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To cite this article: Hongzhou Zhang & Mingjiang Li (2018) A process-based framework to examine China's approach to transboundary water management, International Journal of Water Resources Development, 34:5, 705-731, DOI: [10.1080/07900627.2018.1476225](https://doi.org/10.1080/07900627.2018.1476225)

To link to this article: <https://doi.org/10.1080/07900627.2018.1476225>



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Published online: 20 Jun 2018.



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A process-based framework to examine China's approach to transboundary water management

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ABSTRACT

As China emerges as a regional and global power and its interest in utilizing the transboundary water resources within its borders continues to grow, a better understanding of China's policies and practices towards transboundary waters is of critical importance. Scholars have explored various approaches to the study of this subject, including the legal perspective, the socioeconomic-environmental lens, the foreign relations/neighbourhood diplomacy angle, and international relations theories. Each approach has its merits and weaknesses. On the basis of all the existing analytical studies, this article proposes a process-based framework to study China's policies towards transboundary water management.

ARTICLE HISTORY

Received 13 Nov 2017
Accepted 09 May 2018

KEYWORDS

Transboundary water; China; water hegemon; hydropolitics; water wars

Introduction

In March 2016, over half a million people in the lower Mekong region faced their worst drought in recent history. To alleviate water shortages, China released water from one of its six dams on the upper Mekong River (Grumbine, 2017). While China's move was hailed as benevolent water diplomacy by some observers, many critics argue that the hydroelectric dams built by China, along with hydropower-exporting Laos, have exacerbated the Mekong region's water and environmental problems. In October 2016, reportedly, China blocked a tributary of the Brahmaputra (known in China as the Yarlung Zangbo) for a USD 740 million hydro project which is to be completed by 2019. This immediately aroused concerns from India. In fact, after China completed the construction of the Zangmu Dam in Tibet (the first major hydropower dam on the Brahmaputra River) in late 2014, many international security observers warned that 'water wars' were brewing between India and China. Along with the Doklam standoff between June and August 2017, China's failure to share hydrological data on the Brahmaputra River with India has raised serious worries that rivers could emerge as the next irritant in Indo-Chinese ties (Khadka, 2017).

In North-West China, despite the close ties between China and Kazakhstan, water conflicts have long been a source of tension between the two countries. Kazakhstan is concerned about China's increasing attempts to divert water from the Ili and Irtysh Rivers to meet the growing water demands of Xinjiang's booming petroleum and

agricultural sectors. Furthermore, since the early 2000s, China has adopted an ambitious new policy to revitalize North-East China, which is the largest old industrial base of the country. This new policy aims to restructure and revitalize the traditional manufacturing sectors in three north-east provinces: Heilongjiang, Jilin and Liaoning. China's push to revitalize the north-east region has already significantly damaged transboundary rivers, particularly the Amur River Basin. For example, the 2005 Songhua River toxic spill triggered public outcry in China and Russia (Simonov & Egidarev, 2017).

China's growing interest in utilizing the transboundary water resources within its borders, along with its rise as a regional and global power, which is set to accelerate under the country's ambitious Belt and Road Initiative, has evoked great interest among scholars. As water is increasingly recognized as the world's greatest societal, economic, and perhaps security risk in the coming decade, it is important to understand China's role as one of the most important transboundary water countries in the world. While studies have greatly contributed to a better understanding of transboundary water conflicts and cooperation in the Chinese context (Biba, 2014a; Dore, Lebel, & Molle, 2012; Economy, 2008; Feng, He, & Wang, 2015; He, 2015; Li, 2014; Zhang, 2015), two inter-related questions remain insufficiently addressed: What are the key factors that affect China's transboundary water policies and practices? And how to explain the variations in China's policies between sub-regions?

This article attempts to answer these two questions. The remainder of this article is organized as follows. The next section reviews the existing literature and identifies the major issues in current research that demand further attention. Following that, a process-based framework is proposed to examine China's approach, and two case studies are presented. The last section summarizes the article, with some concluding thoughts.

Literature review

Most critics outside China have taken a realist approach to China's transboundary practices (Baxter, 2014; Chellaney, 2011; Liebman, 2005; Menniken, 2007; Sinha, 2012; Svensson, 2012). Numerous articles have been written describing China as a malevolent hydro-hegemon and warning that China's unilateral actions to utilize the shared water resources could lead to 'water wars' (Chellaney, 2013; Christopher, 2013; Economy, 2008; French, 2014; Hussain, 2014; Nickum, 2008; Padmanabhan, 2014).

Still, other scholars have taken different theoretical approaches. Some have examined China's transboundary water policy through a legal lens. Despite the country's active participation in the negotiation and drafting of the 1997 UN Watercourses Convention (UNWC), China is one of the three states (alongside Turkey and Burundi) that voted against this global instrument at the UN General Assembly. There are three critical factors behind China's objection to the 1997 UNWC. First, China felt that the convention overemphasized downstream states' rights at the expense of upstream states. Second, Part III, on Planned Measures, triggered national security and territorial sovereignty concerns for China. Third and perhaps most important, China objected to the mandatory settlement of disputes. Yet, legal experts suggest that China subscribes to the principle of limited territorial sovereignty and endorses the fundamental principles of the convention: the substantive rule of 'equitable and reasonable use', the duty to cooperate,

and the peaceful settlement of transboundary water disputes (He, 2007; Liu, 2015; Su, 2014; Vinogradov & Wouters, 2013; Wouters & Chen, 2015).

Varis, Kummu, Lehr, and Shen (2014) assess the socioeconomic-environmental vulnerability of different river basins in China. They find that the low vulnerability of the Chinese sections of the transboundary basins could (to a certain extent) explain China's 'thin' transboundary water policies. Similarly, Kattelus, Kummu, Keskinen, Salmivaara, and Varis (2015) conclude that the lack of salience of international river basins in China's decision-making can be partially explained by geography: most border areas are relatively unpopulated and are inhabited mostly by minorities that lack economic or political clout. Biba (2014b) believes that China has not acted as a strictly uncooperative upstream hegemon as suggested by the theory of hegemonic stability. Instead, Biba (2014b) reasons that China has repeatedly sought to reconcile its hydro-politics with its own broader policy objectives and those of its neighbours. Ho (2014) maintains that China manages its transboundary water as a subset of its broader relations with other riparian states, producing discernible differences in China's approaches to its various international river systems. In another study, Ho (2016) compares case studies of the Mekong and the Ganges to understand China's and India's hydro-hegemonic behaviour. Ho points out that the regional context and domestic politics of hydro-hegemons constrain their behaviour and determine whether they have a positive or negative leadership style.

While the existing research has contributed significantly to the understanding of transboundary water issues both in general and in the Chinese context, three major issues need further study to shed light on China's transboundary policies and practices.

The uniqueness of each river

Existing research on China's approaches to transboundary water issues overlooks the uniqueness of each river basin or river. Without fully comprehending the crucial differences between river basins, cross-comparison of China's transboundary water policies and practices could easily generate unconvincing conclusions. For instance, the absence of a water-sharing treaty between China and another riparian state (or states) in a river basin could be merely due to the absence of conflict over shared water (or the quantity of water). Hence, to better understand the key factors which influence China's responses to different basins, it is crucial to start with mapping the unique characteristics of each river or basin.

