the contents in their action plans and legislation reveal heavy influences from the central government’s CNCCP and the White Paper, lacking adequate consideration of local contexts.

For the EU and some of its member states where subsidiarity principle (SP) is widely accepted and implemented, the localised nature of adaptation does not raise additional institutional conflicts. Primarily applied as an effective guidance to allocate environmental responsibilities between higher and lower government, 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. 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. Many local councils and state government have undertaken progressive steps to facilitate adaptation. However, for China, which has a unitary system and where SP has not been formally accepted, empowering local governments to take adaptation initiatives will encounter several difficulties.

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111 Ibid.
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, especially when considering certain political and institutional path dependence. This dependence recognises that once duties and liabilities are allocated, it is difficult to alter these allocation rules. 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.

3 Requirement for Wider and More Effective Public Participation

The introduction part of Chapter 1 provides the concept and elements of (good) water governance. 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.’ 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.’ 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.\textsuperscript{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 climate-related risks among all stakeholder groups.\textsuperscript{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.\textsuperscript{121} This part will begin with an in-depth investigation and assessment of the legal framework and practices of the public participation in Yangtze water management. The challenges for a wider and more effective public participation in adaptation will be expounded after that.

\textit{(a) Analysing and Assessing the Legal Framework 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.\textsuperscript{122} According to the UNDP, civil society is defined as: ‘individuals and groups, organised or unorganised, who interact in the social, political and economic domains and who are regulated by formal and informal rules and laws.’\textsuperscript{123} It is not limited to traditional non-governmental organisations (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.\textsuperscript{124} 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

\textsuperscript{119} Ibid.
\textsuperscript{124} Ibid.
down-to-earth step would be to promote public (mainly those stakeholders and affected public) participation. Without effective and institutionalised public participation mechanism, any progress toward civil society engagement would be futile. Here the public participation in environmental protection area will be analysed and assessed to provide the backdrop of its role in water management.

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. 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 mobilisation for the purposes of implementation.’ After realising that environment protection cannot be completely entrusted to the government and is best handled with the participation of all concerned citizens, the Chinese government stipulates public participation as a principle of environmental protection in China’s 1989 Environmental Protection Law (EPL). This law articulates that every citizen and organisation in China has the obligation to protect the environment and shall have the right to report or file charges against units or individuals that cause pollution or damage to the environment. This clause, however, if given serious investigation, is ‘the principle of mass participation’. It is fundamentally different from ‘public participation’ in the international discourse which is based on the environmental rights of citizens. It is mainly about relying on the public to protect the environment rather than engaging them to participate in the decision-making process. As described in Article 6 of the EPL, the public have been imposed upon an obligation to cooperate with and support the government in the implementation and enforcement of relevant laws and policies. By contrast, the rights to be informed, consulted and heard in the decision-making process in order to shape polices and strategies on environment protection have been absent.

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126 Ibid.
As the core of social public policy, rights justify the qualification of possessing certain resources or interests, influencing and shaping actors’ behaviour. More than 20 years after the 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. As a result, the public, especially the stakeholders, have generally been excluded from the environmental planning and management process.

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 and the public to participate in the EIA process in appropriate ways’. 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.’ 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.

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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.\textsuperscript{135}

Nonetheless, due to the limited extent of the public who are able to participate, limited access to information, limited impacts of the public in decision-making and limited access to judicial redress, most of these laws do not set up effective institutionalised mechanisms and supporting systems for public participation.\textsuperscript{136} Moreover, they inherit the legacy of Chinese legislation mentality – more akin to policy statements and propositions of ideals than laws.\textsuperscript{137} Most of these laws 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.\textsuperscript{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’.\textsuperscript{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, general, vague and aspirational languages are frequently employed in provisions.\textsuperscript{140} The exhortational terms ‘encourage’ (guli) and ‘should’ (yinggai) are commonly used rather than the stronger terms ‘require’ (yaoqiu), ‘shall’

\textsuperscript{136} Zhao, above n 129, 118-22.
(dei) or ‘must’ (bixu). While these flexible terms may present discretion for local government to tailor appropriate adoptions to its local circumstances, they also provide local officials considerable leeway for interpretation. 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. Many scholars characterised it as ‘imposed, involuntary, manipulative, unsustainable or unaccountable practices’.

The absence of institutionalised participation system has resulted in an increasing number of environmental protests, such as Dalian and Xiamen PX (P Xylene) protests. 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. Related governments were very passive in organising people to participate. They only initiated the hearing procedure after the environmental protest became a serious social stability issue. Generally, there are three stages of public participation: (1) local interest groups and local governments get a polluting project underway in violation of environmental regulations; (2) local affected people spontaneously organise the mass to protest against the project in question, an activity neither supported law nor policy; and (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. This so called ‘interaction without rules’ has been a very

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141 Ibid.
142 Wu, above n 138, 317.
147 Tang, above n 145.
common path of responding to environmental issues, reflecting the absence of a strong rule of law and institutionalised procedures for public participation in China.  

(b) Assessing the Public Participation Practices in the 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. All of them involve various interest groups that are of high interest and relevance. Stakeholders and the interested public could participate in the water management process mainly through the following ways: (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 organised 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 organise public hearings to consult various stakeholders; (3) Experts’ reviews of development policies and plans, where professionals with expertise are involved in water management; and (4) stakeholder coordination, where representatives of various stakeholders communicate and negotiate over water-related issues relevant to their interests. At first glance, these four types of public participation could significantly influence the decision-making on water issues from various perspectives. Unfortunately, in practice, the affected groups and the public are treated as recipients of inconsequential information or information about decisions that have been made. They are consulted and allowed to comment

148 Tang, above n 145.
150 Ibid 21.
only on pre-determined issues. Their opinions, comments and suggestions are not able to influence or shape final decisions.\textsuperscript{154}

This dominant top-down decision-making approach has advantages in producing rapid, centralised responses to address severe water threats, and to mobilise state and social factors to take collective actions.\textsuperscript{155} It has been efficient in addressing water conflicts and large-scale urgent crises such as floods and droughts,\textsuperscript{156} due to its merits in mobilising resources, directing performances and keeping social stability.\textsuperscript{157} For example, during the 2009 spring and 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 centralised system.\textsuperscript{158} In those severe droughts, the centralised top-down approach has shown its advantages in mobilising people and the army, deploying resources and allocating funds.\textsuperscript{159}

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. First, 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.\textsuperscript{160} 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.\textsuperscript{161}

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 conducive 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 per cent of the

\begin{footnotesize}
\begin{itemize}
\item[154] Eng and Ma, above n 141.
\item[155] Gilley, above n 125, 300.
\item[157] Ye, above n 32, 90.
\item[158] Ye, above n 32, 89-90.
\item[159] Larson, above n 94.
\item[160] Richerzhagen and Scholz, above n 122, 317.
\end{itemize}
\end{footnotesize}
respondents never consider saving water resources; and only 14.3 per cent of the respondents feel panic with current water scarcity problems.\textsuperscript{162} 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 behaviours in that case are likely to be aggressive and irrational,\textsuperscript{163} 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.\textsuperscript{164} 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. Effective and institutionalised public participation has been absent in area of water management. This status quo is not able to address crosscutting and complicated adaptation, which demands more effective and broad-based public participation.

\textit{(c) Adaptation Requirement for Widely Public Participation — From a Risk Society Perspective}

Given the intrinsic uncertainty and complexity of climate change, the whole human race 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

\textsuperscript{162} 郑通汉[Zheng Tonghan],《制度、文化、水危机》[Institution, Culture and Water Crisis] 2005 (2) 中国水利 China Water Resources 15, 15-21
\textsuperscript{163} Xie, above n 151, 57.
\textsuperscript{164} 李春梅[Li Chunmei], 《城镇居民公众参与态度实证研究—以成都市为例》 [An Empirical Study on Urban Residents’ Public Participation and Attitudes: The Case of Chengdu] 2005 (5) 国家行政学院学报 Journal of China National School of Administration 67, 67-70.
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.\footnote{Robin Kundis Craig, “‘Stationarity Is Dead’—Long Live Transformation: Five Principles for Climate Change Adaptation Law” (2010) 34 Harvard Environmental Law Review 10, 35.} One could avoid the risk of nuclear power and GMF, but he/she
could not escape from the risks presented by climate change. We are all stakeholders
of climate change and adaptation demands the response of all levels of
stakeholders.\footnote{United Nations Educational, Scientific and Cultural Organization, Adapting to Climate Change: Why We Need Broader and ‘Out-of-the-Box’ Approaches (2011) 14-15.}

In his book ‘World Risk Society’, Beck stated that ‘so far, risk has seemed a purely
negative phenomenon, to be avoided or minimised. But it may be seen at the same
time as a positive phenomenon too, when it involves the sharing of risks without
borders.’\footnote{Beck, above n 61, 16.} 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 same understanding and
response when confronting with risks. On the contrary, their perceptions and reaction
towards risks may be very diverse. Risk is not only a factual statement with technical
understanding, but also a value statement – a combination of ‘knowledge’ and
‘awareness’. That is mainly because individual and collective behaviours are partly
shaped by deeply embedded cultural and societal norms and values. Rules, strategies
and institutions to manage risks and social change are highly dependent on people’s
perception, belief and knowledge of risks.\footnote{Adger et al., above n 24, 338.} 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.\footnote{Timothy O’Riordan and Andrew Jordan, ‘Institutions, Climate Change and Cultural Theory: Towards a Common Analytical Framework’ (1999) 9 Global Environmental Change 81, 81–93.} Therefore, managing future climate change risks must consider
various values of those affected.

As Beck explained, ‘risks are related directly and indirectly to cultural definitions and
standards of a tolerable or intolerable life’.\footnote{Beck, above n 61, 138.} First, their goals or objectives set when
managing risks are obviously defined by related social and cultural factors.\textsuperscript{171} Although in the context of climate change adaptation, the general goal is to reduce vulnerability and enhance resilience to climate change and its impacts,\textsuperscript{172} specific goals should be made, such as land use optimisation, 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.\textsuperscript{173} In many cases, their priority list of risks does not necessarily fit with the rationality of these risks. For example, individuals and communities tend to respond to risks and concerns immediately or personally.\textsuperscript{174} In that case, any risk reduction strategy that is not in tune with people’s understanding of risks and priorities are unlikely to succeed.\textsuperscript{175}

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.\textsuperscript{176} 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.\textsuperscript{177} 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.\textsuperscript{178} 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.

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

\textsuperscript{171} Adger et al., above n 24, 341.
\textsuperscript{172} Smit and Pilifosova, above n 25, 891.
\textsuperscript{174} Adger et al., above n 24, 347.
\textsuperscript{176} Jäger and Moll, above n 97, 213.
\textsuperscript{177} Ibid.
\textsuperscript{178} Adger et al., above n 24, 338.
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.\textsuperscript{179}

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,\textsuperscript{180} particularly those marginalised vulnerable groups. More importantly, the values and knowledge developed by non-mainstreaming groups should be perceived and recognised politically, socially and legally.\textsuperscript{181} For China, where even institutionalised public participation is absent, this requirement will be not so easy to achieve.

4 Challenges to the Capacity of IWRM in Managing Water-related Climate Change Impact

Challenges to the IWRM regime presented by climate change can be interpreted from two dimensions. First, while IWRM aims to achieve SD, climate change may compromise this outcome due to its adverse impacts. This aspect can be understood as the general physical impacts of climate change which have been discussed earlier in Chapter 3 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 investigated. The following content of this part will analyse how climate change adaptation will challenge the IWRM regime.

\textsuperscript{179} Beck, above n 61, 5.
\textsuperscript{180} Adger et al., above n 24, 350.
\textsuperscript{181} Beck, above n 61, 119-20.
The emphasis of most work on IWRM is, as its name suggests, managing water and related resources in an integrated way to maximise economic and social welfare, without considering responding to exogenous pressures like climate change. First, the adaptability of the current water system was set up, designed according to historical information and current climate conditions, which may be unable to adapt to future uncertain climatic projections. Second, the IWRM was adopted and developed before climate change became an internationally hot issue and a domestic policy driver, and thus not explicitly required to integrate climate change considerations. Most water governance frameworks do not explain how to address the increasing levels of variability, uncertainty and irreversibility presented by climate change. 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 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. The scientific basis of IWRM concept and practice has not been well established. 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. 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 minimise vulnerabilities and disaster risks throughout society, through prevention, mitigation

182 Aerts and Droogers, above n 72, 92.
183 Aerts and Droogers, above n 72, 88.
186 Ibid.
and preparedness.’ 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. 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 separately.

In fact, IWRM and DRR are intertwined with each other. IWRM is generally centred on water quality and water quantity issues. ‘Too much’ (floods), ‘too little’ (droughts) and ‘too dirty’ (pollution) are the three main aspects of water management. 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 floods and droughts. In this circumstance, the risks of causing water disasters must be considered, assessed and minimised when taking water management measures. 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.

The negative impacts 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 are well integrated with IWRM to build resilience to cope with floods, droughts and other climate change induced disasters. This integration could also benefit climate change adaptation which has close link with DRR. Although climate change adaptation and DRR are different in terms of their origins, scopes and

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190 Beek, above n 59, 52.
institutional arrangements, they have a considerable and growing overlap. 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 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 defence in adapting to climate change and a no-regret climate change adaptation strategy.

The international community has recognised 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...’ By building linkages among IWRM, adaptation and DRR, a triple win could 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. Along with this paradigm transition is an approach evolution from ‘engineering-based solutions’ to an ‘ecosystem approach’ and ‘community-based DRR’ approach. Not only are these transformations corresponding to the requirements of adaptation (such as vulnerability-reduction approach adoption), but also they coincide with IWRM (such as an integrated approach). This denotes that the integration of DRR (which is part of climate change adaptation) with IWRM (that provides the framework for water adaptation) could generate synergic effects.

195 The requirement of adaptation will be expounded in Part A of Chapter 5.
C Analysing the Potential to Mainstream Climate Change Adaptation in the IWRM Related Legal and Institutional Frameworks

Unlike the vigorous comparison between IWRM and adaptive management, both of which are approaches of managing water resources, there are not many studies to compare IWRM with water-centred 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-centred 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-centred adaptation can be deemed as a response to an emerging exogenous challenge – climate change. While the endogenous and exogenous challenges are currently recognised and addressed separately because of their different concerns, they overlap 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 investigated. This part will conduct a comparison between IWRM and water-centred adaptation from various perspectives to detect their distinctions, overlaps and the likelihood of integrating them (Table 4.2).

