

Final Report: RGS-IBG Hong Kong Research Grant 2017

Project title: Coupled Infrastructure Systems - Comparing the development of water rights and water markets in Heihe, Shiyang and Yellow Rivers

Abstract

Three cases in northwestern China are used to examine how water rights and associated market mechanisms have developed in the face of socioeconomic and hydrological changes: Zhangye city (Heihe River), Ningxia province (Yellow River), and Shiyang River (Gansu province). A coupled infrastructure systems (CIS) perspective is applied to the cases to help explain how and why water rights systems and water markets have changed over time and space since 1949. The evolution of water rights systems in northwestern China has been shaped by periods of physical human-made infrastructure that was characterized by water-supply projects, and periods of soft infrastructure that emphasized regulatory and institutional measures to manage water resources. The findings illustrate that transferring and trading water rights emerged as a response to river basin closure in all three basins at a time of larger social-economic and political change within China in 1990s and 2000s. Further, the article argues that all three cases have developed the soft infrastructure – a cap, initial allocation of water rights and trading rules – for trading water and thereby laid the foundation for further institutional reform and formation of water markets. Together, the development of water diversion projects that alter the natural water cycle and nationwide market-oriented water allocation reform programs will continue to coevolve in the future as part of complex coupled infrastructure system. The project calls for a research agenda in China by using the coupled infrastructure systems (CIS) view.

1. Description of project

2018 marks the Fortieth anniversary of the initiation of China's 'Reform and Opening' period. Over these four decades China's diverse social ecological systems (fisheries, wetlands, forests, rivers) have gone through rapid transformation on a scale and speed unprecedented in human history. As China's urbanization and industrialization increasingly extends from the coastal regions to the Western Hinterland, the pressure to reallocate water from agriculture to industry will likely increase (Wang et al., 2015). Competition for water between agriculture, cities, industry, and the environment has elevated water to the top of the policy agenda in China, culminating with 'the strictest system of water resource management' in the country, called the 'Three Red Line Policy'. A national water use cap of 670 billion m³ for 2020 has been divided and distributed at nested hydrological scales across China. Based on the national water use cap, China's Ministry of Water Resources selected seven provincial areas in 2014 for establishing pilot markets for trading water rights. As large scale common pool resources (CPR) characterized by consumption rivalry and difficulty of exclusion, rivers in northern to northwestern China face an increased level of uncertainty due to changes in water availability and rapid economic development. The Heihe River Basin, Shiyang River Basin and Yellow River Basin in Gansu and Ningxia provinces are at the leading edge of China's water resource challenge and are placing increasing emphasis on water rights reform.

The overall objective with the research project was to provide a comparative analysis of water rights and trading systems in northwestern China through a coupled infrastructure systems lens. The choice of the conceptual framework was strategic, given that many policy-questions in China are centered around

the concept of infrastructure and the utility of this framework is to consider an array of factors affecting types and patterns of water-rights trading. Juxtaposing Heihe River and Shiyang River in Gansu province with Ningxia province in Yellow River presents the chance for a “most similar systems” comparison, yielding insight about how different classes of infrastructure are associated with the formation of water rights and trading mechanisms. These three cases have been selected using a most similar system design. Shiyang Basin, Zhangye city in Heihe Basin and Ningxia province in Yellow River share a number of similarities including: semi-arid conditions, a historical major allocation of water to the irrigation sector, over-exploitation, and the development of water markets as a support to water allocation reforms. Following the periods considered by Shen (2014), the evolution of the water rights systems in China are categorized into three phases; before 1998, 1998-2009 and post-2009.

Primary data was based on extensive analysis of Chinese governmental reports and archive documents, supplemented by semi-structured interviews with Chinese academics and officials during July-August 2017. A total of 12 group-based and individual semi-structured interviews were conducted in Beijing, Zhengzhou (Henan province), Yinchuan (Ningxia), Helan county (Ningxia), Zhangye city (Gansu), Gaotai county (Gansu), Liangzhou county (Gansu), with provincial and prefecture officials, river basin organization staff, irrigation district staff and Water User Associations (see Appendix A). Two of the authors also completed site visits to the three river basins. The identification of the interviewees relied on snowballing procedure. Prior to the field-work in the two provinces, one of the authors contacted people relevant to the study, who in turn directed us onwards to other people. The number and range of interviewees were determined by the need for diverse variation in opinions on allocation of water entitlements, and the feasibility of access to information. Given the historical approach to explain the development of water rights and associated market mechanisms, the sources of data were analysed by using content analysis and process-tracing of the sequence of reforms and changes. Furthermore, triangulation was employed in the data collection and analysis to ensure accuracy of findings.

2. Findings

- During the period from 1990:s and 2000:s, China experienced a gradual transition from hard-human made (engineering) to soft-human made infrastructures emphasizing economic and institutional measures to manage water resources. As China’s political economy evolved, the objectives of water resources management changed from a strict focus on development to a focus on environmental sustainability.
- Evolving water demands and limited supplies came at a time of larger economic and political change within China, prompting the Government to establish cap, allocation, and trading regulations. In this context, trading and transferring water-use rights became the response to water allocation challenges associated with basin closure. Despite differences in types and patterns of water trading, all three cases have achieved the necessary conditions for developing a water market, including a cap, initial allocation and trading rules. Together, these factors form the soft infrastructure of the water rights trading systems and have laid the foundation for further institutional reform.
- In comparison to Heihe and Yellow Rivers, the water market in Shiyang Basin established China’s first online website for users and water managers to supervise the trading application process. Trading water by using the online platform cuts down the transaction costs in the market.
- The current role of the water market for irrigation water reallocation among WUAs lead to low level of efficiency because the irrigation water price is low and the variety of agricultural water

productivity across WUAs is small in Shiyang River. More recently, there are industrial farms emerging in the basin, in which the industry rent and collect the small size lands from farmers and then centralize those lands for industrial farming to gain scale effect of agricultural production. The further development of the water market rely on the high profit trades between agriculture and industry.