First, there are different types of transboundary rivers. [Figure 1](#) shows three major types: cross-border rivers, border rivers, and hybrid rivers. A hybrid river is a river of which a certain section forms the border between riparian states). This categorization has important implications. Countries with rivers running across their shared borders would be expected to have conflicts related to resource scarcity, but where the river forms the border, conflicts could also arise due to fuzzy and changeable river boundaries (Gleditsch, Furlong, Hegre, Lacina, & Owen, 2006). Evidence suggests a positive correlation between water scarcity and conflict among countries which share a cross-border river, rather than a border river (Gleditsch et al., 2006; Voza, Vuković, Carlson, & Djordjević, 2012), though some scholars point out that even upstream-downstream asymmetries appear to have little effect on international water cooperation and conflict

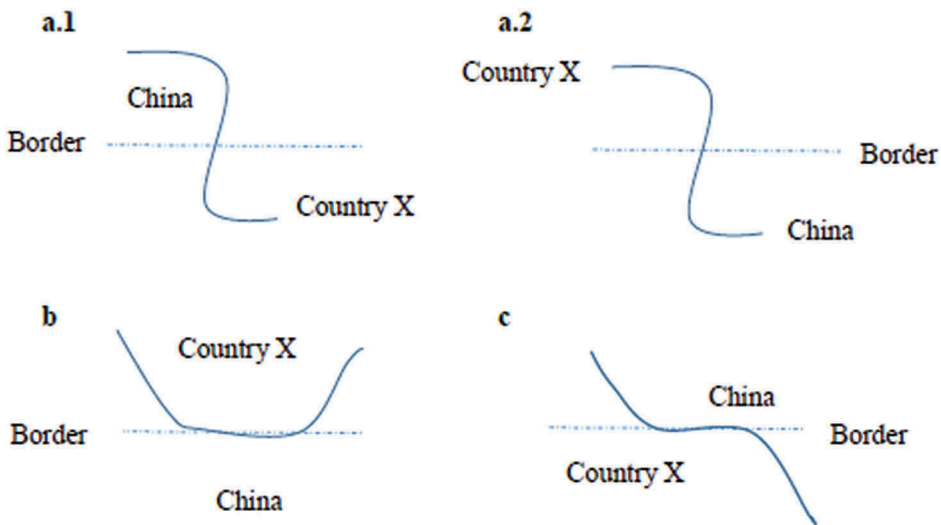


Figure 1. Different types of transboundary river. Source: own construction based on Gleditsch et al. (2006).

(Beck, Bernauer, Siegfried, & Bohmelt, 2014). Also, it is important to keep in mind that a river can have multiple tributaries and multiple crossings at the border.

Second, China certainly enjoys upstream advantages in most of the major transboundary rivers that pass through its territories, such as the Brahmaputra, Mekong, Irrawaddy and Salween. There are cases where China is downstream of a cross-border river or downstream of a tributary of a major cross-border river. Riparian status can determine a state's approach to shared water resources. In an upstream–downstream relationship, when the upstream state is the powerful riparian, it is likely to develop the river to meet its domestic needs and will be less likely to sign formal agreements with other riparian states. By contrast, a downstream 'hegemon' will prefer to establish a basin regime or sign formal agreements to protect its interests (Lowi, 1995; Zeitoun & Warner, 2006). While a lower-riparian state is certainly disadvantaged in the non-navigational use of water, its negotiation power can be significantly enhanced if it controls the estuary of the river, which can be a vital navigation channel. For example, the Amur River, Yalu River, and to a lesser extent the Mekong River can provide China's landlocked provinces access to the sea (Dore et al., 2012; Li, 2014).

Third, even under the most common upstream–downstream asymmetries with China upstream, transboundary rivers must meet certain criteria to become a source of inter-state conflicts. To the concept of 'degree of water scarcity', which refers to the quantity of water, must be added other important aspects of rivers, for example, water quality, fishing, navigation and hydropower generation (Brochmann & Gleditsch, 2012). Still, water can also be a multiplier of conflict, as in the China–India border disputes. Both sides' hydropower projects (and potential water diversion plans) are being carried out in problematic areas where transboundary water cooperation and regional economic cooperation are undermined by ongoing territorial disputes (Barua, Vij, & Rahman, 2017; Feng et al., 2015; Kattelus et al., 2015).

The role of sub-national actors

Until recently, the majority of the transboundary water management studies have taken for granted that the state or national government is the sole or primary actor in international relations and international water affairs (Suhardiman & Giordano, 2012; Wolf, Yoffe, & Giordano, 2003). This is especially true in the study of transboundary water issues in the Chinese context. Water scholars and security experts often present China as a single-minded monolith and describe everything that China has undertaken in its relations with the region as part of the country's strategic calculation (Ho, 2017; Mertha, 2009; Moore, 2017a).

Although the national government has a critical role in defining formal governance structures and even informal interaction in transboundary water issues, an exclusive focus on the national government is problematic for two primary reasons. For one, decision-making processes in transboundary water governance are highly dynamic and shaped by different actors operating at multiple levels of governance. For another, the state-centric approach does not explain how a particular national policy or approach to a transboundary issue develops or how it influences international power dynamics, as it tends to overlook the scalar relationships and interactions between regional, national, sub-national and local actors (Dore et al., 2012; Fox & Sneddon, 2007; Hirsch, 2016; Sneddon & Fox, 2006; Suhardiman & Giordano, 2012; Warner, 2012; Zawahri & Hensengerth, 2012). As Moore (2017b) points out, amid conflicts of interest and contending mandates between different ministries and departments, water policy-making is not always a top-down, linear process, even in authoritarian and semi-authoritarian regimes; instead, sub-national units such as provinces and cities play important roles in water resource management, and their interests often vary considerably from those of the national government.

The responsibilities related to transboundary water governance among the relevant ministries and departments are separately assigned by the Chinese national government (Table 1). The Ministry of Water Resources (MWR) and the Ministry of Environmental Protection (MEP) are the principal bodies. Other ministries' departments are also involved in general transboundary water resources management and are collectively called the 'nine dragons governing water' (Ching & Mukherjee, 2015). In 2009, the Division of International Rivers was established under the MWR, and the Department of Boundary and Ocean Affairs was established under the MFA. Both share responsibilities for transboundary water management (Feng et al., 2015; Huang & Xu, 2017; Li, 2015; Li & Wu, 2016). Clearly, there is not a single leading agency responsible for China's transboundary water management. The 'nine dragons' arrangement implies overlapping and fragmentation of water management tasks across these departments.