<table>
<thead>
<tr>
<th>Distinctions</th>
<th>IWRM</th>
<th>Water-centred adaptation</th>
<th>Possible synergies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving forces</td>
<td>An approach to address internal fragmented water management</td>
<td>A response to the external climate change challenges of water management</td>
<td>Combining the internal and external factors</td>
</tr>
<tr>
<td>Objectives</td>
<td>Delivering sustainable water management by integrating competing and</td>
<td>Reducing the threats to water security posed by climate change-induced risks and impacts</td>
<td>Aiming to achieve sustainable water management, promote sustainability and</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>General approaches</th>
<th>Preferring an integrated approach; thinking at basin level and implementing at local level; from top to down</th>
<th>Preferring approaches based on specific site; acting at local level and thinking at basin level; from bottom to top</th>
<th>A balance between a holistic thinking and local actions; a balance between basin and local interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional arrangements</td>
<td>The MWR, MEP and their sub-level counterparts, RBCs</td>
<td>The NDRC and DRCs, meteorological agencies (MA), MWR and lower water authorities</td>
<td>Collaborating among the NDRC, MWR, MA and MEP; empowering RBCs and the MEP</td>
</tr>
<tr>
<td>Legislation assumptions</td>
<td>Assuming that the water system is stationary</td>
<td>Assuming that the water system is non-stationary and inherent with uncertainty</td>
<td>Bridging the assumption gap by reflecting IWRM and reducing uncertainties</td>
</tr>
<tr>
<td>Social status</td>
<td>Water problems are recognised as a core and urgent issue</td>
<td>Climate change is not a priority issue and is a long-term issue</td>
<td>Climate change is very likely to aggravate water problems and threaten water security, thus must be taken seriously</td>
</tr>
</tbody>
</table>
Both are crosscutting issues; close link with SD; share the same ultimate goal to achieve sustainable water development; a process rather than a one-shot approach; require information sharing and dissemination; participatory process and need stakeholder involvement; both need structural and non-structural approaches, good governance, social justice consideration and the engagement of woman…

Table 4.2: Distinctions and commons between the IWRM regime and water-centred adaptation

As shown in Table 4.2, it is clear that IWRM and adaptation share much in common: (1) IWRM and water-centred 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; (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 synergising IWRM and adaptation in the same process. However, in addition to the great challenges to legal assumptions and institutional arrangements demonstrated in the previous part, they are also distinct in many aspects. Hence, it is vital to analyse whether and how these differences could be bridged or resolved.

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, it should be developed in a reflective discourse in order to adapt to the changing situation. Recently, 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 more urgent. Some leading Chinese water professionals have
acknowledged the limitation of stationarity which is based on historical records and
not considering climate change. They also accept that uncertainty is one of the most
challenging topics for water-related research and decision-making. Nevertheless, this
scientific understanding needs some time to be understood by water managers 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 recognised and integrated in IWRM, the gap
between them should be reduced to minimise the possibility of policy failure.
According to some scholars, both a ‘filling’ strategy and a ‘bridging’ strategy could be
employed to address this gap in the context of adaptation. To ‘fill’ the gap, more
research information and data should be input in the decision-making process. Earlier
in Part B 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. Their research outcomes and outputs should be refined and
translated properly to inform the decision-making process. On the other hand, water
managers should recognise 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 recognising the information
limits and decreasing the demand for information in decision-making process.

197 Fischman and Rountree, above n 67, 25.
198 Fischman and Rountree, above n 67, 27.
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 research 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 and respond to emerging information or knowledge; it is a promising approach to reduce the demand for information and create flexibility which is desirable for climate change adaptation;

(4) A risk management approach which is able to reduce risks, provide alternatives, distribute risks among societies and prepare for negative risks;

(5) A vulnerability-based approach which focuses on reducing climate exposure and human sensitivity as well as increasing adaptive capacity;

(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.

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200 Fischman and Rountree, above n 67, 30.
201 Aerts and Droogers, above n 72, 93.
202 Ford, above n 33, 11.
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.

2 Integrating an Integrated Thinking with Locality-based Actions

Part B of this chapter presented the institutional challenges posed by adaptation that favours localised initiatives to IWRM which prefer 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. 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. 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 the YRB which has very diverse natural, economic and social circumstances among different regions and provinces.

Research in Chapter 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 the Yangtze River require that water management strategies and measures must be based on certain contexts. At the same time, water-related decisions made at local levels

204 Pangare et al, above n 189, 48.
should be in-line with national frameworks and plans to achieve the broader river basin objectives.\textsuperscript{206}

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.\textsuperscript{207} 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 localised 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 YRB. This research 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 impacts such as flooding, changing precipitation and temperature are often regional, cutting across administrative borders. Furthermore, adapting to water-related climate change impacts is eventually managed by water authorities through existing water management regimes and frameworks. As concluded in Chapter 2, water resources in the YRB are apt to be managed at the basin level (both basin and sub-basin level). In that case, water-centred adaptation should keep pace with the same trend. In practice, in the CNCCP, climate change impacts are observed and assessed according to regions and river basins. For example, the Hai-Luan River basin is identified as the most vulnerable region to climate change,


\textsuperscript{207} Nicola Ranger and Su-Lin Garbett-Shiels, ‘How Can Decision-makers in Developing Countries Incorporate Uncertainty about Future Climate Risks into Existing Planning and Policymaking Processes?’ (Policy paper, Centre for Climate Change Economics and Policy, Grantham Research Institute on Climate Change and the Environment, 2011) 12.
followed by Huai River basin and Yellow River basin. Some scientific research and empirical study on climate change has been undertaken on regional, basin or tributary level. Just name a few examples: the scientific research on climate change impacts organised by China Meteorological Administration is based on regions; some scholars also have studied the climate change impacts on water resources in the Han River basin (the largest tributary of Yangtze River); the YRB (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.

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 together but also will be able to minimise 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 water management, both of them need to integrate a holistic thinking and local reality considerations.

3 Developing Collaborative Mechanisms between the Central and Local Governments

Part B discussed that the cooperation among central and local governments along the YRB is very weak in terms of resolving complicated water problems and minimising 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 ‘Yangtze Forum’ organised by the CWRC could play a significant role in bringing together various levels of government to

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discuss coordinated management of the YRB. The same requirement to establish an
effective central-local collaboration mechanism could also be found in adaptation,
which provides another opportunity for synergising with IWRM.

Climate change and adaptation are characterised by highly specialised 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. 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. 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.212

4 Understanding the Threats to Water Security Presented by Climate Change

Another concern of mainstreaming adaptation is how adaptation, which is not the priority of Yangtze 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 urbanisation, water problems such as water shortage, water pollution and uneven water distribution have been one of the urgent core issues of the Yangtze water managers. Their importance also has been widely recognised 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, Yangtze water managers never stop promoting sustainable water development. They have adopted and implemented IWRM 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 recognised climate change as a security issue.213 Although some policies and plans related to climate change adaptation (such as the CNCCP and the White Paper) have been promulgated in the past five years, adaptation practices have not progressed. As revealed in Chapter 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, Yangtze water managers have to realise 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. In addition, Yangtze 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 Yangtze water resources. 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, reduce vulnerability and enhance resilience of water ecosystem. For the YRB, where water crises have already been very severe, 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 ADB in helping China integrate adaptation considerations through policy and institutional development has promoted adaptation to the frontline. 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. 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.

5 Identifying the Potential of IWRM in Including Adaptation Considerations

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215 Moore, above n 214, 31-2.
Water resource management has traditionally been about understanding and assessing risks and uncertainties that hydrological cycles brings and designing robust responses to them.\textsuperscript{218} The constant change in economic circumstances and social priorities also catalyse approaches of water resources management to evolve to meet these challenges.\textsuperscript{219} 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 arrangements 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 practices to evolve to adapt 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.\textsuperscript{220} The environmental criteria and the participatory process it values also 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.\textsuperscript{221} Third, many of the principles or ideas underlying the process of IWRM planning and implementation lend themselves to effective adaptation planning and implementation.\textsuperscript{222} For example, the inter-sectoral and inter-institutional cooperation based on river basin level IWRM 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.

\textsuperscript{220} Beek, above n 59, 72-3.
\textsuperscript{221} Aerts and Droogers, above n 72, 93.
\textsuperscript{222} Bruch and Troell, above n 218, 831.
As a result, IWRM is assumed and believed by many organisations 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.223 It recognised 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 paradigm.224 The Global Water Partnership (GWP) suggests that IWRM provides the best approach to manage water-related climate change impacts.225 Some other water-focused organisations also identified IWRM as one of the mechanisms to mainstream climate change adaptation within water resources planning.226 In China, by underscoring the implementation of the strictest water resources management (SWRM), Chinese water managers acknowledge the importance of IWRM for addressing climate change impacts.227 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.’228

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227 Phukan and Tomar, above n 192, 137.
228 Aerts and Droogers, above n 72, 92.
to develop continuously to be more adaptive and robust to the changing climate. The following chapters will analyse how IWRM-related legal and institutional frameworks could be developed to integrate adaptation considerations in order to adapt to the changing climate.

D Conclusion

Against the increasing climate change impacts on Yangtze 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 frameworks. It will be a very promising and cost-effective approach for Yangtze 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 the possibility of synergising them is very high. Current IWRM legislation and institutional arrangements theoretically base on a stationarity assumption, a holistic thinking and integrated approach, while climate change adaptation entails an uncertainty assumption, bottom-up approaches and localised responses. On the surface, it is difficult to mainstream adaptation within IWRM related legal and institutional framework due to the gaps identified between 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 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 for 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 realities. 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 harbour a holistic mentality to avoid maladaptations for other scales and regions in order to achieve policy consistency and benefit optimisation. For the YRB, 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 water resources 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 Yangtze 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 Yangtze water managers, the first step would be to understand and recognise the need of mainstreaming adaptation in the improved IWRM framework. Chapter 2 has given some feasible recommendations on improving Yangtze IWRM from a legal and institutional perspective. If adaptation could be fully considered while taking these recommendations, IWRM could minimise climatic risks, reduce the vulnerability to changes and improve the water management effectiveness in the YRB.
Literature reviews show 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 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 technology, but also could significantly influence the strategies of adaptation, the functioning of government institutions and the behaviour 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 frameworks in Chapter 3 shows that they are very weak in coping with uncertainties associated with climate change. They are 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 analysed the challenges to the water-related legislation and institutional arrangements presented by climate change adaptation, as well as the possibility of mainstreaming adaptation in the IWRM. The

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\(^4\) Jan McDonald, ‘Creating Legislative Frameworks for Adaptation’ in Jean Palutikof et al. (eds), Climate Adaptation Futures (John Wiley and Sons, 2013) 127.
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 be reflected in legal and institutional frameworks regulating water allocation, utilisation 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. In turn, this could shape people’s behaviour. Different legal assumptions could produce different legal values, objectives, requirements and approaches. The dead ‘stationarity’ and pervasive ‘uncertainty’, analysed 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. 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 basing on the ecological sustainable development (ESD) principle. The application of the ESD principle in the court requires both government and business to consider climate change factors in their actions.

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6 Interview with interviewee 6, member of the Research Centre for Climate Change, the Ministry of Water Resources, China (email interview, 24 May 2013).
Legal principles are significant to provide guidelines for 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 regulatory framework. In addition, simply realising and recognising 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 regulatory requirements. The principles of environmental laws relating to sustainable development could serve this purpose. They could help to set the objectives and mechanisms of adaptation-related laws, identify adaptation methods and complement implementation when specific legislation is absent. Some of the principles analysed in this part are fundamental for water management, such as the principle of sustainable development (PSD), the precautionary principle (PP) and the principle of public participation (PPP). However, the 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 Yangtze water management practices. Part A, B and C will mainly focus on the PSD, PP and PPP to understand the challenges and development in the context of climate change adaptation.

In addition to these well-recognised principles, Part D of this chapter proposes that social justice should be regarded as another important legal principle when addressing water-related adaptation issues, due to the strong social dimensions of adaptation. Lastly, based on the institutional challenges identified in Chapter 4, Part E will provide recommendations on the improving the adaptive capacity of water-related institutional arrangements.

A Re-thinking the Principle of Sustainable Development

1 The Principle of Sustainable Development in the Context of Climate Change Adaptation

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8 Ke Jian, He Xiangbai, above n 5.
9 Ke Jian, He Xiangbai, above n 5.
Part A of Chapter 4 analysed the nexus between climate change adaptation and sustainable development (SD) and concluded that the principle of SD (PSD) should be implemented in order to mainstream adaptation in the IWRM. However, in practice, the PSD has long been criticised for its ambiguous and rhetoric description which does not provide applicable and practical guidelines.\textsuperscript{10} Other critics argue that, originated during severe environmental crises, the PSD has a strong bias in favour of environmental (ecological) SD.\textsuperscript{11} The social aspects of SD, on the other hand, have been overlooked. Furthermore, the dominant development paradigm tends to target predictable environmental problems without considering the complex risks and challenges to SD. Adapting to climate change impacts and risks requires further developments in the understanding and applications of the PSD. This is also the first step to effectively mainstream adaptation in the IWRM regime. While climate change poses new challenges to China’s SD practice, it also provides an opportunity and impetus to reflect the conception and understanding of SD and to ‘revisit some long-standing problems of environment and development in an innovative way.’\textsuperscript{12} This research will review the following three misinterpretations of SD and the PSD in China in an adaptation context.

First, the PSD 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, large project developers are making efforts to improve the efficiency of natural resource utilisation to mitigate 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 emphasise the symptoms of environmental degradation rather than the underlying driving factors of these environmental problems.\textsuperscript{13} China’s current efforts in adapting to climate change impacts provide examples. Most

\textsuperscript{11} Ibid.
\textsuperscript{13} John Drexhage and Deborah Murphy, ‘Sustainable Development: From Brundtland to Rio 2012’ (Background Paper, United Nation Secretary-General’s High-level Panel on Global Sustainability, 2012) 13.
strategies and actions focus on adapting to climate change impacts, such as extreme events in the YRB, without examining underlying factors relating to vulnerability, which usually results from ecological, economic and social disadvantage.

Second, the perception and application of the PSD focuses on development outcomes, without giving adequate attention to development paradigms that have more focuses on the development process. Sustainability is more truly described as the ability to ‘tolerate and overcome damage, diminished productivity and reduced quality of life from an extreme event without significant outside assistance.’ 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 SD in the context of climate change adaptation.