- As mega water diversion projects has gathered pace, the market-oriented water allocation reform programs – such as in Gansu and Ningxia provinces – have also increasingly become critical responses to China’s water resource challenges. From a couple infrastructure systems perspective, the physical human-made infrastructures (water diversion projects) and soft infrastructures (nationwide water rights trading) are co-evolving into a path of water conservation development in contemporary China.

3. Budget

Type of Costs	Costs in Pounds	Sum of total	Source
Airfare	600£	600£	RGS-IBG Hong Kong Research Grant
Accommodation per diem rates	11£ x 77 days	847£	RGS-IBG Hong Kong Research Grant
Food per diem rates	10£ x 77 days	770£	RGS-IBG Hong Kong Research Grant
Domestic travel	200£	200£	RGS-IBG Hong Kong Research Grant
Other	300£	300£	Personal savings
		2,717£	

4. Incident report

No incident happened or were reported.

5. Publications

The author has submitted a manuscript to the journal of *Water International*. The author has also established links and partnerships with China Water Exchange Platform to advance research about compensation mechanisms to water reallocation between cities in China.

6. Appendix A. Photos from the field



Zhangye City, Gansu province.

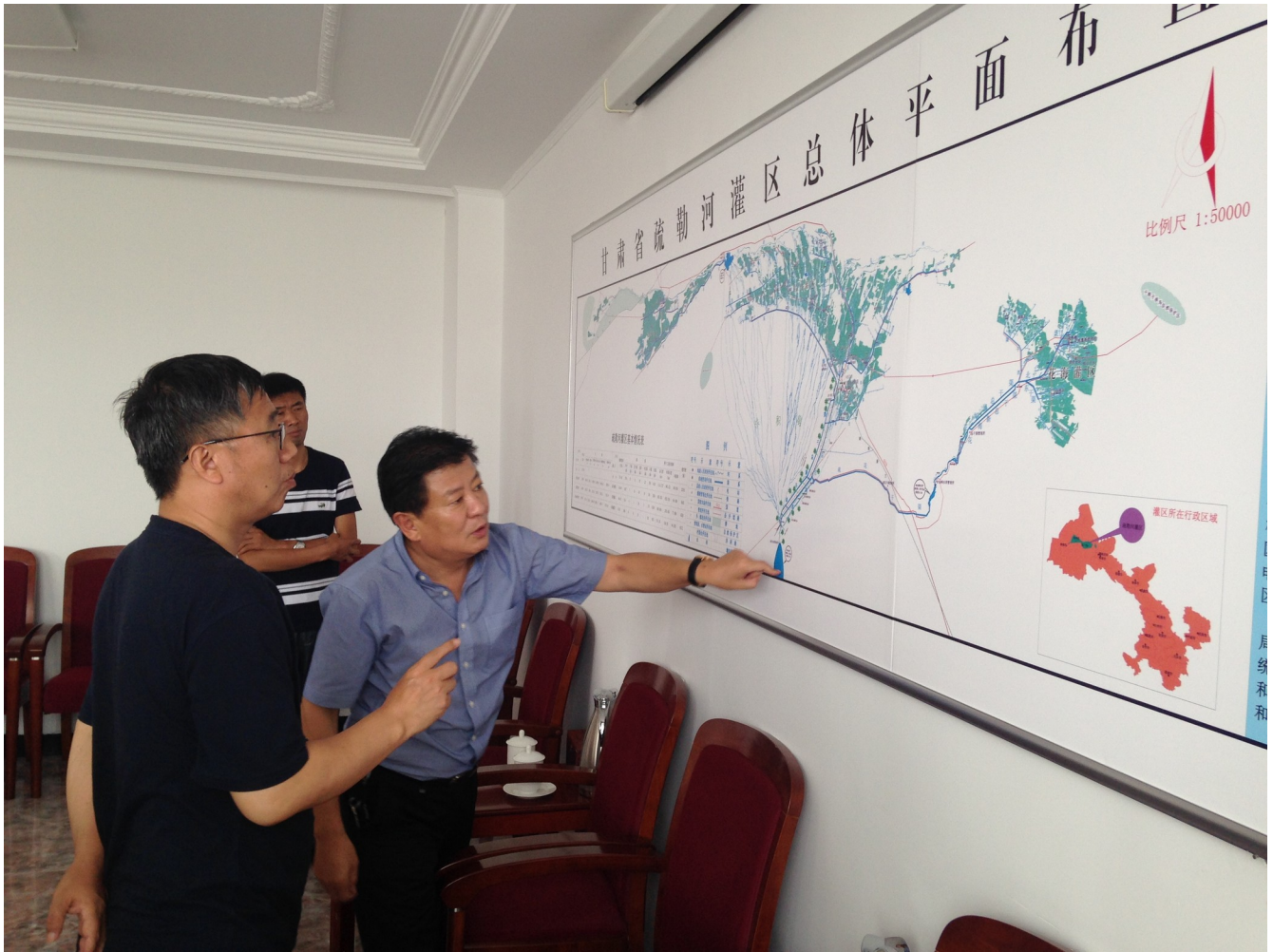


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Water Resources Officials, Gansu province



Yellow River Basin Commission, Zhengzhou, Henan province.

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