According to MWR's regulation, transboundary water sources are managed by four river basin commissions (Table 2). For instance, the Changjiang (Yangtze) Water Resources Commission, based in Wuhan, manages the water resources and river courses of China's part of the Brahmaputra, Salween, Mekong, Indus and Irrawaddy Rivers. However, as observed by Turner (2004), 'Chinese river basin commissions are merely extensions of the MWR and take a very top-down and narrow approach to manage the river basins.' This means that while they cooperate with many agencies and local governments, these commissions lack the authority to command any of them. The

Table 1. Chinese administrative institutions on transboundary water governance.

Ministry or department	Tasks on transboundary water
Ministry of Foreign Affairs	Development of policies concerning land boundaries, management of land boundary delimitation and demarcation, handling of external boundary matters, negotiations on international river agreements, and cases concerning territories
Ministry of Water Resources	International water allocation, hydrologic monitoring and management, international water law, disasters, treatment and conservation along frontier rivers' reach
Ministry of Environmental Protection	Transboundary water pollution, international environmental law
Ministry of Housing and Urban–Rural Development	Construction of cities and towns, planning, management, drainage system planning and management in border regions
Ministry of Agriculture	Fish diversity protection in international rivers, prevention and control of aquatic bio-invasion
State Bureau of Forest	Bio-invasion control, wetland management, development and management of cross-border natural reserves
State Power Group	Hydropower development, planning, and management of international rivers
National Development and Reform Commission	Transboundary infrastructure development, regional cooperation, cooperation strategy and action plans for international river basins
Ministry of Transport	International navigation development and management, channel maintenance, port construction, regulations on international watercourse navigation along international rivers
Ministry of Health	Cross-border disease prevention and control, protection and management of drinking water sources in the border region
State Bureau of Tourism	Development and management of cross-border tourism routes, tourist sites construction and management

Source: Feng et al. (2015); Huang and Xu (2017); Li and Wu (2016).

Table 2. Management of major transboundary rivers.

River basin commission	Location	Major transboundary rivers
Yangtze River Water Resources Commission	Wuhan	China's part of the Brahmaputra, Salween, Mekong, Indus and Irrawaddy
Yellow River Conservancy Commission	Zhengzhou	China's part of the Ili and Irtysh
Songliao River Water Resources Commission	Changchun	All the rivers in China's part of the Amur River basin, and the Tumen, Yalu, Khalkh and Kherlen
Pearl River Water Resources Commission	Guangzhou	China's part of the Red River and the Black River

Source: Ministry of Water Resources, P.R. China (1996).

structure of the water management sector suggests that all water departments of provincial and local governments are subordinate to river basin commissions to some extent. However, to a much greater extent, they are linked to their own provincial or local governments. This means that river basin commissions must work through many links between agencies and committees to manage water in the basins (Simonov & Wickel, 2015).

In fact, at the national level, limited communication between the relevant departments and ministries inevitably causes delayed responses and compromised decisions on transboundary water issues (Huang & Xu, 2017). The highly fragmented water management creates opportunities for sub-national actors (particularly provincial governments and non-state actors, including non-governmental organizations [NGOs] and energy enterprises) to intervene in transboundary water governance.

For starters, the relations between the national government and subnational governments are far more complicated than the concept of a unitary state might suggest

(Young et al., 2015). Sub-national governments are important actors in the field of water resources management and overall interactions with neighbouring countries (Ho, 2014; Li, Beresford, & Song, 2011; Li, 2014; Moore, 2014; Shen & Wu, 2016). As pointed out by Moore (2014) and Ongley and Wang (2004), it is totally possible to pursue competing and individual jurisdictional interests even within a centralized political system. Subnational governments' role in water protection, administration, and water policy implementation has a substantial impact on water resources development and management. Provincial governments enjoy the same bureaucratic rank and status as central ministries, such as the MWR. Although the MWR is ultimately responsible for water resource allocation, sub-national governments are almost entirely in charge of implementing allocation plans in their respective jurisdictions. One example is the assignment of water rights to individual water users.

Next, subnational governments play important roles in shaping the evolution of China's relations with neighbouring countries (Li, 2014). The evolution of China's relations with South-East Asia is at least partially attributable to collaboration between provincial governments in China, primarily Yunnan and Guangxi, and the Mekong River countries. Yunnan and Guangxi serve as the policy implementers for the national government in Beijing. But subnational governments do more than passively carry out the national government's initiatives. In many cases, the subnational governments take the initiative to make major proposals and actively lobby the national government for consent and support for local development (Freeman, 2017; Ho, 2016; Räsänen et al., 2017). Yunnan's Gateway Strategy, Guangxi's Pan-Beibu scheme, and the Nanning–Singapore Economic Corridor are all likely to have major impacts on relations between China and the Mekong River countries. Leaders from Yunnan and Guangxi frequently travel to the capitals of Lower-Mekong riparian states to present their proposals for cooperation. In this way, subnational governments are semi-independent actors in fostering strong bilateral ties with neighbouring countries. Likewise, the successful expansion of China's influence in Central Asia cannot be solely explained by the effort of the national government. The Xinjiang Uygur Autonomous Region government and the Xinjiang Production and Construction Corps must be recognized for their roles as well. In recent years, Xinjiang regional governments have aspired to serve as the centre of a Central Asian Economic Circle and also as the core region for the Silk Road Economic Belt initiative (Li, 2016).

Other players could also play significant roles in transboundary water management. In his article on Turkey's Ilisu Dam, Warner (2012) highlights the crucial role of international NGOs in shaping river basin politics through the anti-dam movement. In their study on the Ganges River and Mekong River, Zawahri and Hensengerth (2012) focus on the crucial role played by domestic NGOs in influencing states' decisions in international agreements. They point out that environmental activists can achieve what years of international negotiations between riparian states failed to accomplish. Media and civil society groups have been occasionally successful in halting the pollution of waterways by local enterprises. For example, together with the media and local scholars in Yunnan, these NGOs have played powerful roles in pushing for the suspension of proposed hydro projects (Guo, 2014; Magee, 2006; Mertha, 2009; Wu, 2013; Yeophantong, 2017). Chinese dam builders are crucial players, too. As Urban, Siciliano, and Nordensvard (2017) note, Chinese dam builders play a major role in China's transboundary river management, most notably along the Mekong River.

The conflict–cooperation spectrum

Many of the comparative studies have placed China's policy and behaviours in transboundary water issues on the conflict–cooperation spectrum, focusing mainly on the national government's willingness and practices regarding the formulation of an international agreement or treaty, or other official policies (Biba, 2014b; He, 2015; Ho, 2014; Li, 2015; Li & Wu, 2016). In particular, the Basins at Risk event intensity scale (also known as the BAR scale) has been widely adopted (Wolf et al., 2003; Yoffe & Larson, 2001). It defines water-related events from -7 , the most conflictive (war), through 0 (neutral events), and up to $+7$, the most cooperative (voluntary unification into one nation). For instance, Ho (2017) categorizes memoranda of understanding (MoUs) and expert-level mechanisms as $+1$; cultural or scientific agreements, or non-strategic support as $+2$; and water-sharing agreements as $+6$. Based on this categorization, Ho (2017) argues that China has been the most cooperative with Kazakhstan, followed by the Mekong states, and the least cooperative with India.