Third, although there is general agreement that the PSD 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 been manipulated to serve traditional, unsustainable economic development. According to the objectives of the 1989 Environmental Protection Law (EPL),

this law is formulated for the purpose of protecting and improving people's environment and the ecological environment, preventing and controlling pollution and other public hazards, safeguarding human health; and facilitating the development of socialist modernization.

In the same law, it also requires that

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the state shall adopt economic and technological policies and measures favourable to environmental protection so as to coordinate the work of environmental protection with economic construction and social development.  

This utilitarianism in interpreting environmental protection too often ends up with giving way to the economic development when enforcing environmental laws. 

Based on a dichotomy – progress or backwardness, economic growth is overwhelmingly assumed as the best way to solve poverty, to bring employment and improved welfare and to protect the environment. In other words, economic growth has been treated as tantamount to SD in China. 

For example, the gross national product (GDP), personal incomes, industrialisation, technology advance and the employment rate have long been served as the criterion of development. 

However, recently, this assumption has been severely questioned and criticised 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. 

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. 

For example, 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.\textsuperscript{22}

As the two core interests of China (economic development and social stability), continuous economic prosperity is assumed as fundamental to maintaining social stability.\textsuperscript{23} 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 SD.\textsuperscript{24} It does not automatically enable a high quality society and the realisation of human freedom – other aspects of SD deserve equal attention as well.\textsuperscript{25} 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 SD 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 synchronised 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 recognised. The ignorance of social SD 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 SD also leads to less development in the procedural justice, such as public participation, access to information and the judicial system. Although it mainly derives from the long history of feudal dynastic system – an embedded cultural and traditional inertia one would argue,\textsuperscript{26} the selective ignorance coming from current political and legal system aggravate the backward procedural development.

\textsuperscript{22} Ibid.
\textsuperscript{26} Yuchao Zhu, ““Performance Legitimacy” and China’s Political Adaptation Strategy” (2011) 16 \textit{Journal of Chinese Political Science} 123, 129.
According to Sen’s argument, political freedom, economic facilities, social opportunities, transparent guarantees and protective security are five distinct, but interconnected, types of freedom. For instance, political freedom and social opportunities could promote economic development and participation. Similarly, backward social development undermines the ability to achieve economic and environmental sustainable development 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. SD, in the context of climate change, requires that this unsustainable social development must be resolved to eliminate the economic and environmental inequity.

2 Applying the Principle of Sustainable Development in the Adaptation Mainstreaming Process

Considering the PSD in regards to climate change impacts raises an inevitable dilemma. Climate change adaptation should be an integrated part of SD, but it also constitutes a threat and challenge to SD that needs to be dealt with in the mainstreaming process.

PSD 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. Climate change could provide an experiment to evaluate SD: whether climate change impacts are properly managed or not could be used as a lens or criterion to assess the sustainability of water management strategies. SD should also be the objective and guiding principle for taking adaptive measures in water management. It is important to acknowledge that, as a conceptual principle and a widely acknowledged objective of environmental decision-making, there is no fixed metrics to measure SD – it is a dynamic developing process. A sustainable status for one region or sector in a specific time may be unsustainable for another region or sector.

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27 Sen, above n 25, 38.
28 Sen, above n 25, 11.
The evaluative criteria for SD must be tailored to specific situations and also constant revised and improved to reflect developing economic, social and cultural conditions.\textsuperscript{30} There is a clear urgency for further development and experimentation of the PSD in the mainstreaming process. In this thesis, the following aspects will be identified while mainstreaming adaptation considerations towards the SD of Yangtze water management:

First, Yangtze water management activities should be able to help reduce water-related climate change risks rather than increase risks. Too much of the so called ‘water development’ has been shown to increase people’s exposure to climate change hazards and add the vulnerability of the disadvantaged or marginal groups.\textsuperscript{31} For example, the rapid development of hydraulic projects has increased the vulnerability of ecosystems; the urbanisation process has reduced the resilience of agriculture due to the loss of skilful farmers; fast economic growth has led to severe environmental problems, increasing inequality and social conflicts.\textsuperscript{32} All these development trends are examples of climate change maladaptation that could increase risks.

Second, a successful mainstreaming process in the water sector 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. This aspect will be analysed in detail in Part D of this chapter.

Chinese water managers need to take SD out of the economy ‘box’, or even the environment ‘box’, and consider wider social agendas.\textsuperscript{33} Current social inequity and injustice must be minimised. Reducing inequity means coming closer to promoting intra-generational and inter-generational equity which is at the heart of SD. Furthermore, besides economic wealth, information and knowledge, technology and infrastructure, all of which could determine adaptive capacity, social capital also plays

\textsuperscript{30}陆益龙[Lu Yinglong], above n 19, 52.
\textsuperscript{32} Cannon and Müller-Mahn, above n 18, 624-5.
\textsuperscript{33} Drexhage and Murphy, above n 13, 20.
a crucial role. If China employs a comprehensive method to facilitate the social aspects of SD (such as promoting democratic processes, reducing social injustice, facilitating information access and public participation, and recognising basic rights such as the freedom to organise), the adaptive capacity will be improved in a more balanced and sustainable way. In addition, new metrics comprising social factors and adaptive capacity should bring forward integrated SD.

Lastly, based on above reflection, flexible and resilient water management mechanisms should be designed to cope with different climate change scenarios, risk identification, management, monitoring and adaptation through robust decision-making with the support of the government, the private sector and civil society.

### B Institutionalising the Precautionary Principle

In some countries, the PP is regarded as part of a suite of principles of SD. For example, Australia lists it as one of the sub-principles of the ESD. By contrast, in Chinese research literature, it is a different principle parallel with the PSD. After recognising the limitations of scientific and technical information, the PP was formed in order to promote regulatory actions to prevent the threat of environmental harm, even in circumstances of lack of full knowledge. This concept received particular legislative, judicial and scholarly attention after its birth, both at the international level and domestic level, due to its challenges to traditional regulatory thinking. It signals a different paradigm to resolve the gap or tension involved in translating scientific knowledge to policy or decision-making. Nevertheless, it does not represent a

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39 Santillo et al., above n 37, 941.
decrease of the role of scientific research. On the contrary, it requires an improvement in scientific understanding in order to provide the best available knowledge. The unquantifiable risk of irreversible consequences of climate change is so great that it may destabilise both society and ecosystems, and lead to unacceptable permanent consequences. Therefore, a changing climate provides the right place where a far more precautionary approach should be adopted.

1 Understanding the Precautionary Principle in the Context of Climate Change Adaptation

The PP has experienced great development since its transition from German environmental policy to international instrument dealing with marine environmental pollution. It is generally recognised that the 1987 Second International Conference on the Protection of the North Sea for the first time adopted the PP formally in the international setting. However, it was not until 1992 at the Rio Conference where the PP was recognised and accepted widely around the world. The definition given in the Rio Declaration on Environment and Development (Rio Declaration) has gained the most popularity. Principle 15 of Rio Declaration states that the precautionary approach shall be widely applied by States according to their capacity. 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. By adopting the term ‘precautionary approach’ rather than ‘precautionary principle’ and the adjective term ‘cost-effective’, Rio Declaration expressed a very weak version of the PP (The Weak Precautionary Principle). Nonetheless, as a principle of customary international

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41 Peel, above n 36, 12.
law, 45 this weak version could provide significant incentives, guidance and requirements for its implementation in domestic environmental policies and laws.

Realising the urgency of acting on climate change, the United Nations Framework Convention on Climate Change (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.46

The PP has been used to persuade decision makers to undertake precautionary measures regardless of the scientific uncertainty. With regard to adaptation, uncertainties are even more pervasive and variable.47 As earlier argued, they not only include scientific uncertainty – the underlying science of climate change, such as the causality, timing and probability, but also contain epistemological and ethical uncertainties – uncertainties on 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. The key question here is when decision makers do not have full knowledge about who, when and how to take adaptation actions, whether the PP is still applied and how do we take precautionary actions.

This thesis 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. Thus, it is necessary to take proactive actions to adapt to unavoidable impacts. 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.

Second, there are always risks and costs on both sides of a decision: actions can bring risk, but so can inaction. 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. 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 favours cost-benefit risk reduction and management.

Fourth, as mentioned in Part A 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 minimise risks and adverse effects. Many risks and damage are preventable and manageable by undertaking proactive measures with today’s technology and knowledge. Policies and laws informed by

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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.\textsuperscript{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.

2 \textit{The Application of the Precautionary Principle in China}

Unfortunately, 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), the PP is absent from environmental legal framework and has not been widely recognised and adopted in related decision-making process. It has not been stipulated as a general principle by the 1989 EPL. Among other specific laws, only ‘Air Pollution Prevention and Control Law’ implies the PP in managing ozone layer depleting substances, but in very vague language.\textsuperscript{53} Although the PP is recognised by the UNFCCC at the international level, it is still absent in the recently drafted Climate Change Law.\textsuperscript{54} Existing legal framework generally focuses on regulating predictable environmental harm and behaviours to which prevention principle is applied.\textsuperscript{55} It does not pay particular attention to risks that are difficult to predict and quantify.

While the uncertainty and risks in the water management area have been increasingly recognised by water managers, there is an urgent need to incorporate the PP in water-

\textsuperscript{52} Jan McDonald, ‘Mapping the Legal Landscape of Climate Change Adaptation’ in Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), \textit{Adaptation to Climate Change: Law and Policy} (Federation Press, 2010) 31-2.

\textsuperscript{53} 《大气污染防治法》[Air Pollution Prevention and Control Law] (People’s Republic of China) National People’s Congress, Order 32, 29 April 2000, art 45.

\textsuperscript{54} ClimaXiMi, ClimaXiMi’s Legal Comments on ‘Climate Change Law of the People’s Republic of China’ (26 May 2012) <http://www.climaxmi.org>.

related laws. Climate change uncertainties exaggerate this need to take precautionary measures while managing water resources. China has joined the ‘Rio Declaration’ and the UNFCCC, which implies that proposals for adopting precautionary approaches in these two international frameworks should guide and influence China’s domestic legal framework. In that case, how to incorporate the PP in the existing legal framework, and how to make decisions in the face of climate change uncertainty, will be one of the most challenging tasks for Chinese decision makers.

Based on different legal systems and judiciary tradition, the adoption and implementation of the PP could take several forms: (1) a legally non-binding principle; (2) a legally binding principle; (3) a statutory requirement. Both (2) and (3) require that the PP must be taken into account by decision makers. In some cases, it even should be applied directly or implicitly in judicial decisions. For example, Australia not only endorsed the PP in its environmental policy, but also incorporated it in numerous environmental statutes, both at the federal and the state level. The application of the PP by the Australian judiciary has provided great opportunity to develop its meaning and requirements. It has presented a myriad of answers on how the PP should be interpreted and applied, with its vague language and the context of scientific uncertainty.

From a long-term view, China’s legal system should stipulate the PP as a legally binding principle to regulate decision-making under circumstances of significant scientific uncertainty. Nevertheless, given the judicial system in China, where environmental litigation is underdeveloped and the environmental principles are not applied in judicial decisions, placing the PP as a guiding principle of making decisions would be more politically and legally practicable. It would at least urge Chinese decision makers to shift their entrenched paradigms and adopt precautionary measures in order to prevent possible irreversible damage.

3 Applying the Precautionary Principle in the Adaptation Mainstreaming Process

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56 See, e.g. Intergovernmental Agreement on the Environment (1992) s 3.5
57 See, e.g. Environment Protection and Biodiversity Conservation Act 1999 (Cth) s 391 (3).
58 Peel, above n 36, 14.
59 Peel, above n 36, 25.
To some extent, mainstreaming adaptation in Yangtze 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 a guiding principle, the PP could be approached from both substantive and procedural perspectives. Substantive incorporation 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. This approach is vital, but also has been proved very difficult, mainly because of the inherent problem in setting up quantitative standards. It has been submitted that the focus should be switched from outcomes to the decision-making process in which precautionary concerns are taken into account from the very beginning. This procedural approach to the PP application in the mainstreaming process requires clarifying the factors and tools that could contribute to risk identification, prevention and reduction in the face of uncertainties. 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. According to this proportionality principle, precautionary measures against uncertain climate change risks should be proportionate and reasonable for the objectives to be achieved. Cost-benefit analysis and the prioritisation of no (low) regrets measures are highly recommended in this thesis to balance risks and benefits of undertaking precautionary actions.

Based on above analysis, this thesis proposes that following factors and instruments to be considered and implemented while applying the PP:

1. 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.

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60 Peel, above n 36, 24.
61 Peng Feng, above n 55, 27.
62 Peng Feng, above n 55, 27.
63 Peng Feng, above n 55, 27.
(2) Identifying the possible actions (options) to address risks, and assessing the potential consequences (both the benefits and threats) of these actions or inaction

Alternatives should be provided to assess and compare their likely social and economic consequences. Issues such as who benefit from these decisions, and who loses, should be identified. Particular attention should be paid to those vulnerable or marginal communities and groups whose interests are easily ignored.

(3) Enhancing the capacity of monitoring and early warning

Monitoring and early warning are important to minimise and prepare for adverse impacts of climatic surprises by timely detection of an occurrence of possible large-scale instabilities in the climate system.

(4) Employing instruments such as risk management, adaptive management and environmental impacts assessment (how adaptive management and environmental impacts assessment are conducted in the mainstreaming process will be analysed in Chapter 6) to assess possible risks and take mitigation measures.

(5) Engaging with broader public in the decision-making process

Public participation is an integral part of implementing the PP because of the need for decision makers to balance value judgement when assessing different types of risks. There is usually a political, cultural and social dimension of what risks are ‘acceptable’ or ‘unacceptable’. The input of public perspectives and information on climate change risks in the decision-making process not only could benefit the evaluation of uncertainties associated with climate change adaptation, but also could provide decision outcomes with legitimacy. More importantly, if they are engaged in the assessment of risks and decision-making, their knowledge, views and experiences could help to deliver decisions that are more resilient.

(6) Adopting cost-benefit analysis and no-regrets (low-regrets) strategies

64 Lee Godden and Jacqueline Peel, Environmental Law – Science, Policy and Regulatory Dimensions (Oxford University Press, 2010) 266.
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.  

Nevertheless, the commitment to a proactive decision-making approach does not necessarily ensure that adequate precautionary actions are taken. Due to lack of binding provisions, the PP is very likely ignored by water managers. 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, empowering stakeholders, non-governmental organisations (NGOs) and the public could be helpful in asking decision makers to justify their decisions regarding the possibility of significant risks involving irreversible impacts.

C Advancing Public Participation

IWRM recognises 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 PSD and PP analysed earlier in this chapter clearly entail a much more effective PPP to bring pressure for decision makers who are very likely postpone actions due to the non-binding legal positions of these principles and the uncertainty associated with climate change. However, according to Chapter 2, public participation has not been effectively institutionalised and implemented in Yangtze 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.

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 – from an ‘object’ role to a ‘subject’ role. 66 Compared to the ‘object’ role, where the public are 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 the 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. 67 Furthermore, this approach requires that the effectiveness of water-centred adaptation strategies be judged according to the public’s own interests and values rather than the criteria set without their consent. It is the affected public who 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 categorised into eight types – from manipulation and therapy to inform, consultation and placation, and to partnership, delegated power and citizen control. 68 They present four different levels of public participation: passive participation, consultative mechanism, interactive

66 Sen, above n 25, 18-19.
processes and self-mobilisation.\textsuperscript{69} 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 analysed in Chapter 4, public participation in the Yangtze 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.\textsuperscript{70}

Shifting the public’s role in the mainstreaming process requires going beyond this ‘consultative’ approach of organising 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’.\textsuperscript{71} This corresponds to the requirements of a risk society to open its decision-making structures, which has been analysed in Chapter 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 SD. A myriad of research literature has provided recommendations to promote public participation, mainly through improving laws and regulations to provide an institutionalised public participation mechanism, reforming

\textsuperscript{69} Michael Pimbert and Jules Pretty, ‘Parks, People and Professionals: Putting “Participation” into Protected Area Management’ in Krishna Ghimire and Michael Pimbert (eds), \textit{Social Change and Conservation} (Earthscan, 1996) 297, 309-10.
\textsuperscript{71} Arnstein, above n 68, 216.
judicial systems to include public interest suits, disclosing information, loosening control on NGOs and raising public awareness. 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.

2 Improving the Public Access to Climate Change Information

The significance of public access to information for effective public participation has been recognised 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. 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. 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,’ 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.

(a) Assessing the Regulations and Practices of Water-related Information Disclosure


Ibid 57-8.

There has been growing citizenry demand for access to environmental information in China in the past decade.\textsuperscript{76} Two methods could be used by the public 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 the 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 governments. 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 what to share, how to share, and with whom.\textsuperscript{77} The following part will analyse the regulatory framework and practice on water-related information disclosure, mainly to assess their effectiveness and capacity in satisfying people’s information demand.

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’.\textsuperscript{78} ‘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 that related to state secrets, business secrets, or personal privacy.\textsuperscript{79} 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.\textsuperscript{80}


\textsuperscript{78} 董文慧, 李海玲, 《中华人民共和国水法》[Water Law of People’s Republic of China] (People’s Republic of China) National People’s Congress, Order No 61, 29 August 2002, art 16.


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. 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.

After 5 years’ enforcement, the information published on the websites of water and environment authorities has increased greatly, ranging from legislation to government conferences. The information access by 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. 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.

Nonetheless, the information disclosure mechanism in China is criticised as ‘hidden with half face’ and far from the public’s real information demand. After analysing relevant legal provisions, this research reveals three main factors relating to these limitations:

(1) There is limited scope of information disclosure.

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81 Environmental Information Disclosure Methods (People’s Republic of China) the State Environmental Protection Administration, Order No 35, 8 February 2007.
82 Environmental Information Disclosure Methods (People’s Republic of China) the State Environmental Protection Administration, Order No 35, 8 February 2007, art 4, 5.
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. 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.

(2) 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’; the other one is ‘information disclosure should not harm national security, public security, economic security and social stability’. 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.

(3) The information disclosure is government-centred rather than user-centred, without tailoring to the user requirements.

Water-related authorities prefer to publish information that is produced by technology, that they are confident in or 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.

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86 《环境信息公开办法》[Environmental Information Disclosure Methods] (People’s Republic of China) the State Environmental Protection Administration, Order No 35, 8 February 2007, art 11.
87 《环境信息公开办法》[Environmental Information Disclosure Methods] (People’s Republic of China) the State Environmental Protection Administration, Order No 35, 8 February 2007, art 12.
88 《环境信息公开办法》[Environmental Information Disclosure Methods] (People’s Republic of China) the State Environmental Protection Administration, Order No 35, 8 February 2007, art 10.
and the scales required for the affected people (they are often concerned with site-specific and more immediate information) to take specific decisions.\textsuperscript{90}

Further, the information provided to the public is required to be systematic and consistent. Unfortunately, the existing fragmented management regime of Yangtze water resources determines that the information collection is fragmented and information coordination is inadequate. Information collectors (mainly water-related authorities) 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 institutionalised information division and cooperation mechanism has not been established.\textsuperscript{91} 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.\textsuperscript{92} By distributing the responsibility of coordinating different sources of information to local governments, it seems that this provision recognises the inconsistency of information provided by various water-related authorities. Nonetheless, the following provision weakens this assumption because it only emphasises the role of water authorities and river basin commissions (RBCs) in dynamic monitoring of water resources.\textsuperscript{93} 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 authorised hydrological organisations’, which permits total control over the release of...
independent assessments and monitoring. The expression ‘relevant government departments or authorised hydrological organisation’ 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.

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’. In addition, the public are viewed as being ignorant and lacking capacity to understand while the governments are ‘omniscient and omnipotent’. Decades of highly centralised governance also determines that Chinese leaders are reluctant to disseminate information and open decision-making processes to the public, for fear of causing chaos and undermining its ability in managing conflicts and divergence.

\(b\) \textit{Recommendations for Improving the Access to Information in the Climate Change Context}

Climate change is characterised 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. Adequate information also helps the public undertake proactive adaptation measures to minimise 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


\(^{95}\) Wu, above n 85, 292.


\(^{97}\) Interview with interviewee 5, member of the Development and Reform Commission at the county level, Jiangsu Province, China (online interview, 22 May 2012).

conducive to distributing different levels of risks. In view of the above understanding and assessment of the regulatory framework on water-related information disclosure, progressive measures should be taken to facilitate public access to information on water resources and 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. 99 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 recognised as a human right. 100 As an integral part of an environmental right, the right to know should be recognised as a human right issue as well. 101 Such an important and fundamental right is assumed to be protected by environmental laws. 102 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 existing in the current information disclosure system. Although the RDGI stipulates that citizens and organisations could apply for

102 Elizabeth Swanson and Elaine Hughes, The Price of Pollution: Environmental Litigation in Canada (Environmental Law Centre, 1990) 205.
administrative reconsideration or file an administrative suit,\textsuperscript{103} 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. Even if the right to know has not been unanimously accepted as a principle of customary international law, which could bind all nations, it is emerging as so.\textsuperscript{104} Therefore, Chinese legislation should follow this trend by clearly defining the right to know, in order to effectively use climate information to adapt to uncertain water-related climate change impacts.

\textit{Second, incorporating climate change-related information in the legal framework and clarifying limitations}

Climate change is primarily recognised 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 categorised 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 thesis suggests that climate change-related information in water management should include, but not be limited to: (1) the specific water-related climate change impact (for example, more precipitation or more glaciers melting). Due to uncertainty, a range 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; and (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


\textsuperscript{104} Vlavianos, above n 101, 5.
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 utilising 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 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 transportation or agriculture water use. In most cases, they are affected by climate change simultaneously. For instance, the changing precipitation pattern in the YRB 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 localised nature of climate change impacts is hardest to predict 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 and their impacts on water availability.\textsuperscript{105} 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.\textsuperscript{106} 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.\textsuperscript{107} 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 behaviours, 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 the 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 socio-economic aspects.\textsuperscript{108} Only through intensive and effective information communication among these three parties could uncertainties be properly managed and robust decisions be made.

\textsuperscript{106} Ralph Lugon, ‘Climate Information Decision Making: Lessons Learned from Effective User-Provider Communication Schemes’ (Project Report, the Graduate Institute, Geneva Centre for International Governance, 2010) 5.
\textsuperscript{107} Srinivasan1, Rafisura and Subbiah1, above n 89, 6.
In the past decades, some environmental NGOs have actively devoted themselves to environmental 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, safeguarding environmental rights and promoting sustainable development.\textsuperscript{109} They have made great progress in influencing environmental policy-making and presenting themselves as stakeholders in order to promote transparency in water management.\textsuperscript{110} In some cases, the involvement of NGOs has delayed a few large hydraulic projects from degrading the water ecosystem.\textsuperscript{111} 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.\textsuperscript{112} 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.\textsuperscript{113}

Unfortunately, most NGOs struggle with strict registration procedures, financial requirements for registration and political control in China.\textsuperscript{114} For example, a national civil organisation must have no less than Yuan 100 000 (around US$16 000) for registration, which is very difficult for most non-profit environmental organisations. 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 and the general public need most is a loose legal control on NGO

\textsuperscript{111} Ibid 179.
\textsuperscript{112} Ibid 177.
\textsuperscript{113} Ibid 179.
registration, a transparent information publication and a supportive enabling environment.

Recent amendments to some of related laws show a very controversial picture and uncertain future for NGO community. On the one hand, it is encouraging to notice that in the latest amendment of Civil Procedure Law, passed on August 2012, related authorities and organisations will be allowed to file public interest litigation against environmental pollution.115 On the other hand, it is frustrating to know that the second amendment of 1989 EPL limits the subject of a public interest suit to All-China Environment Foundation (sponsored and managed by the central government), ‘a surprising retrogress’ regarded by both the NGO community and environmental protection community.116 Fortunately, the criticisms from the environmental protection community were reflected in the third amendments of the EPL. The subject of the public interest suit was enlarged to include those national social organizations which were registered at the Ministry of Civil Affairs, have been engaged in environmental protection for at least five years in a row and have good credits. It shows that the Chinese government is very prudent about public interest litigation and it is very unlikely that NGOs will be granted with subject qualification quickly.

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.117 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.118 In this document, they appeal to

118 曹格丽, 姜彤 [Cao Geli and Jiang Tong], 《中国适应气候变化的政策、行动与进展》 [The Policy, Action and Progress of Climate Change Adaptation in China] in 王伟光, 郑国光 [Wang
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 behaviour and 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. 119 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. 120 Different from mitigation-oriented climate policy which involves much international negotiation and economic choice, adaptation strategies are more internal-development oriented. NGOs could play a greater role in delivering climate-proofing water management strategies and advancing the adaptive capacity of vulnerable communities.

Promoting NGO participation is also conducive 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 and practices greatly. 121 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 WWF, and a project titled ‘mainstreaming adaptation to climate change into water resources management and rural development’ initiated by the World Bank. 122 Their knowledge and experiences could present valuable insights for further water-centred adaptation in the YRB. It is also notable that many well-known NGOs have attracted

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121 Ibid.
many highly regarded experts to provide scientific-based comments and recommendations. These organisations, if entrusted with power and responsibility in the decision-making process, 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, minimising 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 having 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.

4 Developing Community-based Participation

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. Drawing on participatory approaches and methods developed in both disaster risk reduction and community development work, 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 marginalised communities, it prioritises 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.

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124 Hannah Reid et al., ‘Community-based Adaptation to Climate Change: An Overview’ in Holly Ashley and Angela Milligan (eds), Participatory Learning 60: Community-Based Adaptation to Climate Change (International Institute for Environment and Development, 2009) 11, 11.
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. Local communities in above affected area adopted diverse measures to manage disaster risks, reduce exposure and rebuild post-disaster life. 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 thesis argues that developing community-based participation in larger-scale decision-making process is crucial to fulfil above requirements.

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. Yet in most of the literature, the term ‘community’ is not defined and popularised, partly because of the less developed nature of civil society in China. There is still controversy on the definition of community. It could be defined and identified according to ethnicity, gender, age, administrative region and literacy. All these categories of community 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 while elderly people require better welfare system due to their fragile health condition. While realising their differences in adapting to climate change impacts, this thesis will define a community as an administrative unit, such as a

127 Ibid.
county, a town or a village, depending on the 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 mechanisation 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 localised social, institutional and economic factors.

Public participation in the Yangtze water management framework and practice is mainly discussed and undertaken at a macro-level or 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 marginalised 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, 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-centred 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 Yangtze water management, this research 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, 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. 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. For example, scientific models could provide guidance on the probability that precipitation will increase or

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131 Reid et al., above n 124, 16.
decrease and to what extent. However, the interests of the community must be considered and served while applying modern science and policy in the decision-making process. Having analysed that, proposals in this thesis to develop community-based participation when mainstreaming adaptation mainly involve:

1. Recognising the role of local knowledge and experiences in identifying local environmental changes and adapting to adverse impacts

This could be achieved 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.

2. Increasing communities’ awareness and understanding of climate change-related risks, vulnerability and the causes (drivers) and effects (consequences) of climate change impacts, for example, the risks of flooding and their impacts on local livelihood

This could be realised through education, training courses and related public forums. Scientific knowledge and information disseminated to communities should be easily accessible, understandable and free of charge.

3. Making use of local institutions and organisations to collect voices and interests, such as township government, village committee, local leadership and the Water Users Association (WUA)

While some argue that the WUA has played a great role in coordinating water delivery and improving water use efficiency among different water users, others disagree by illustrating its constraints and challenges in institutional alignment with existing local organisations. Being aware of divergent opinions on the WUA, this research will not go further to analyse its benefits and challenges. Instead, based on this observation, it

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suggests that any further initiative on community-based participation should consider local institutional settings and coordinate with different levels of institutions.

(4) Integrating community representatives to existing decision-making structures and institutions, such as the Changjiang Water Resources Commission (CWRC) and the Yangtze Forum

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.

D Integrating the Social Justice Concern

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).\textsuperscript{134} 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 – the initiatives should reduce vulnerability to climate change; efficiency – the benefits should outweigh the costs;

\textsuperscript{134} Jessica Ayers and Tim Forsyth, ‘Community-based Adaptation to Climate Change Strengthening Resilience through Development’ (2009) 51 (4) \textit{Environment} 1, 3.
and equity – distributional consequences should be taken into account.\textsuperscript{135} The first two criteria are widely employed to assess adaptation actions in light of their achievement and benefits/costs, whereas the equity criterion is very likely neglected. This part suggests that the equity and justice issues related to adaptation should be understood, identified and addressed by adaptation studies and practices. 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.\textsuperscript{136} In this research, Justice will be generally used as a broad and overarching concept dealing with all justice and equity concerns associated with adaptation.