Although the BAR scale could be a useful tool in the quantitative analysis of China's policies and practices in different basins, putting conflicts at one end of the spectrum and cooperation at the other end means that 'the less ugly faces of conflict and less pretty faces of cooperation are overlooked, and the political aspects of the interaction are routinely ignored' (Zeitoun & Mirumachi, 2008). Not all cooperation is equally appreciated by the riparian states under different circumstances of power asymmetry. Moreover, in some cases, 'low levels of cooperation may be impeding efficient management of the water resources under the demise of a collective agreement' (Mirumachi & Allan, 2007).

The mere existence of an international water agreement is a poor indicator of the status of cooperation between two countries over shared water resources. As rightly pointed out by Warner and Zawahri (2012), even when international water agreements are signed, it does not mean that the contracting states are genuinely cooperating. Nor does the absence of formal agreement mean that riparian states are fighting. In other words, the presence of a treaty does not automatically result in behaviour-altering cooperation. Even worse, when a treaty lacks the flexibility to accommodate changes, issues of implementation may deter cooperation: first, by forcing countries to deviate from an agreement after it is in place; second, by posing an immediate risk of international conflict (De Bruyne & Fischhendler, 2013). For instance, despite the Ganges Treaty, India's water consumption of shared river resources has continued to cause grave concern in Bangladesh, with many accusing India of not living up to its treaty obligations (Samaranayake, Limaye, & Wuthnow, 2016). Of the 57 rivers that enter Bangladesh, 54 originate in India. Yet, there is only one water-sharing agreement, on the Ganges River, between the two countries. Furthermore, while water treaties, hydrological data-sharing agreements, technical exchanges and basin organizations may indicate a degree of concord at the interstate level, this does not prevent discord at other levels of governance. Apparent cooperation in the form of water agreements and treaties may amount to symbolic gestures aimed more at mollifying an angry public (Yeophantong, 2017).

Many consider that China's reluctance to enter water sharing agreements and share hydro data with its neighbours represents an uncooperative stance on transboundary water issues. But two considerations are important here. First, despite media hype, China's utilization of the water resources in its transboundary rivers leads to very little

reduction in flow (except on the Ili and Irtysh Rivers, shared with Kazakhstan). For example, the Mekong River Basin is fed by a unique abundance of freshwater that is capable of supporting energy and food production in the region (Economist Intelligence Unit, 2017). Thus, water sharing is not a high priority in transboundary water negotiation there. Second, China's highly fragmented water governance means that it would be very difficult to fulfil the conditions of water-sharing agreements. As Li et al. (2011) highlight, water sharing among different provinces has been very problematic, and the local governments in China do not disclose scientific information such as data on existing water resources and the annual amount of abstraction approved by local authorities.

Likewise, under the Indian Constitution, states have exclusive power to regulate water supplies (Ching & Mukherjee, 2015), and this accounts for serious conflicts between the two main Brahmaputra-bearing states, Arunachal Pradesh (Southern Tibet) and Assam. The states do not share river data with each other, and Arunachal Pradesh has rejected a proposal to establish a Northeast Water Resources Authority because it prefers to deal bilaterally with lower-riparian Assam (Samaranayake et al., 2016). Water has become a bargaining chip as politicians begin to threaten to disrupt water supplies to their neighbouring states in India (Moore, 2016).

Therefore, a more robust and nuanced understanding is needed for the analysis and for policy-making to reflect the multifaceted reality of transboundary water conflict and cooperation between China and its neighbouring countries. Instead of framing water relations via a conflict-cooperation spectrum, the concept of 'water interaction', developed by Zeitoun and Mirumachi (2008), should be adopted. Here, 'transboundary water interaction' refers to relations of both cooperation and conflict among communities, groups, or states over transboundary waters. Even more importantly, cooperation itself is not the desired end for the developing countries, such as China and its neighbours (Biswas, 2008); rather, cooperation should be perceived as the basis for proceeding with the development of water resources in certain basins (Sneddon & Fox, 2006). Again, the mere existence (or not) of water agreements is a poor indicator of the degree of water interaction. The context of broader economic ties between China and the other riparian state or states in a particular river basin is crucial and should be included in the analysis.

A process-based framework for studying transboundary water issues in China

With the above research gaps in mind, this section presents a process-based framework (Figure 2), inspired by the previous studies on the process-focused approach (Molle, Wester, & Hirsch, 2010; Suhardiman & Giordano, 2012). The framework has three main steps.

Step 1: Understanding river basin vulnerability and conflicts

In the Chinese context, transboundary rivers can be largely divided into two groups: cross-border rivers with China upstream, such as the Nujiang-Salween, Yarlung Zangbo-Brahmaputra, Yuanjiang-Red River, and Lancangjiang-Mekong; and border rivers, cross-border rivers with China downstream, and hybrid rivers. Most of the transboundary rivers in the north-east region are either border rivers or hybrid rivers, including most notably the Amur, Yalu and Tumen. Although in most cases China is the upper riparian

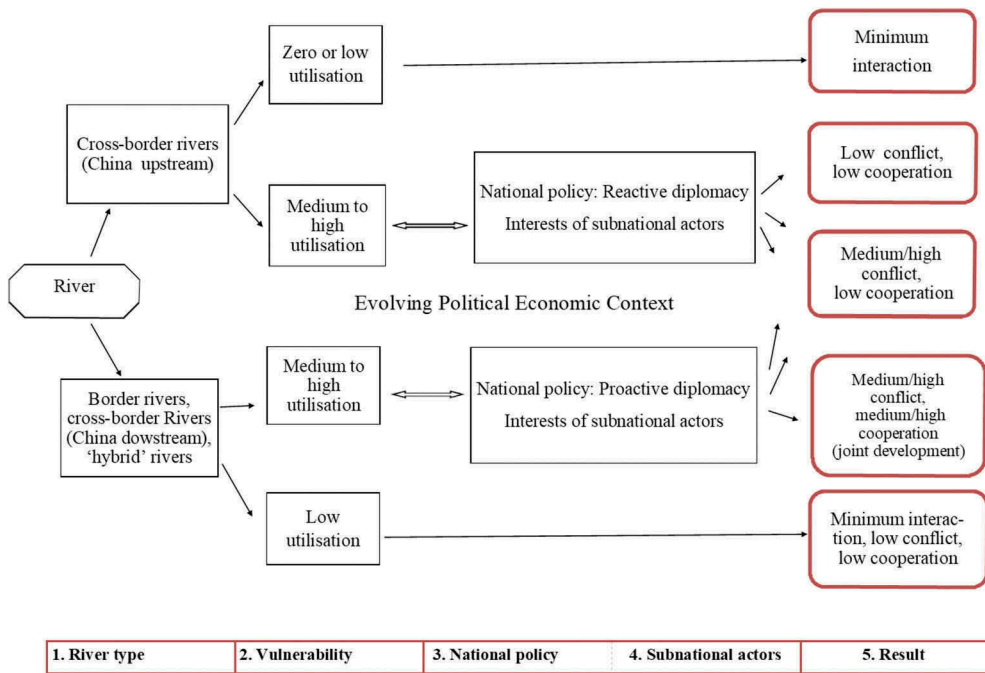


Figure 2. A process-based framework. Source: own construction.

state, there are a few rivers where China is downstream. For instance, China is the lower riparian state of the Kherlen River, which originates in Mongolia. The Ili River is a much more complicated case. The main source of the Ili River is the Tekesi River, which originates in Kazakhstan. Also, a major tributary of the Ili River is the Khorgos, which forms the 150 km border between China and Kazakhstan.