Environmental justice has been used to deal with the different exposure of marginal groups or minorities to environmental stresses and risks.\textsuperscript{137} It is based on the premise that all people should be treated equally and involved meaningfully with respect to the development and implementation of environmental decisions, regardless of their race, income and nationality.\textsuperscript{138} Vulnerable populations should not bear a disproportionate share of adverse environmental impacts of public and private actions.\textsuperscript{139} Climate change provides a good framework for practical illustration of the divergent environmental justice debates between different countries and between different communities.

The justice implication on climate change has been underlying international negotiations for decades, especially in the fair sharing of the mitigation burden and in distributing the responsibilities of developed countries to assist developing countries in adapting to the changing climate (such as finance, technology transfer and insurance).\textsuperscript{140} The argument that anthropogenic climate change is caused predominantly by the GHG emissions of developed countries (they are also benefiting


\textsuperscript{137} Ibid 197.


\textsuperscript{139} Ibid.

from GHG emissions) whereas developing countries are suffering the impacts of climate change disproportionately is the major starting point of the justice debate at the international community.\textsuperscript{141} As a result, social equity and justice was declared as a principle in the 1992 Rio Declaration and 2002 New Delhi Declaration.\textsuperscript{142} 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.\textsuperscript{143}

Downscaling to the domestic level, the argument between developed countries and developing countries also extends to adaptation in the YRB, where different streams and reaches 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. This part will analyse the application of social justice on adaptation, and how to integrate it in the mainstreaming process.

1 Analysing the Social Justice Implication of Climate Change Adaptation in the Yangtze River Basin

Rawls supposes that in a well-ordered society, reasonable citizens will agree on the principle of justice,\textsuperscript{144} according to which, social and economic inequity could only be arranged to be of the greatest benefit of the least-advantaged members of society.\textsuperscript{145}

Yet Chapter 3 concludes that most of the existing adaptation-related policies, legislation and institutional arrangements in China are deeply influenced by the mentality and paradigm in managing environmental and economic issues. This means they do not prioritise 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

\textsuperscript{144} John Rawls, The Theory of Justice (Harvard University Press, 1\textsuperscript{st} ed, 1971) 397.
\textsuperscript{145} Ibid 302.
social injustice’ both substantially and procedurally. 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 essential.

Literature shows that most of the social injustice implications in adaptation area mainly take place in two dimensions: spatial and demographic. For the former, while industrialisation and high concentration of population are major sources of GHG emissions, people in less developed remote areas are more often than not suffering more than their counterparts who emit the majority of GHG in developed areas. For instance, people living along the downstream of the Yangtze River emit the majority of GHG through their economic activities while the adverse climate change impacts are experienced more intensively and frequently in the less-developed upper stream.

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 marginalised by virtue of their social-economic status, age, gender or ethnicity. For example, in the YRB 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. Moreover, they have a relatively limited ability in influencing the decision-making process that may affect collective adaptation measures.

It is revealed 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

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148 Dzul Khaimi Khailani and Ranjith Perera, ‘Mainstreaming Disaster Resilience Attributes in Local Development Plans for the Adaptation to Climate Change Induced Flooding: A Study Based on the Local Plan of Shah Alam City, Malaysia’ (2013) 30 Land Use Policy 615, 615.
149 McDonald, above n 52, 13.
vulnerability in dealing with and absorbing adverse climate change impacts.\textsuperscript{151} 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 Yangtze stream, where the development is backward and many groups are marginalised. 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.\textsuperscript{152}

2 Towards a Framework of Justice for Mainstreaming Adaptation in Yangtze Water Management

After the Reform and Opening-up, China’s policy-making and legislation formulation has been guided by economic-oriented mentalities and policies, without giving adequate attention to social equity and justice.\textsuperscript{153} 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.\textsuperscript{154} For example, many water infrastructures or environmental conservation projects conducted in the upper Yangtze River are the drivers of poverty and social injustice because they are not accompanied by adequate economic development assistance, subsidies or long-term compensation payments.

\textsuperscript{151} Barry Smit and Olga Pilifosova, \textit{Adaptation to Climate Change in the Context of Sustainable Development and Equity} (Cambridge University Press, 2001) 877-912.
\textsuperscript{152} Kristin Dow, Roger E. Kasperson and Maria Bohn, ‘Exploring the Social Justice Implications of Adaptation and Vulnerability’ in Adger et al. (eds), \textit{Fairness in Adaptation to Climate Change} (MIT Press, 2006) 95.
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.\(^{155}\) 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.\(^{156}\) Starting with, and ending up, with efficiency,\(^{157}\) this marketisation contributes to improving the water use efficiency and reducing water pollution remarkably. However, it should also be made aware that aquatic degradation is driven partly by marketisation and social transition, thus it would be ineffective to completely rely on market mechanisms to address existing water problems.\(^{158}\) 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 maximise 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 maximising the economic value of water resources.\(^{159}\) 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.\(^{160}\) 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 rights, whose

\(^{155}\) See e.g. 李雪松[Li Xuesong]《中国水资源制度研究》[China Water Resource Management] (武汉大学出版社[Wuhan University Press], 2006).


\(^{157}\) 陆益龙[Lu Yinglong], above n 19, 207.

\(^{158}\) 陆益龙[Lu Yinglong], above n 19, 207.

\(^{159}\) Cao, Chen and Zhu, above n 154.

interests or what rights should be sacrificed? As stated earlier in this part, vulnerability could be a result of disadvantaged socio-economic status, but also could also 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. 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. 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 analysed 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. 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, realising social justice requires future policymaking, legal implementation and measures undertaken around mainstreaming to recognise people’s need, share benefits sharing as well as allocate risks and burdens appropriately. A standardised approach to assess the social impacts of decisions on

162 Paavola and Adger, above n 141, 2.
vulnerable populations would be significant to identify possible negative impacts and mitigation measures. Some developed countries such as America 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. 166 ‘Environment’ in their environmental acts is clearly defined to include the surroundings of man both as an individual and social group. 167 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. 168

Given the increasing social protests due to social injustice in China, 169 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 include 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 Yangtze 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 programmes 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-centred adaptation mechanisms or measures need to have dual-proposes: remediing historical injustice and preventing new injustices. For instance, due to inadequate ecological compensation in the YRB, developed downstream owns an

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168 Ibid 113-22.
169 朱力, 龙永红[Zhu Li, Long Yonghong], 《中国环境正义问题的凸显与调控》[Environmental Justice in China: Problems and Solutions] (2012) 49 (1) 南京大学学报（哲学·人文科学·社会科学）Journal of Nanjing University (Philosophy, Humanities and Social Science).
‘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. 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 using existing procedural rules which neglect vulnerable communities, but do not deliver just and equitable outcomes. Thus, when mainstreaming adaptation factors in Yangtze 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. Motivated by a variety of factors such as power, prosperity, long-term stability and durability for the governance regime, a ‘harmonious society’ slogan has been proposed by former President Hu’s group to resolve tensions over economic growth, social inequity and pollution in 2006. It was the first time in 25 years to focus on social issues rather than on economic or political development. It is believed that a ‘harmonious society’ should put people first and make all social activities beneficial to people’s subsistence. Although there are some critics of this...

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170 Paavola and Adger, above n 163, 594-609.
slogan, such as the unclear definition and misunderstanding of ‘harmonious’,\textsuperscript{176} and the utilitarianism of government’s focus,\textsuperscript{177} it no doubt will help to bring the concern of social justice to the frontline to be an emerging factor affecting decision-making process.

\textit{E Developing Robust Institutional Arrangements}

Effective institutions as the centre of vulnerability reduction are an integral part of high adaptive capacity.\textsuperscript{178} Institutional arrangements 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 the Yangtze water management, current institutional frameworks must be enhanced to deliver resilient and effective water management decisions and outcomes. Chapter 3 has assessed the capacity of the institutional arrangements on adaptation, and concludes that the marginal role of environmental authorities and the absence of institutionalised local governance hinder adaptation mainstreaming in the Yangtze water management practices. Chapter 4 has identified the institutional challenges to Yangtze IWRM 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 analysed and provided separately in Section C of this chapter. Thus, this following section will particularly focus on the roles of local governments, environmental authorities and CWRC in building a resilient institutional framework for mainstreaming adaptation in the IWRM.


\textsuperscript{178} Sietz, Boschütz and Klein, above n 2, 494.
Before providing detailed recommendations for institutional arrangements, it is important to understand that a resilient or robust institutional framework not only refers to the 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 analysing 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 organise; and (8) nested enterprises or polycentric governance.179 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.180

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-organisation and graduated sanctions.181 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.182 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 (organisational rules); and (2) how decisions are made (decision-making rules). There is no clear distinction between these two types of rules, but instead, different organisational structures could shape positions of different actors, the outcomes of the decision-making process and the effects of those outcomes.183 For example, whether responsibility allocation is clearly defined or

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181 Patrick Huntjens et al., ‘Institutional Design Propositions for the Governance of Adaptation to Climate Change in the Water Sector’ (2012) 22 *Global Environmental Change* 67, 68.
182 Ibid 70.
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 analyse 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 thesis emphasises following ones 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 authorities and CWRC towards a higher institutional adaptive capacity should be directed by these principles.

1 Increasing Local Government’s Role in Water-related Adaptation Issues

Both water management and adaptation are multi-level processes. According to the analysis of vertical institutional arrangements on Yangtze water management in Chapter 2, water management actions take place within a hierarchical structure by 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. 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 in the YRB. This question is of significance since it affects the understanding, explanation, implementation and assessment of adaptation.

measures.\textsuperscript{185} In order to improve local government’s role in reducing vulnerability and building adaptive capacity, this thesis proposes that at least the following measures should be taken:

\textit{(a) Clearly Defining the Boundaries of Local Governments in Managing Water-related Climate Change Impacts and Risks}

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 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.\textsuperscript{186} In addition to the distribution on 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, studies also show that 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.\textsuperscript{187} It must be emphasised that 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-centred 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.\textsuperscript{188} Some water-related adaptation issues in the YRB are best managed by provincial governments, while others are more appropriate to leave for the CWRC at the basin level. Chapter 4 has


\textsuperscript{186} Huntjens et al., above n 181, 70.

\textsuperscript{187} Huntjens et al., above n 181, 70.

\textsuperscript{188} Huntjens et al., above n 181, 75.
argued that adaptation mainstreaming plans 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 including 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 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 decentralisation, which influences the adaptation-related power and 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 characterised by the insufficient transfer of powers and resources to local government, under tight central-government oversight. 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, on issues that do not produce direct economic benefits, local governments are more likely to respond to the directives from a higher level of government rather than responding to local needs. Chapter 3 has revealed that most of the provincial climate change programs are negative responses to the central government, lacking of adequate internal 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 the criteria of assessing government officers’ performance rather than the implementation of higher directives. Moreover, they should also build higher capacity to understand and assess the costs and benefits of adaptation policies and actions.

Furthermore, provincial policies and plans should provide guidelines and assessment criteria for adaptation implementation at the city, county and township level. These

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lower levels of government should also be entrusted with power of taking adaptation initiatives according to their jurisdictions and capacity. In turn, the experiences and knowledge gained through adaptation actions at the lower levels should offer insights for provincial policy and plan formulation. Defining all-purpose indicators for successful adaptation at different levels of government is very complicated and contested due to specific contexts and requirements. Yet, at least equality, efficiency and justice criteria, which are widely recognised, should be employed to evaluate the effectiveness of adaptation at various levels.

(b) Promoting the Development of 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 YRB 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, adaptation initiatives should not be restrained by administrative borders. 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 YRB are experiencing droughts, another area 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 minimising 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 regulatory framework and political environment.\(^{190}\) 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.\(^{191}\) In the 1989 EPL, the 2002 Water Law and the ‘Water Pollution Prevention and Control Law’, environmental pollution prevention, 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.\(^{192}\)

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 thesis as a means to increase local government’s initiatives and capacity to adapt to climate change impacts.

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.\(^{193}\) This legal mechanism is premised on the constitutional equity among states and between states and the federal government.\(^{194}\) It has been recognised 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 popularised.

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\(^{194}\) Ibid 58-60.
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. 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’. Three provinces of Northeast China even have established cooperative legislation framework to provide a good legal environment for development. 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 regulatory framework. In addition, the absence of a dispute resolve mechanism in agreement impedes its effective implementation. 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

Recognising the difference between China and Australia, between the YRB and Murray Darling Basin (MDB), this research argues that the successful practices of employing intergovernmental agreements in the MDB could provide some insights for the YRB 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

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196 叶必丰[Ye Bifeng], above n 193, 61.
199 何渊[He Yuan], above n 195.
agreement. The Commonwealth was not given ‘express legislative power over this resource at federation but has the power and capacity to affect, directly and indirectly, water resources management through several of its legislative and financial powers.’

Before 2007, the federal government exercised its influence mainly by adopting policy guidelines, providing financial assistance and fostering interstate trade in water entitlements. However, due to increasing water disputes and the deteriorating aquatic environment in the basin, the commonwealth has recently stepped in to oversee a coordinated approach to manage the basin water resources for the national interest. 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.

It provides the process and substance for the integrated management of the MDB, including the institutional arrangements, financial support, responsibility distribution and dispute resolution. 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. In the 2007 Water Act, the main piece of legislation under which the Murray-Darling Basin Authority (MDBA, the successor of the Commission) operates,

202 Ibid.  
204 Water Act 2007 (Cth) schs 1(1).  
205 Water Act 2007 (Cth) schs 1.  

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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. 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’. Although there are still many difficulties with 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 is revealed that the effectiveness of the Basin Agreement in the MDB is mainly determined by: (1) its legal status in legislation; (2) the institutional arrangement 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. This partnership overcomes current local government’s low adaptive capacity in dealing with climate change challenges by fostering institutional cooperation and learning. This alliance enables local government to draw insights from local stakeholders to develop and assess adaptation options which are specific to

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207 Water Act 2007 (Cth) schs 1pt II(5).
209 South East Councils Climate Change Alliance (SECCA), SECCA: Local Governments in the South-East Responding to Climate Change <http://www.secca.org.au/about.asp>.
their local areas. 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 the YRB*

As Chapter 2 mentioned, the YRB has 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 Division project. This research 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 should be built and facilitated when there is a need for cooperation or negotiation.

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 thesis puts forward the following key messages to enable AA to play a greater role: (1) a regulatory 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’; (2) the mechanism ‘Joint Meeting of Administrative Chiefs’ should be institutionalised to provide organisational 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,

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211 Ibid.
212 叶必丰\[Ye Bifeng\], above n 193, 69.
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 organisation representing stakeholders and the public. Based on the social justice principle analysed 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. If these recommendations are put in place, AA will help local government to develop a higher capacity in addressing water adaptation issues as a legal mechanism.

2 Engaging Environmental Agencies in Water-related Adaptation Issues

In Chapter 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 recognised, 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 improve the MEP’s role in adaptation-related decision-making process, implementation and institutional arrangements.

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. \(^{213}\) Compared to the Congress and other agencies, the EPA has led the nation actively in taking mitigation and adaptation actions. \(^{214}\) It has contributed to climate change adaptation significantly through issuing adaptation-related policy statements, making


adaptation plans and implementing plans to integrate adaptation in its mission, operations, and programs. 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. 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, coordinating various agencies and influencing the decision-making process.

Compared to the EPA in the US, China’s MEP is not entrusted with sufficient substantive and procedural power in challenging economic decisions that may bring harms to the environment. This not only limits the 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. Addressing these above constraints will be crucial for the MEP to play a part in adaptation. Under this premise, and inspired by the EPA’s adaptation actions, this thesis puts forward the following propositions to engage the MEP in the water-centred adaptation mainstreaming process: (1) entrusting it with certain power to formulate environment-related adaptation policies or guidelines for water management; (2) entrusting it with the bargaining power 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) adequate access to climate change knowledge and information.

216 Ibid.
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.

3 Increasing the CWRC’s Institutional Adaptive Capacity

As the river basin commission of the YRB, the CWRC has the responsibility to assess the vulnerability and adaptive capacity of the Yangtze water resources, to identify the key entry points of mainstreaming adaptation and to implement adaptation-related water plans, strategies and actions. As a result, it generates greater requirements for the CWRC to increase its institutional capacity in undertaking adaptive water management measures and delivering resilient and sustainable outcomes. This part proposes three approaches to improve the CWRC’s awareness and capacity in addressing water-based adaptation issues.

Building institutional coordination and collaboration with other adaptation-related agencies

The CWRC 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 YRB. In the future, on the one hand, the CWRC 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 CWRC’s information requirements of decision-making to RCCC.

Improving knowledge and information communication by using forums and dialogues

The Third Yangtze Forum (YF) organised by the CWRC in 2009 discussed the climate change challenges to urban water security, and the Fourth YF in 2011 set ‘Climate Change and Water Resources’ as a sub-forum to assess climate change impacts on water resources and develop adaptive strategies. Yet there is still a big gap between research and decision-making. 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 the YF 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). 218 The absence of local NGOs, lower levels of government (mainly prefecture and county government), and stakeholders has made CWRC lose good chances to obtain local knowledge, information and experience in adapting to water-related climate change impacts. This research 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 CWRC or in the CWRC. 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. 219 As of 2004, 18 dialogues have been initiated throughout the world at

regional, national and basin level, including China’s Yellow River Basin. 220 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. 221 In practice, it has helped to formulate policies recommendations and inventory activities on water-based adaptation. 222 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. 223

This dialogue initiative could be introduced for the YRB to provide a platform for knowledge base development and information exchange between water communities and climate communities. It could be organised jointly by the CWRC 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. 224 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. 225 Compared to the YF, it gives much more focus on the water and climate change interaction, which could largely increase the awareness on water adaptation.

F Conclusion

220 Changming Liu, ‘Dialogue on Water and Climate in the Yellow River Basin (China)’ (Dialogue on Water and Climate, 2002).
222 Ibid 6.
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 PSD and PP are analysed and assessed, and conclusions drawn that they should be developed to incorporate adaptive objectives and to provide guidance and instructional support. The PSD 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 the PSD to establish resilience to uncertain climate change impacts. The PP should be given legal status 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 thesis concludes that placing the PP as a guiding principle of making decisions on adaptation mainstreaming would be more politically and legally practicable. With the PP as a guiding principle of mainstreaming process, decision makers need to clarify the factors and tools that could contribute to risk 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 research 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-centred information system, recognising the role of NGOs and developing community-based participation will be desirable for Yangtze 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 CWRC 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 PSD and PP, 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 recognised and communities are represented in the CWRC. In addition, whether the CWRC is regarded as a fledged river basin commission or not is largely determined by the adequacy of public representation and the implementation of institutionalised public participation procedures.

In a nutshell, there is not 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.
VI RECOMMENDATIONS ON MAINSTREAMING CLIMATE CHANGE ADAPTATION IN THE YANGTZE INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) – EXAMPLES OF THE KEY ENTRY POINTS

The previous Chapter 5 analysed 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 Yangtze water management plans, strategies and actions. This is the last question put forward in Chapter 1.

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 mainstreaming 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 sectoral 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 the above different levels of interventions in mainstreaming adaptation, this thesis argues that there are three hierarchical layers of entry points in the context of legal and institutional frameworks: (1) sectoral entry point: determine which sectors or resources are more vulnerable to climate change variability and make them the frontline of adaptation; (2) policy/plan entry point: for this sector or resources, determine which policy or plan could serve as the entry point of mainstreaming adaptation; and (3) implementation entry point: what are the adaptation factors and considerations that should be mainstreamed in the above policy or plan. These three layers of entry points are illustrated in the following table (Table 6.1).

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<table>
<thead>
<tr>
<th>Hierarchical entry points</th>
<th>Suitable entry points</th>
<th>Entry points in this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>First layer: which sectors are more vulnerable to climate change</td>
<td>Water resources, agriculture, terrestrial ecosystem, coastal ecosystem</td>
<td>Yangtze water resources</td>
</tr>
<tr>
<td>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 frameworks is a feasible tool to mainstream adaptation</td>
<td>(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; effectiveness and implementation monitoring; agencies collaboration; stakeholder consultation and public participation</td>
<td>(1) integrated water resources planning (both basin and sub-basin level) (2) EIA and SIA of water planning and project construction</td>
</tr>
<tr>
<td>Third layer: how to mainstream adaptation considerations in the above entry points</td>
<td>Developing and implementing water-related legal and institutional frameworks; assessing climate change impacts, vulnerability and adaptive capacity; integrating adaptation factors; adopting adaptive approaches</td>
<td>Integrating key adaptation factors in the steps of water planning, SIA and EIA in the context of legal and institutional frameworks</td>
</tr>
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**Table 6.1**: The three layers of entry points in adaptation mainstreaming analysis
This chapter identifies two entry points to illustrate how to mainstream adaptation factors in the Yangtze water management practices in detail: integrated water planning (Part A) and EIA (Part B), 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.

Water planning is the most significant tool of mainstreaming 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 the YRB 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 Yangtze water resources and the early stage of making individual plan and decision. They are currently the priorities of the Yangtze water management, which provides the best political and social environment for adaptation mainstreaming. This chapter will illustrate and analyse how these two entry points could operate, based on the enabling legal and institutional environment established in the previous chapter.

A  Key Entry Point 1: Adaptive Integrated Water Resources Planning and Implementation

Planning, by definition, is a forward-looking, anticipatory and preventative instrument to achieve sustainable development through translating visions into actions and
Development planning is the process of setting goals for social, economic and environmental development, and designing strategies to achieve these goals through the distribution and management of available resources. 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 regulatory decision-making. 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.

Generally, the 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); and (6) monitoring and evaluation (tracking progress and measuring the achievements of water plan implementation). 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-centred factors to be identified and

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6 UNDP-UNEP Poverty-Environment Facility, above n 1, 47.
7 OECD Environment-Development Task Team, above n 4, 165-6.
analysed 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 review of water plans in the YRB and its consideration of adaptation factors. Given the requirement for adaptation mainstreaming, the following section of this part will analyse the shift towards a more adaptive water management regime. The last section will focus on how various adaptation factors could be integrated in each planning step.

1 China’s Current 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. 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 utilisation 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. 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 also be applicable 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 speciality water planning. The former is about the strategic deployment of water resources exploration, utilisation 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 speciality planning, which should

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conform to the comprehensive planning. 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. Among the tributaries of the YRB, only the water planning of Tai Lake Basin is identified with national significance and 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. In this case, the attitudes and capacity of these water-planning authorities (the MWR and CWRC) towards climate change impacts, to a large extent, 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, the literature review 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 Report of the Yangtze River Basin Comprehensive Utilisation Planning’ formulated in 1990. For more than two decades, this planning has provided important rules for the overall allocation and arrangement of Yangtze water resources. However, it emphasised the development and utilisation of water and hydraulic resources with inadequate focus on water ecosystem conservation and protection. To reflect the new changes in water resources and economic-social development in the past twenty years, ‘The Integrated Yangtze River Basin Planning (2012-2030)’ was approved at the end of 2012 by the State Council, after five years of revision. Later, ‘The Integrated Tai Lake Basin Planning (2012-2030)’ was approved by the State Council

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as well in order to promote the basin’s water supply security, food security and ecosystem security.\textsuperscript{16}

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 of the YRB 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 Programme (CNCCP) was released, the conference on river basin planning revision identified some key points of climate change impacts for planning revision.\textsuperscript{17} It articulated the need to analyse 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 organised 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.\textsuperscript{18} 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.\textsuperscript{19} After analysing 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 utilisation planning and project planning.\textsuperscript{20}

Unfortunately, these discussions and concerns have not been reflected in the new basin and sub-basin plans, let alone those at lower levels. Although the above


\textsuperscript{19} 娇勇[Jiao Yong], above n 17.

\textsuperscript{20} 娇勇[Jiao Yong], above n 17.
illustrations show that the Yangtze water managers have recognised the climate change impacts on the river basin and the necessity to reflect them in water planning, the 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 emphasised 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. In addition, all of recommendations appear confined to theoretical suggestions such as ‘consideration’, without realising the need for the transformation of current water management regime through policies, legislation and institutional arrangements.

To effectively mainstream adaptation in the Yangtze IWRM planning, this thesis 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.

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21 Dzul Khaimi Khailani and Ranjith Perera, ‘Mainstreaming Disaster Resilience Attributes in Local Development Plans for the Adaptation to Climate Change Induced Flooding: A Study Based on the Local Plan of Shah Alam City, Malaysia’ (2013) 30 Land Use Policy 615, 616.
Based on a stationarity assumption, the current water management regime in China is characterised by a data collection, assessment-based predict-and-control approach as well as an emphasis on expensive engineering solutions to provide water security.\textsuperscript{22} Aiming to provide a strategic long-term vision (a decade or more) for water resources exploration, allocation and protection, water resources planning in the YRB relies upon a robust capacity to predict future scenarios and to assess the plan’s costs and benefits.\textsuperscript{23} Unfortunately, both the uncertain, nonlinear and complex climatic, hydrologic and social systems (such as population growth, industrial growth and demographic changes) challenge this water management regime by making long-term prediction problematic.\textsuperscript{24} 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.\textsuperscript{25} Thus, addressing climate change risks in a changing society will ultimately require managing water resources in such a way that it is able to adjust and manage changes rather than merely resorting to prediction.\textsuperscript{26}

Under this circumstance, the adaptive management theory developed in the ecology area (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.’\textsuperscript{27} By

\textsuperscript{25} Ibid 91.
\textsuperscript{26} Esther Conrad, ‘Climate Change and Integrated Regional Water Management in California: A Preliminary Assessment of Regional Approaches’ (Report, Department of Water Resources, California, 2012) 33.
incorporating the interaction of human behaviour with climate change, adaptive management could provide flexibility for the planning process to integrate new information and experience via experimentation, trial and error and the iterative learning process. It allows and assists water managers to act without complete knowledge and information, and to minimise 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. 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.\(^{30}\)

As a result, adaptive management has been advocated as the most promising approach to address uncertainties on the climate change arena.\(^{31}\)

In terms of the definition of adaptive management, this research will adopt the one given by Pahl-Wostl: ‘adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of implemented management strategies.’\(^{32}\) With an adaptive management approach, management actions are treated as experiments rather than as final solutions.\(^{33}\) It also has been regarded as a highly useful approach when addressing environmental problems (including climate change in this research) collaboratively.\(^{34}\) The main elements of adaptive management that are widely recognised are: (1) revisiting and revising objectives periodically; (2) integrating new conditions and information into future decisions; (3) developing a range of management options; (4) monitoring and evaluating management actions; (5) learning-by-doing; and (6) stakeholder


\(^{29}\) Conrad, above n 26, ix.


\(^{34}\) Ibid.
participation. It shows an active culture of reflection, evaluation, collaboration and openness to learn by acknowledging the uncertainty and complexity of social-ecological systems. In contrast to the traditional dominant front-end decision-making paradigm, which is heavily reliant on prediction, adaptive management is centred by revisiting, revaluation and iterative learning.

With respect to water resources management, adaptive management requires the development of a capacity to respond to changing water management scenarios, and the emerging information, experiences and insights. The incorporation and application of adaptive management in IWRM has been referred to as adaptive and integrated water management (AIWM) by some scholars. 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:

1. The 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.

2. The 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.

37 Patrick Huntjens, Claudia Pahl-Wostl and John Grin, ‘Climate Change Adaptation in European Basins’ (2011) 10 *Regional Environmental Change* 263, 263-84.
(3) The integration of the outcomes from monitoring and evaluation of Yangtze water planning and its implementation

Water planning makers and practitioners should monitor the implementation outcomes of planning to assess the extent to which the measures are having the intended effects (whether there are unintended effects and whether other factors are unexpectedly affecting the outcomes). Slightly different from monitoring, evaluation is about the assessment of how plans containing adaptation strategies are addressing these climate change impacts. Based on monitoring, evaluation attempts to answer how and why these measures are, or are not, achieving the goals. The periodic assessment generated from monitoring and evaluation should be used to identify whether further additional actions are necessary, or whether the current plan needs to be revised.