The above groupings are useful for analyzing the degree of vulnerability from China’s perspective and the likelihood of conflicts between China and neighbouring countries over a shared river. China feels more vulnerable in the cases of border rivers. China is party to some 50 treaties governing or related to its shared water resources, and most of these treaties are about border rivers (Wouters & Chen, 2013). This is not only due to water-related issues but also because changes in the river course affect national borders. When China is downstream of a particular cross-border river, its river basin vulnerability is certainly higher. Take the Ulungur River. It is shared between China and Mongolia. The Ulungur arises in the Altai Mountains in western Mongolia, flows south into China, and then turns north-west before emptying into the Ulungur Lake in Xinjiang (China.org, 2013). China’s lower-riparian status puts it at a disadvantage, and thus the river basin vulnerability for China is much higher. In this context, China has been most active in reaching out to Mongolia on transboundary water cooperation. Over the past decades, China has signed four agreements with Mongolia relating to the Ulungur River and other transboundary waters, including China’s first-ever water treaty, the 1994 Agreement on the Protection and Utilization of Transboundary Waters between the PRC and Mongolia (Chen, Rieu-Clarke, & Wouter, 2013). Of all the water agreements signed by China, only the 1994 China–Mongolia agreement includes provisions related to the protection of ecosystems. These provisions

require the two parties to jointly protect the ecosystem of transboundary waters and to take measures to prevent, mitigate and eliminate possible damage to the quality, resources and natural dynamics of the transboundary waters and aquatic animals and plants by natural or human factors. The inclusion of strict obligation not to cause transboundary harm is clearly attributable to China's lower-riparian status (Chen, 2013).

The likelihood of conflicts over water between China and its neighbours in a particular transboundary river basin is influenced by four key factors: the degree of water scarcity (including other important aspects of water, such as safety); the extent to which water supply is shared by more than one region or state; the relative power of the basin states; and the ease of access to alternative freshwater resources (Isaac & Shuval, 1994). Sometimes, transboundary water conflicts have been caused by factors other than lack of water in a shared river basin. For instance, in North-East China and Russia's Far East, water resources are relatively abundant. Less than 6.7% of the transboundary water resources are used. This means that water quantity is not a major problem in North-East China. But China's industrial activities have led to severe water pollution. Over 130 organic contaminants have been detected in Songhua waters (He et al., 2014). As a result, the poor water quality of the transboundary rivers is the main source of conflict in the north-east region. As far as these cross-border rivers with China on the upstream are concerned, China has the advantage, which means less incentive for China to negotiate with neighbouring countries over transboundary water issues.

Compared with its downstream neighbours, China's vulnerability in most of the transboundary river basins is much lower (Table 3). The differences in basin areas under China's control and the size of the Chinese population in each river basin could partially explain the variation of certain key dynamics between river basins. Still, as an upstream state on most of its transboundary watercourses, China faces the enormous challenge of balancing its need for water with the needs of its downstream neighbours (Wouters & Chen, 2013). In short, the degree of vulnerability and the likelihood of conflict will determine how China's national government deals with transboundary water issues with its neighbouring countries.

Step 2: Assessing national policies and overall bilateral ties

In China (and perhaps in most countries), water is only one of the factors that influence states' transboundary water policies. China's current and historical bilateral ties with its

Table 3. Major transboundary rivers, areas and population

River	Area in China (10 ³ km ²)	Area in other countries (10 ³ km ²)	Population in China (millions)	Population in other countries (millions)
Amur	895.2	1201.9	64.4	4.1
Red	84	73.5	11.7	18.1
Mekong	168.3	647.4	6.7	64.1
Salween	139.8	124.1	3.6	4.4
Irrawaddy	21.5	392.9	1.9	34.3
Brahmaputra	316.9	1320.3	1.7	645.6
Indus	86.1	1058.9	0.04	240.7
Irtys	50.4	2960.6	0.4	28.2
Ili	57.7	364.3	2.2	2.9
Tarim, Junggar	1411.3	45.1	17	0.07

Source: Varis, Kumm, and Salmivaara (2012); Varis et al. (2014).

riparian countries also play an equally (if not more) important role in shaping its transboundary water policies and practices (Table 4). As China lacks a comprehensive transboundary water policy, its shared water issues are managed as a subset of its bilateral relationships with neighbouring countries, or through a one-river, one-country approach (Ho, 2014; Li, 2015; Wouters & Chen, 2013). This approach, to a large extent, accounts for China's most notable success in the sharing of the water resources of the Yalu and Tumen Rivers with North Korea, China's only military ally (Chan et al., 2009). In 1961, the two countries signed the Sino–North Korean Mutual Aid and Cooperation Friendship Treaty, which has endured since. This treaty includes a mutual defence clause, compelling each side to do whatever is necessary to oppose hostilities against the other. Similarly, though Sino–Russian interaction on transboundary water resources has had its ups and downs, the closer political relations between the two states over the last few years have enhanced water-related cooperation (Vinogradov & Wouters, 2013).

Furthermore, good bilateral relations also provide opportunities for intensive inter-actions which make issue linkage possible. China recognizes that a strong partnership with Kazakhstan on a wide range of issues is highly advantageous for four purposes: enhancing domestic stability involving the Uighur minority in Xinjiang; strengthening Sino–Kazakh economic and energy cooperation; engaging in regional competition for influence and power in Central Asia between Russia, China and the United States; and implementation of China's Belt and Road Initiative. For years, Kazakhstan has deliberately linked transboundary water issues with energy, economic ties and security issues (Deng, 2012; Ho, 2017). For example, in May 2017, Kazakhstan's president, Nursultan Nazarbayev, while attending the Belt and Road Forum for International Cooperation in Beijing, suggested that 'it is important not to miss complex environmental issues, including the problem of rational management of water resources of intercontinental transboundary rivers, which can be transport arteries' (Orazgaliyeva, 2017).