(4) The adoption of 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.38

Saavedra and Budd emphasise the importance of understanding the inherent resilience of a certain region and the enhancement of the resilience through stakeholder engagement.39 Inherent resilience, in relation to a climate change, is the natural capacity of people, communities and habitats to cope with and adapt to climate change impacts, especially disastrous events.40 The inherent resilience of a particular

community or group depends on their sensitivity and vulnerability to adverse impacts, the minimisation of their exposure to these impacts by physical or other means and the maximisation of adaptive capacity to face these impacts.\textsuperscript{41} The traditional and indigenous knowledge of local residents contributes an important part of inherent resilience. Nevertheless, this knowledge 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 recognised as a conceptually promising approach to manage water resources under climate change, AIWM could descend into ‘a vague promise of future adjustments without clear standards’.\textsuperscript{42} However, this difficulty should not be the pretext for discarding adaptive management. 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.\textsuperscript{43} 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 untenable 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.\textsuperscript{44} The traditional

\textsuperscript{43} Bruch, above n 24, 100.
mindset about legal and regulatory frameworks has been stability and certainty, 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.’\(^{45}\) There is also concern that the flexibility and unspecified standards of adaptive management would allow authorities to delay or avoid taking actions,\(^{46}\) especially given the political and social status of adaptation in China. A policy and legal transformation to practise a fully realised 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.\(^{47}\) This thesis 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 then be transformed from the conventional water management regime.

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 on the integration of adaptation considerations from the preliminary step


\(^{47}\) Ruhl and Fischman, above n 42, 427.
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 regulatory frameworks to conduct water investigation and assessment. According to their content, the analysis of precipitation, evaporation, water quantity, water quality and water availability are the main aspects of comprehensive water resources investigation and assessment.\(^{48}\) Climatic conditions have been considered as one of the factors affecting them, yet the incremental challenge from climate change has not been fully realised. It even deliberately excludes the analysis of climate change impacts by stipulating that ‘the impacts on water resources due to the change in temperature and precipitation effected by greenhouse gas will not be analysed’.\(^{49}\)

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 resources was not mature enough either. Ten years later, when the 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 resources 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 input climate change impacts in the water planning process, a ‘climate change adaptation lens’ should be applied to identify and assess adaptation considerations in each planning step.\(^ {50}\) 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


\(^{50}\) Lebel et al., above n 9, 8.
scenarios. Based on the basic steps of the water planning process, which were 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 (Figure 6.1). 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.51 Given the research scope of this paper, the mitigation of GHG in water planning will not be purposely investigated here. 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 so as to provide a better understanding of water resources. This may be done by providing a range of estimated results, or specifying a confidence level (in terms of the scientific uncertainty), for projected climate impacts.52 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 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

51 Conrad, above n 26, 6-7.
52 UNDP-UNEP Poverty-Environment Facility, above n 1, 44.
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 – in addition to the recognised 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 targeted goal in water planning: the analysis and selection of adaptation strategies should be put forward; institutional coordination should be facilitated to build consensus among different water-related authorities; stakeholder participation could offer
crucial knowledge and information in terms of managing uncertainties. Corresponding alternatives containing vulnerability reduction and adaptation strategies should be developed by planners to prepare for various climate scenarios. They are very important to achieve the same planning objectives in the context of climate change uncertainties. Not only can alternatives provide a comparison and evaluation among different methods achieving the same goal, they can 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.53

(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 hypothesis 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.

(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.

53 Jeroen Aerts and Peter Droogers, ‘Adapting to Climate Change in the Water Sector’ in Fulco Ludwig et al. (eds), Climate Change Adaptation in the Water Sector (Earthscan, 2009) 87, 92.
The above entry points are only the generalised 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 in investigating certain mainstreaming factors and criteria. Given the conclusion reached in the 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 criterion is necessary to ensure that IWRM plans to investigate,
consider and address the effects of climate change on water resources, from a preventative perspective.

**B Key Entry Point 2: Integrating Adaptation Considerations 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. 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 minimise potential significant adverse environmental impacts.

The EIA of hydraulic projects has made some progress in the YRB but the EIA of water plans has been weakly implemented. However, in the context of climate change, both of them are facing multiple challenges in China. Developed and implemented as an instrument to prevent environmental damage induced by plans/projects, EIA currently does not focus on the climate change impacts on the environment. The large-scale and long-term climate change impacts are not assessed, and climate-friendly and climate-proofing alternatives are not considered. However, for adaptation, analysing the impacts of environment, especially the changing climate, is crucial and essential. Thus it is uncertain whether the methodology and practice of EIA can be applied to adaptation issues. Based on these suspicions 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.

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Chapter 3 has illustrated that climate change poses series of effects on the Yangtze water quantity, quality, distribution, water infrastructure and the aquatic environment. This implies that if climate change impacts fail to be taken into account in the EIA process, they will have a large potential to affect the actual performance of water plans/projects. Without adequate consideration of the extreme events induced by climate change, dams and reservoirs may fail or be unable to control floods. Furthermore, in cases where plans/projects are designed and implemented under certain circumstances or scenarios, climate change impacts may paralyse these plans and projects by affecting their operating environment.\textsuperscript{56} For instance, the conduct of China’s giant South-to-North Water Diversion 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 Yangtze River have been struggling with water deficiency and emerging droughts induced by climate change in recent years.\textsuperscript{57} 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.

Part B of this chapter will start with the introduction of EIA, where the theoretical introduction and related legal framework in China are demonstrated and analysed. It then identifies the legal and institutional difficulties of incorporating 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 Chapter 5, as well as the experimental practices in other countries. Existing practices of EIA are also analysed to define the barriers and opportunities of mainstreaming adaptation.

1 \textit{The Introduction of EIA}

EIA was first introduced in the USA in 1969 as a mechanism which mandated that all levels of governmental decision-making for policies, acts, plans, programs, approvals

\textsuperscript{56} Agrawala et al., above n 54, 8.
\textsuperscript{57} The climate change impacts on the Yangtze River have been analysed in Part A of Chapter 3.
and infrastructure projects, should undergo a process to reduce and mitigate adverse environmental impacts. 58 Theoretically, EIA can be divided into three different categories: (1) policy level EIA – EIA that involves the formulation of 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; and (3) project level EIA – EIA focusing on 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 advocates ‘development first and then pollution treatment’, and the punitive ‘command-and-control’ approach which advocates the setting of standards and rules enforced by pecuniary and criminal forms of punishment, 59 EIA is distinguished by its preventative and mitigative nature. It has been demonstrated as an effective tool to assess potential environmental impacts and to prevent adverse impacts. The requirement that a comprehensive EIA should be conducted prior to the final approval of plans and projects is a significant addition to the development of environmental laws. 60 This requirement, if effectively implemented, enables environmental impacts to be given equal consideration in the assessment of social, economic and environmental impacts. 61 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, 62 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 analyse, predict and evaluate potential environmental impacts, to identify effective measures for preventing and

60 Ruhl, above n 27, 413.
reducing adverse impacts and to monitor activities. In China, EIA is mainly applied to plans and projects. Since the concept of EIA was introduced in 1973, China has developed a relatively comprehensive legal framework on EIA. Only some of the crucial legislation on EIA in China is provided here.

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) came into effect in 2003 that certain plans were 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 EIA. 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 six years of implementation of EIA Law in China, approximately 500 plan-level EIAs have been undertaken which, according to some commentators, represents remarkable progress.

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.

Article 8 of this law also stipulates that when formulating special plans for energy resources, water conservancy and natural resources exploitation, EIAs should be

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64 In Chinese, Guihua can represent both plan and program. In this article, the term plan will generally refer to plan and program.
organised before submitting the draft of special plans for approval. These provisions denote that both comprehensive water planning at a basin and sub-basin level and speciality 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.

2 Identifying the Difficulties of Factoring Climate Change Adaptation in EIA

(a) The Legal and Institutional Difficulties of Integrating Climate Change Adaptation in EIA

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 methodology.

Based on the stationarity assumption that the surrounding environment of plans/projects is stable, stationary or constant, EIA is 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. In the technical guidance of planning EIA, GHG emission has already been clearly listed as one of the environmental objectives and assessment indicators of regional planning, land-use and urban planning. More research outcomes and government conferences have called for the integration of GHG emission control in EIA legislation. By

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68 OECD Environment-Development Task Team, above n 4, 123.
70 See, e.g. 时进刚等 [Shi Jingang et al.], 《论温室气体控制和气候变化因素纳入规划环评必要性及可行性》 [The Necessity and Feasibility of Integrating Greenhouse Gas Control and Climate Change
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.71 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) existing 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 and the intensity and frequency of extreme weather events are not scoped and assessed. In addition, the vulnerability and capacity of the water plan/project related socio-economic system in responding to climate change impacts is not listed as part of environmental baseline investigation and assessment.72 This may not provide meaningful and correct foundations to identify appropriate adaptation needs and measures. Factoring climate change adaptation in EIA requires reviewing, redesigning and modifying assessment indicators, relevant regulations and standards to reflect the adaptation requirement in the EIA process.

From an institutional perspective, inputting adaptation factors also presents some challenges to EIA decision-making and implementation. As presented in Chapter 3, there are two separate policies, legal and institutional systems in managing environmental issues and climate change issues. This could generate a series of

institutional difficulties when managing climate change issues cutting across
development concerns and environmental protection. For example, the Ministry of
Environmental Protection (MEP) and some lower-level environmental agencies are
responsible for approving the EIA of some basin and local water plans. However,
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.

(b) Difficulties in 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

73 Arvai et al., above n 28, 217-25.
74 Shardul Agrawala and Maarten van Aalst, ‘Bridging the Gap between Climate Change and
Development’ in Shardul Agrawala (ed), Bridge over Troubled Waters: Linking Climate Change and
Development (OECD, 2005)133, 137.
information on local vulnerability also creates difficulty in assessing the resilience of proposed water plans/projects.

(c) 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.\(^{75}\) 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.\(^{76}\) 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. Generally, climate variability could have a large impact on water resources and ecosystems. Climate change is expected to have an ever greater and larger scale impact through changes in precipitation, evaporation and temperature, leading to more frequent and intensive storms, floods and droughts.\(^{77}\) It is also acknowledged that climate change and its impacts distinguish themselves from climate variability by their larger-scale uncertainty, complexity and cumulative effects.\(^{78}\)

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


\(^{78}\) Jan McDonald, ‘Mapping the Legal Landscape of Climate Change Adaptation’ in Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), *Adaptation to Climate Change: Law and Policy* (Federation Press, 2010) 23-35.
proposed plans/projects due to lack of coordination and cooperation among different sectors and agencies.\textsuperscript{79} This deficiency is worsened by the new cumulative effects caused by climate change on a new scale.\textsuperscript{80} 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 thesis will attempt to explore the potential of EIA in screening, assessing and mitigating the adverse climate change impacts on water plans/projects, through reviewing EIA legislation and obtaining references from other countries.

3 \textit{Approaches to Integrating Climate Change Adaptation in EIA}

There are some gaps between intention, operational guidance and actual implementation.\textsuperscript{81} Through expressing its intention to address climate change in the planning/design stage and project construction process but without specifying how to do that, China is clearly on the first stage only.\textsuperscript{82} As an important instrument applied in the planning and designing stage, EIA is not currently 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 in the existing EIA legal and regulatory framework. Meanwhile, this thesis 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.

\textsuperscript{81} Agrawala et al., above n 54, 13.
\textsuperscript{82} 《我国国民经济和社会发展十二五规划纲要》[The Twelfth Five Year Plan for National Economic and Social Development] (People’s Republic of China) National People’s Congress, 13 March 2011, ch 21.
Canada is probably one of the few leading countries considering climate change factors in its EIA paradigm. 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, Canada has gained relatively rich experiences. In this part, Canada will be used as a comparative study to see how it overcomes the aforementioned difficulties and to use EIA as a tool address climate change issues. Its experiences could provide valuable insights for Yangtze water managers on employing EIA to manage adverse water-related climate change impacts.

(a) Identifying the Possibility of Integrating Adaptation in EIA-related Legislation

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. This intrinsic flexibility in the EIA legislation provides an opportunity for incorporating climate change impacts. Furthermore, the adoption of the principle of sustainable development (PSD) and the precautionary principle (PP) provides the legal foundation for considering climate change impacts in EIA. Pizarro articulates that:

83 Agrawala et al., above n 54, 14.
86 Christopher, above n 58, 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’.  

In order to promote sustainable development, decision makers are required to acknowledge the obvious climate risks and take any appropriate countermeasure. In both Canada and China, EIA has been recognised as a powerful tool to help decision makers achieve the goal of sustainable development. 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’ (my emphasis). Although climate change is not regarded 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.

One of the central assumptions in this thesis 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 PP 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 minimise the adverse effects of climate change. Compared to the current preference of ‘sound science’ in public policy, the PP requires decision-makers to adopt a more cautious approach by changing embedded regulatory thinking and information demands to embrace uncertainty. By assessing and mitigating environmental impacts at a very early stage of plans/projects, EIA is a significant legal instrument to manage climate-related uncertainties through its underlying paradigms such as alternatives, evaluation and dynamic monitoring.

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90 Nicola Durrant, Legal Response to Climate Change (Federation Press, 2010) 220.
Recently, the PP has been stipulated as a requirement under the Canadian Environmental Assessment Act 2012 (Canadian Act), \(^92\) while in China’s EIA legislation there is no mention of the PP.

\(\begin{align*} 
(b) \text{ Three Approaches of Managing Climate Change Uncertainties} \\
\end{align*}\)

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 climate change uncertainties. \(^93\) With regard to China, there may not be sufficient 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 the uncertainty of assessing the 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, \(^94\) which relies on effective stakeholder and public participation. Relevant responsible authorities in Canada are even obliged to establish a participant-

\(^{92}\) Canadian Environmental Assessment Act, SC 2012, s 4 (2).

\(^{93}\) Byer and Yeomas, above n 84, 85.

\(^{94}\) Canadian Environmental Assessment Act, SC 2012, s 19 (3).
funding program to support public participation. Those who are directly affected, who have community or aboriginal traditional knowledge and those with relevant expert knowledge can apply for this funding. 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 Chapter 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 realises 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. As the most promising approach to address uncertainties in the climate change arena, adaptive management ‘requires the internalisation of the ability to identify, document and disseminate best practices, and the ability to learn from emerging experiences with adaptation strategies and actions’. 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.

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, 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

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95 Canadian Environmental Assessment Act, SC 2012, s 57, 58.
their development outcomes due to unexpected climate change impacts, feasible alternative options should be provided under given climate change scenarios. Alternatives 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’. While factoring in climate change issues, it is assumed that technically and economically feasible alternatives are required to prepare for different climate change scenarios. Developing relevant provisions of EIA legislation in the climate change context are important for China since there is currently no clear legal requirement to consider alternatives.