Next, low utilization of shared water resources could mean lower risks of conflict between China and its neighbouring countries. Consequently, water interaction is highly limited in these basins. In fact, most of the transboundary rivers belong to this category. For most of its transboundary rivers, transboundary water interaction between China and neighbouring countries is highly limited due to the insignificance of these rivers and minimal utilization by riparian states. Where China is upstream on major cross-border rivers, an advantageous position coupled with a high likelihood of conflict, it mainly

Table 4. China's bilateral relationships with other riparian states

Type of bilateral relations	Countries
Military alliance (Treaty of Friendship, Cooperation, and Mutual Assistance, 1961)	North Korea
Comprehensive strategic partnership of coordination	Russia
All-weather strategic partnership	Pakistan
Comprehensive strategic partnership	Kazakhstan, Cambodia, Laos, Vietnam, Myanmar, Thailand, Mongolia
Strategic partnership	Kyrgyzstan, Bangladesh
Strategic and cooperative partnership for peace and prosperity (with existing border disputes)	India
Comprehensive partnership	Nepal
No official diplomatic relations (with existing border disputes)	Bhutan

Source: Ministry of Foreign Affairs, P.R. China (2017).

adopts reactive diplomacy. Many of China's water agreements or MoUs are negotiated and concluded in response to requests from its downstream neighbours, often after particular incidents. For example, in November 2005, an explosion in a petrochemical factory in Jilin City caused hundreds of tonnes of benzene to leak into the Songhua River, causing severe transboundary pollution downstream, as the Songhua drains into the Amur River separating Russia and China. In 2008, China signed the Agreement on Reasonable Utilization and Protection of Transboundary Water between China and Russia (He et al., 2014).

By contrast, regarding the major border rivers, cross-border rivers on which China is downstream, and hybrid rivers, China largely employs proactive diplomacy, owing to its greater vulnerability. This means that China will be more willing to sign water agreements if bilateral ties are strong. Moreover, this proactive diplomacy has been largely related to China's attempts to settle its border areas since the late 1970s. Most of the treaties and agreements on matters related to international watercourses concern borders (Wouters & Chen, 2015). Of the four bilateral water agreements, the 1994 China–Mongolia water agreement covers two border rivers, a border lake and a cross-border river (with China downstream). The China–Russia and China–North Korea water agreements are also related to border rivers (Feng et al., 2015; Wouters & Chen, 2013). It is similar with China and Kazakhstan. In April 2011, the China–Kazakhstan Friendship Joint Water Diversion Project was launched on the Khorgos River, a tributary of the Ili and a border river between the two countries (Chen et al., 2013; Ho, 2017). Given that some river basins include both border-river tributaries and cross-border tributaries, China's approach to transboundary water issues can contain both proactive and reactive components.

Step 3: Considering the roles of sub-national actors

Sub-national actors, such as local governments, NGOs and state-owned enterprises, can influence the country's transboundary water management in three major aspects: the degree of utilization of transboundary rivers; China's overall relationship with neighbouring countries; and the implementation of the national government's policy. Regarding construction of hydropower projects and water diversion projects, the national government's policy has prompted competition between coalitions of different interest groups. Take the Nu River dam project. In 2003, the Yunnan provincial government signed an agreement with Huadian Corporation to develop hydroelectric stations on the Nu River to support local heavy industry. Immediately, NGOs, media and scholars (with support from the National Environmental Protection Bureau of China) launched a high-profile campaign against the proposed dams, which eventually led to the suspension of the proposed hydro-project (He, 2015; Magee, 2006; Mertha, 2009; Yeophantong, 2017).

In Tibet, while the government of the Tibet Autonomous Region is interested in using the hydropower potential of the Brahmaputra River to solve Tibet's electricity shortage problems, the People's Liberation Army (PLA), which has a large presence in Tibet and manages Tibet's problematic borders, is one of the strongest supporters of the proposed Grand Western Water Diversion, which would divert water from the Brahmaputra to the country's dry north (Ho, 2014; Zhang, 2015). In 2006, the proposal was endorsed by 118 generals, including 16 three-star generals and 17 lieutenant generals (Fu & Liu, 2006).

Furthermore, the Tibet Military Command, being directly under the PLA, is one level higher than its counterpart provincial-level military commands (Krishnan, 2016).

In Xinjiang, the Xinjiang Production and Construction Corps (XPCC) is a unique economic and paramilitary (semi-militarized) government organization. It enjoys the same rank as the Xinjiang Uygur Autonomous Region's government. It has administrative authority over several medium-sized cities, as well as settlements and farms in Xinjiang. As its administrative areas are mostly in extremely arid areas and it is predominantly an agricultural economy, the XPCC has been the key driving force behind water-diversion projects along the Ili and Irtysh Rivers and has played a major role in handling transboundary water issues with other riparian states (Wang, 2016; XPCC, 2017). In 1969, the XPCC even engaged in a small-scale armed clash with soldiers of the former Soviet Union due to disputes over the shared Akequeke River, which resulted in five people from the XPCC being captured by the Soviets (XPCC, 2015). In recent years, the XPCC has been responsible for the construction of a joint water diversion project on the Khorgos, which was launched together with Kazakhstan in 2011 (Chao, 2011), and XPCC officials are among the members of the Chinese delegation for the China–Kazakhstan Joint Commission for transboundary river utilization and protection.

More importantly, sub-national actors, particularly the provincial governments, are playing an increasingly important role in shaping China's overall relations with neighbouring countries. As discussed in the previous section, the peripheral provincial governments have been pushing, within the possible national foreign policy parameters, for transnational collaboration and cooperation in the economic, social, cultural and non-traditional security arenas. In recent years, land-locked peripheral provinces including Yunnan, Xinjiang, Heilongjiang and Jilin have been highly active in advancing economic and trade ties with their respective neighbouring countries (for instance, Jilin with North Korea, and Xinjiang with Kazakhstan and Kyrgyzstan). The leaders of Heilongjiang, Jilin and Yunnan highly value the navigation channels offered by transboundary rivers to meet their desperate need for sea access (Li, 2014). Thus, China has been most cooperative in navigation. As Ho (2014) notes, China's every multilateral initiative towards a river involves improving navigation to facilitate trade. The Yunnan provincial government is also in charge of promoting border trade with the Mekong riparian states, developing infrastructure linking the Mekong countries, and taking steps to attract foreign investment in hydropower projects. Furthermore, China's participation in the Greater Mekong Subregion and Mekong River Commission is largely driven by the needs of Yunnan Province (Li, 2014). Free trade zones, joint development areas and friendship projects have been established along the transboundary rivers. In North-West China, China and Kazakhstan launched the China–Kazakhstan Friendship Joint Water Diversion Project on the Khorgos River, a 150 km tributary of the Ili and a border river between the two countries, in 2011. Under the agreement, each side is allotted 50% of the diverted water, and two countries also seek to improve irrigation, secure water supply for the ecosystem, and moderate flood damage, especially in Khorgos Port and the China–Kazakhstan Trade Cooperation Zone.

Moreover, while the national government enjoys a predominant position in foreign policy-making, the implementation of many foreign policies requires the support of sub-national governments. This provides more opportunities for local governments to influence the actual outcome of water agreements. In spite of the close diplomatic

ties between China and Kazakhstan at the national level, the slow progress towards a water-sharing agreement between the two countries could be at least partially due to the critical importance of transboundary water for the economic and social development of Xinjiang Province and the XPCC (Zheng, 2017). In contrast, Heilongjiang, Jilin, Inner Mongolia and Yunnan even go beyond what is officially agreed at the state level. For instance, the Heilongjiang government initiated a program of inter-regional cooperation for better collaboration with Amur Oblast, and a nature conservation project, Integrated Management of the Amur (Heilongjiang) Basin, between Khabarovsk Krai and Heilongjiang Province, to promote joint monitoring of the quality of surface waters and aquatic living resources. Similarly, Inner Mongolia cooperates with Zabaikalsky Krai to protect the water resources and biodiversity of the Argun Basin.

Case studies

Table 5 provides a summary of China's policies and practices related to two river basins, the Brahmaputra and the Tumen. The *Brahmaputra River*, emanating from the Tibetan Plateau, is one of the largest rivers in the world. It flows across China's Tibet, through the Himalayas, and into India and Bangladesh, before merging with the Ganges and emptying into the Bay of Bengal. Owing to its upper-riparian status, abundant water resources in Tibet, low population density, and limited economic activity in the Brahmaputra basin, China's vulnerability is very low. On the other hand, as China has over 50% of the Brahmaputra River basin area, the potential impact of China's activities on the Brahmaputra River is much more significant than for other rivers. While both the Indus and the Brahmaputra originate in China and are of critical importance to India, India is far less concerned with China's activities on the upstream Indus than with the Brahmaputra. Very few Chinese live in the Indus River basin, and only a tiny portion of the basin is in Chinese territory.

The Brahmaputra River is of great importance to both India and China. For India, it accounts for nearly 30% of the freshwater resources and about 40% of the total hydro-power potential of the country. For China, while at the national level the river's role in the country's total freshwater supply is quite limited, it is of great importance to Tibet. The Brahmaputra River is considered the birthplace of the Tibetan civilization, and it plays a critical role in Tibet's agricultural and energy sectors. Even so, it is highly unlikely that China will embark on large water diversion projects in the Brahmaputra River basin. And even if it does divert water from the river in the future, the impact on the water supplies

Table 5. China's policies and practices towards two selected river basins

River basin	River type	Vulnerability/ conflict	Proactive or reactive	Overall bilateral ties	Sub-national actors	Outcome
Brahmaputra	Cross-border (China upstream)	Low/medium	Reactive	India: strategic rival with border disputes	Tibet, dam builders, military	Medium conflict, low cooperation
Tumen	Border river	Medium/low	Both	North Korea and Russia: close ties	Jilin Province	Medium conflict, high cooperation (joint development)

Source: own construction.

of the downstream countries will be very limited (Zhang, 2015). Although 50% of the basin is in Chinese territory, China only contributes 14–30% to the total basin discharge, subject to different estimates or seasonal variations. Indian officials have even pointed out that precipitation in China contributes only 7% to the flow of the Subansiri, Siang and Lohit, three tributaries of the Brahmaputra which originate in China (Bhaskar, 2013). Also, the utilization rate of water in the Brahmaputra River is very low (Zhang, 2015).

As China intends to harness the enormous hydropower potential of the Brahmaputra River, domestic discussion of possible water diversion projects and water issues on the river has put a strain on India–China ties. In these circumstances, China has adopted a reactive approach. For instance, in June 2000, a catastrophic flood in the Brahmaputra River killed 30 Indians, leaving 50,000 homeless. In response to India's concerns, China and India made a series of agreements to share hydrological data (Samaranayake et al., 2016). Subsequently, in 2006, two sides established the India-China Expert Level Mechanism (ELM) to discuss various issues related to trans-border rivers; in March 2018, the 11th meeting of the ELM was held in Hangzhou, China.

The Brahmaputra River is also linked to Sino–Indian border disputes. The two countries have contested claims in the Eastern Himalayas, in an area from the triple junction of India, China and Bhutan on the west to the Brahmaputra River on the east, largely along the crest of the Himalayas. This disputed area is called South Tibet by China and Arunachal Pradesh State by India, which now controls the area. It has an area of about 90,000 km² and a population of over one million (Zhang, 2015). The lingering border disputes and Sino–Indian strategic contention on many fronts have resulted in an unfavourable diplomatic atmosphere that hinders closer bilateral cooperation on water issues. Taking the hydraulic data-sharing agreements as an example, China agreed to share hydrological data regarding the Brahmaputra River with India and Bangladesh. India needs to pay RMB 850,000 (about USD 134,000) every April to maintain three hydrological centres on the Chinese side, whereas the same data are provided to Bangladesh for free (Samaranayake et al., 2016). The warmer relations between China and Bangladesh could be an important factor in this differential treatment. China's refusal to share hydrological data on the Brahmaputra river with India in 2017 was directly linked to the Doklam border standoff, which seriously damaged China–India bilateral relations. As explained by Zhao Gancheng, director of the Center for Asia-Pacific Studies at the Shanghai Institute for International Studies, 'By infringing on China's sovereignty in Doklam, India has damaged the mutual trust the two neighbours used to enjoy, and China will be hard pressed to cooperate with India on other issues [hydrological data] without the mutual trust' (Zhao, 2017). The absence of a basin-wide water management mechanism for the Brahmaputra River could also be to some extent attributed to the fact that China has yet to establish formal diplomatic ties with Bhutan (Table 4).

Sub-national actors in China, including the Tibet Autonomous Region government, the dam builders, and the military, are more interested in hydro projects for economic and strategic reasons. The Tibetan government has a passive role in shaping Sino–Indian relations, given the very limited opportunities to expand bilateral economic ties in Tibet amid lingering border disputes. This partially accounts for the lack of cooperation between the two countries along the shared rivers. Again, take the Sino–Indian MoU on hydraulic data sharing for example. The problems related to data accuracy and

frequency could, in part, be attributed to the Tibetan government's weak capacity and lack of motivation. Hence, in the Brahmaputra River basin, China's water interaction with India can be categorized as 'medium conflict, low cooperation'.

In comparison, the *Tumen River* is a border river. With its source on the east side of the main peak of Changbai Mountain, on the China–North Korea border, the Tumen flows northwards through four cities in China to two provinces in North Korea, until it reaches its estuary on the Russia–North Korea border, flowing into the Sea of Japan. The mainstream of the Tumen River is 537 km in length and drains a total basin area of 33,168 km². Some 505 km of the river forms the border between China and North Korea, and 15 km between Russia and North Korea (Li, 2017). Because it is a border river, erosion of river banks and changes of river flow pose a direct threat to China's territorial integrity. Hence, a proactive policy was adopted. On November 3, 1998, the Agreement on the Demarcation Line of National Water Boundaries Regarding Tumen River was signed by China, North Korea and Russia (National People's Congress, P.R. China, 2007).