(c) Assessing Climate Change Impacts on the Proposed Plans/Projects and Their 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; and (3) tertiary – changes in physical, biological and social patterns. 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; and (3) changes to the project itself. Inspired by that, this thesis argues that EIA under a climate change context should be understood and assessed in an interactive

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101 Canadian Environmental Assessment Act, SC 2012, s19.
103 Ibid.
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/projects 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 minimise the adverse impacts.\(^{104}\) 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 should be required.

\(^{104}\) The Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment, above n 97, 20.
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 plans/projects 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 dam and the environment in which the dam 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, for example failure in controlling floods, its impacts on the surrounding environment should also be assessed. For example, how floods may affect the 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.

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105 OECD Environment-Development Task Team, above n 4, 4.
(d) 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 any new lessons learned into routine procedures, Canada has highlighted the importance of monitoring and following-up mechanism in the EIA process. 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. The purpose and method of monitoring and following-up should be developed to reflect the need of addressing climate change.

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. 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. 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. Although originated as a preventative approach, EIA in this provision is more of an ‘End-of-Pipe’ method in alleviating the predicted impacts. In addition, this provision is also based on the premise that existing technology and knowledge has the capacity to predict possible impacts, which has already been

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106 The Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment, above n 97, 20.
109 Bruch, above n 24, 100.
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.  

In order to improve the capacity to tackle uncertain risks triggered by climate change, attention should be paid to several aspects and the issues addressed. 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 follow-up assessments primarily emphasise 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 analysed 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 amend their procedures on decision-making accordingly.

In addition, rather than assuming that all impacts can be predicted and assessed before the decision, an effective follow-up mechanism requires proponents to incorporate emerging information, knowledge and lessons within an ongoing decision adjustment process. As analysed 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 follow-up assessment mechanism is expected to adapt to changing situations more effectively without changing the goals of EIA.

110 Christopher, above n 58, 565.
112 Ruhl, above n 27, 418.
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. However, 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 in 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 the plan/project operates. In this case, both the 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. Thus, this research will analyse 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. 113 Water plans/projects in vulnerable regions, or those sensitive to climate change impacts, should be selected in this step. Those may increase vulnerability to the natural or social environment and 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

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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. 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 analysed, 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 categorised 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 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.

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and mitigation measures. Based on this document, environmental agencies shall then make informed decisions.

(4) Alternatives: alternatives are crucial to compare different methods 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 realise 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, after weighing and reconciling economic and social considerations with the environmental issues identified previously. When making decisions, climate variables should be given equal weight to 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 to reduce 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. Climate change impacts and adaptation measures require dynamic monitoring. Due to the uncertainty

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115 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.


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 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 (Figure 6.2).
Figure 6.2: An improved EIA process after factoring in climate change adaptation
4 Difficulties and Opportunities of Implementing Climate Change Integration with EIA in China

While the 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 institutionalised and the requirements of alternatives are understated. These deficiencies in the design not only hinder the effective operation of EIA in China but also impede the meaningful integration of climate change 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’. In many instances, climate change only reinforces the need to take measures that should be implemented. 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.

(a) The Missing Target of Policy and Some Plan Level EIAs

---Dotted line refers to the changes needing to be made.

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Unlike EIAs in the USA, which developed from and focus on proposed state agency actions including policies, legislative proposals, plans, programs and projects, 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, 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 initiated without EIAs often become the sources of adverse environmental effects.

As the former director of the MEP stated:

improper 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. 123

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

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122 Zhu and Ru, above n 118, 620.
paradigm so as to explore alternatives, reduce vulnerability and to include adaptation measures at an early stage and at a higher level.

(b) 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 USA. Nonetheless, according to the Article 17 of the EIA Law, there has been no serious consideration of alternatives in China’s EIA legal system. Although alternatives are stated and required in the technical guideline for plan EIA, their absence in EIA regulatory 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 per cent contain alternative analysis. In addition, ‘alternatives’ only come out with limited options. One common option is ‘no-action plan’ to cancel the plan/project, which seldom takes place due to the institutional framework involving EIA. The other one is ‘recommended changes and mitigation measures from the environmental perspective,’ which implies that the EIA will be approved with alteration. In the context of climate change, the understatement of alternatives in EIA legislation and their weak implementation in practice reduce the adaptive capacity of the plan/project in managing the damages of unpredicted climate-related risks.

As previously discussed, alternatives preparation is an important approach to reduce and manage the uncertainties associated with climate change impacts. Otherwise, unpredicted and unexpected climate change impacts may change the surrounding scenarios and compromise the goal achievement of the proposed plan/project.

127 Wang, Morgan and Cashmore, above n 114, 561.
(c) Lack of Effective Institutionalised 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. The large gap between legal regulations and current practice has been well acknowledged by governmental officials and scholars. According to a survey carried out by some scholars in China, more than 77 per cent 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. This is partly due to lack of public knowledge and financial support, 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 thesis, 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 institutionalised 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.

(d) Barriers to the Implementation of EIA

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

129 Wang, Morgan and Cashmore, above n 114, 562.
130 Wu et al., above n 128, 80.
enforcement of EIA, it reflects the inadequacy of the institutionalisation of the EIA paradigm. In the long run, an effective institutional framework, along with environmental management capacity, must be established in order to facilitate implementation. Due to the fact that the proposed plan/project usually relates to the core interests of current China – economic development and employment, 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 cannot 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 low and the violation of environmental rules is rampant. While provinces claim that the EIA was implemented at a rate of 86.9 per cent, the central government’s own audit found that the rate was much lower at well below 50 per cent.

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 the severe climate change challenges.

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,

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132 Bina et al., above n 65, 519.
regulations and projects. EIA is one of the most important tools that can mainstream climate change 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.\textsuperscript{135} 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.\textsuperscript{136} 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.\textsuperscript{137}

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 climate 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 recognised as vulnerable in the nation’s climate change program.

\textsuperscript{135} Agrawala et al., above n 54, 23.
\textsuperscript{136} Byer and Yeomas, above n 84, 85.
\textsuperscript{137} Europe Union, Commission of the European Communities, \textit{Adapting to Climate Change: towards A European Framework for Action} (6 April 2009) 13; \textit{Sustainable Planning Act 2009 (Qld)}, s 5, 11.
Climate change impacts are part of a wider set of vulnerabilities affecting water resources management in the Yangtze River Basin (YRB). Compared to other factors shaping water management regime and approaches (such as the pressure from demographic change and industrialisation), climate change is an emerging driver and it is not on Yangtze water managers’ political and policy agenda. Thus, this thesis concludes that adaptation considerations should be mainstreamed in the Yangtze integrated water resources management (IWRM) regime, which is well accepted as the best practice by Yangtze water management communities. This approach is expected not only to reduce the non-climatic vulnerabilities through implementing the IWRM regime, but also to cater for the requirement of adaptation to achieve robust water management decisions.

In contrast with mitigation, which creates substantial external benefits, the benefits which adaptation generates are mainly internal, meaning that various levels of Yangtze water managers could be provided with strong incentives to take adaptation actions if they were convinced of the benefits of adaptation. Nonetheless, fieldwork and interviews conducted for this thesis reveal that climate change is perceived as distant in time, uncertain in its effects and less consequential than other imperative development, energy or environmental issues. As a result, there is generally a lack of political will on adaptation which is regarded as less urgent and important by Yangtze water managers. In that case, it is necessary for Yangtze water managers to understand the climate change challenges to water management through establishing a meaningful link between scientific research and policy-making. It is also critical for them to recognise the complementarity and synergetic effects between effective adaptation strategies and the IWRM where proactive and resilient adaptation measures will contribute to water sustainability.

China has developed its legal and institutional frameworks on climate change adaptation outside those on water management, which results in the concern about the possibility of integrating these two different systems that have disparate objectives, priorities and approaches. Although adaptation and the IWRM regime share some of their key determinants and elements, they can be distinguished in various aspects,
such as the legal assumptions, institutional requirements and management approaches. After a comprehensive comparison and in-depth exploration, this dissertation argues that there is great potential to integrate them through making use of their commonalities and bridging their differences. For instance, from a legal aspect, legal approaches and principles of environment management such as risk management, alternatives, precautionary principle and adaptive management could accommodate uncertainties associated with climate change. From an institutional perspective, while the IWRM regime demands an integrated approach and adaptation prefers localised actions, they could converge through water planning at the sub-basin level. The IWRM regime could provide an applicable theoretical and practical framework where water-related climate change impacts are accommodated, adaptation objectives are set and adaptive capacity is developed. As a paradigm to manage different aspects of water issues in a more coordinated way, IWRM is supposed to contribute to adaptation challenges through its reputable determinants, approaches and capacity.

Nevertheless, we cannot just embrace adaptation with the present legal and institutional frameworks on Yangtze IWRM. The existing legal system is not able to bridge the theoretical and practical differences identified between the IWRM regime and adaptation. There is a need for changes and improvements in water-related legal framework, institutions and practices to be more adaptive and resilient so as to tackle uncertainties and encourage adaptive management. Crucial legal principles, mechanisms and institutions entrenched in the IWRM-related legal and institutional frameworks are designed and practised without adequate consideration of pervasive uncertainties. Some of them even act as barriers to adaptive and robust decisions which are featured with flexibility, iterative process, periodic review and a learning-by-doing approach. These legal principles, mechanisms and institutions must be reconsidered and evolved to provide a meaningful and effective enabling environment where the motivation, legal guidance, mechanisms and institutional capacity are well in place for adaptation mainstreaming. In some cases, innovative paradigms and instruments should be developed to justify water management decisions and actions taken under climate change uncertainty and complexity. These deliberate efforts towards a supportive enabling environment should be able to engage government across local, provincial and central levels, various stakeholders and the affected public to collaborate, communicate and negotiate with each other on adaptation
mainstreaming. It is essential and desirable for Yangtze water management to institutionalize mainstreaming adaptation to deliver sustainable and robust water management outcomes.

Having this enabling environment in place is vital, but it does not automatically lead to adaptation consideration in Yangtze water management practices. China has established a comprehensive legal system, but the lack of rigorous provisions and detailed procedures have compromised the implementation and enforcement of legislation. To prevent Yangtze water managers from postponing actions with the excuse of climate change uncertainty and flexibility, the factors and procedures through which adaptation could be mainstreamed based on this enabling environment should be further clarified. This thesis identifies integrated water planning and Environmental Impact Assessment (EIA) of the Yangtze water management as two crucial strategic processes to leverage the integration of climate change adaptation. They are illustrative, however, rather than exhaustive, entry points to make adaptation mainstreaming a standard practice.

After reviewing the parameters of each step of integrated water planning and EIA processes, this thesis finds that adaptation could be factored in by extending the parameters being considered. The impacts of climate change on Yangtze water resources should be investigated and assessed to develop a valid understanding of water resources for water planning and EIA. However, it is by no means a simple extension or rearrangement of various parameters of decision-making on water management. On the contrary, it is a significant shift in water management paradigm and methodology, where decisions must be made under uncertainty, imperfect knowledge and a lack of prior experience. Meanwhile, it is also concluded that there is no panacea for water-based adaptation in the YRB. Successful adaptation mainstreaming requires a set of different but consistent and cooperative approaches, procedures and mechanisms to minimize uncertainties and risks and to maximize resilience and benefits. In addition, it is important to point out that the successful implementation of adaptation mainstreaming has to rely on subsequent integration of adaptation in the budgeting, financing, training and education system.

Reforming legislation and institutional arrangements for adaptation mainstreaming is not that easy, mainly due to possible challenges to entrenched mindsets, stereotypical methods, vested interests and dominant power relations. Developing existing legal
institutions and reforming prevailing institutional arrangements to reflect the changes in the underlying assumptions and dominant paradigms is more than ever challenging. It is firstly underpinned by water managers’ thorough understanding of the economic, social and environmental benefits and costs associated with climate change impacts and adaptation initiatives. To a large extent, it is only through connecting to the current core interests of the Chinese government and Yangtze water managers, that adaptation could be on the agenda of various levels of government who are oriented by economic growth and water development. Nonetheless, adaptation definitely requires a broadening of the understanding of core interests from different dimensions rather than being dominated by the narrowed-minded gross domestic product (GDP) growth. Furthermore, the mentality, mindset and approaches prevalent in Yangtze water management should be developed, or transformed, to effectively manage uncertainties, bridge information gaps and respond to unexpected challenges. Meanwhile, Yangtze water management communities at various levels need to develop their awareness and ability to deliver robust decisions that are not only sustainable but are also climate-proof and resilient to changes.

This dissertation acknowledges that the debate and study of the adaptation is still at a very early stage in China, especially the adaptation research from a legal and institutional aspect. Thus, on the one hand, some of the recommendations in this thesis are inevitably speculative and tentative, while on the other hand, converting theoretical suggestions on adaptation to practical strategies and actions may be very difficult and challenging. As a consequence, the proposed approaches and strategies will need to be tested and improved with the emerging information, knowledge and experiences. Furthermore, the dynamic evolving technology and instruments on climate change and adaptation also entail a constant review and modification of the above recommendations to better reflect and reveal the changing circumstances.

A pilot program, or case study approach, could be desirable and politically feasible to identify effective experiences in certain geographic regions and then scale them up to the Yangtze River Basin level and to the national level. This experimental and bottom-up approach has been widely applied in the climate change mitigation area through developing low carbon economy and initiating the pilot programs of carbon trading scheme establishment at the province and city level, which ultimately provide valuable insights for the establishment of a carbon-trading cap at the national level.
Meanwhile, some international organisations, such as the World Bank and Asian Development Bank, have initiated programs on adaptation in vulnerable sectors of China such as water and agriculture. All these domestic and international studies could foster the interests and commitments of Yangtze water managers to conduct pilot water-based adaptation programs in the YRB. Not only successful experiences from these projects and programs but also lessons of failures should be equally analysed to provide valuable insights for future adaptation mainstreaming strategies and practices. Nonetheless, it is important to underline that successful experiences acquired in pilot projects should be employed under specific contexts, rather than being treated as a universal recipe or checklist.

Climate change impacts and adaptation are traditionally regarded as challenges creating additional difficulties for Yangtze water managers to manage current water problems. Nonetheless, if these challenges drive water managers to a threshold where innovative and robust water management strategies are imperative, they may transform challenges to opportunities through which water sustainability is achieved, vulnerability is reduced and resilience to climate change is maximised. This transformation is underpinned and supported by a diverse but coherent and balanced understanding of water management mentality, technology, information, legislation, institutional arrangement and culture. It is a time when Yangtze water managers should be more open-minded, innovative and reflective, and most importantly, people and ecosystem oriented.
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