In fact, China began exchanging hydrological information with North Korea on the flood season of the Tumen River in the 1950s, and two countries jointly constructed hydropower stations on boundary river to guarantee power generation, flood prevention and water supply. Furthermore, the three riparian states (China, North Korea and Russia), as well as Mongolia and South Korea, have engaged in economic cooperation in the Tumen River basin under the Greater Tumen Initiative (formerly known as the Tumen River Area Development Project) since the early 1990s (Byun, 2008). China has also been leading the way in joint cross-border development with North Korea and Russia. As pointed out by Li (2017), 'China's attempts to facilitate cooperation on the Tumen River are a result of fundamental adjustments in China's national and regional development strategies in the context of substantial geopolitical changes.' Closer political ties between China and North Korea and between China and Russia provided an enabling political environment for deeper regional economic integration and water cooperation. The primary motivation of China's proactive and cooperative policy towards the Tumen River issue is its interest in the restoration of sea access rights and marine navigation. Given that access to the sea by the Tumen River is controlled by North Korea and Russia, China has weak bargaining power over water issues in the Tumen River basin despite being a much more powerful riparian state than North Korea and on the upper stream with respect to Russia. As a result, China has to respond to pressures from North Korea and Russia regarding transboundary water issues. In the past decades, with rapid industrialization, industrial discharge from the Chinese factories in the Yanbian Korean Autonomous Prefecture in Jilin has severely polluted the Tumen River, destroying fish stocks across the region and polluting the coastal waters of North Korea and Russia (Li, 2017). To alleviate the concerns of North Korea and Russia, China has made a sustained effort to tackle environmental issues (Byun, 2008).

What should be noted is that Jilin Province has been the key player in fostering cooperation on the Tumen among the regional countries. As only the Tumen River has an estuary in northern China to access the Sea of Japan, the Jilin provincial government's keen interest in the restoration of sea access and navigation rights is an important factor behind the development of cooperative projects with North Korea and Russia. The idea of cooperation on the Tumen first unfolded in Jilin (Yuan & Song, 1993). In 1984, scholars and specialists in Jilin Province formed a group to study Jilin's

access to the Sea of Japan through the Tumen River (Lampton, 2001). After in-depth research, Jilin submitted a proposal to the national government for the restoration of China's sea access through the Tumen River. Since then, developing the navigation route of the Tumen River has been at the top of the agenda of local economic development and strategy implementation at both national and local levels (Li, 2017). At the supranational level, in 1990, Ding Shicheng, a Jilin provincial official, stood up at an international conference on north-east economic cooperation and called for Chinese, Russian and North Korean cooperation to develop the lower reaches of the Tumen River and open North-East China's access to the sea. With the UN Development Programme representative in Beijing expressing interest in this idea, it became the basis for the Tumen River Area Development Project, announced by the UN in 1991 (Arase, 1999). In 1992, with the completion of the agreement on the eastern section of the China–Russia border, China partially regained sea access rights via the Tumen River. However, as the downstream Russia–North Korea rail bridge is too low (only 7 metres), and the river is heavily silted, only small vessels can pass, and Russia granted only passage of seasonal fishing vessels, not commercial vessels (Global Times, 2015). In 2003, by agreeing to locate the tripoint of its borders with Russia and North Korea in the middle of the river, China secured a right for Chinese vessels to navigate the North Korean–Russian stretch of the Tumen to reach the Sea of Japan (Lipin, 2014).

To Jilin Province, the restoration of sea access and navigation rights through the Tumen River is critical to the implementation and development of the Changchun–Jilin–Tumen River Open Cooperation Zone, which could boost economic and social development of traditional industrial bases in other regions of the province. This explains the crucial role of Jilin Province as a key participant from the Chinese side in the Greater Tumen Initiative. As further growth puts greater stress on the environment, Jilin's economic outreach has also involved progressive environmental initiatives. For instance, under the TumenNET Strategic Action Programme, the Institute for Environmental Protection of Jilin Province is leading the regional effort to develop an Environmental Information System, designed to manage regional data on international waters and biodiversity (Byun, 2008). In a word, China's water interaction with North Korea and Russia in the Tumen River basin can be regarded as joint development.

Concluding thoughts

Numerous academic papers and news articles have taken a realist approach in describing China's policies on transboundary waters and concur that China is a malevolent hydro-hegemon. These alarmist views have hindered regional transboundary water cooperation with their popular 'water wars' and 'Chinese threat' narratives. The real danger of these narratives is that they could become self-fulfilling prophecies as they erode mutual trust and invite overreactions from riparian states. Against this backdrop, this article has proposed a process-based framework to study China's approaches to transboundary water management. The process starts with comprehending the uniqueness of different river basins or a particular river. Various factors, such as the river type, the geographic location of river, the degree of water scarcity, the extent to which water supply is shared by more than one region or state, the relative power of the basin states, and the ease of access to alternative freshwater resources, will determine whether China

adopts a proactive or reactive policy in a river basin or a river. China's overall foreign policy and bilateral relationship with a particular riparian country will also affect the extent of engagement of China with the shared water resources. Sub-national actors such as local government, NGOs, dam builders and media also influence China's behaviour in transboundary water governance in three major aspects: the degree of utilization of transboundary rivers; China's overall relationship with neighbouring countries; and the implementation of the national government's policy.

China's policies and practices towards a particular transboundary river are certainly not static. They evolve with the changing dynamic in the overall political economic context. To begin with, China's overall ties with neighbouring countries shift over time. Before the 1980s, China had a closed-door policy and refrained from interacting with its neighbouring countries, leaving most of the border area vacant. Water cooperation between China and most of its neighbours was very limited, and water conflicts quickly escalated. Since the 1980s, in line with the grand reform and opening-up policy, China has normalized relations with most neighbouring countries. In particular, China's efforts to resolve the border disputes with its neighbours have produced numerous agreements involving border rivers and lakes. In the past few years, under Xi Jinping's leadership, China has attached even greater importance to diplomacy with its neighbouring countries, raising important issues and guiding policy, opening up a sound environment, and laying the foundation for diplomatic work (Freeman, 2017). In late 2013, China launched the high-profile Belt and Road Initiative (BRI) to expand trade and investment and to create a new pattern of regional economic integration. Under the BRI, the central government and border provinces such as Yunnan, Xinjiang, Heilongjiang and Inner Mongolia have been advocating full-scale cooperation with neighbouring countries. In this context, China launched the Lancang-Mekong River Dialogue and Cooperation Mechanism, which includes water resources management as one of its five priority areas. In Central Asia, with the implementation of the BRI, China's efforts to improve regional food and energy production systems could help alleviate water stress in Central Asia. While China's new foreign policy of aiming to build friendship and partnership with its neighbours and the BRI has fostered closer cooperation between China and most of its neighbouring countries, the country's relationship with its only military ally, North Korea, has been losing steam over the past few years. The deteriorating bilateral ties between the two countries have taken a heavy toll on many cooperation programmes between the two sides, including transboundary water cooperation. And North Korea has been standoffish regarding China's efforts to regain sea access through the Tumen River (Zhang & Mei, 2017).

Economic development in China could be both a cause for worry and a source of hope for transboundary water management. On the one hand, rapid urbanization, industrialization, and agricultural development will further exacerbate water scarcity and pollution in China, particularly in the country's arid north. Facing such pressures, China might be tempted to utilize more transboundary water resources. China may even feel compelled to divert waters from the relatively under-utilized transboundary rivers within its borders. China's ambitious plans to reduce carbon emissions through developing clean energies also means that more dams will be built along the transboundary rivers. Such dams will inevitably enrage downstream countries. On the other hand, as pointed out by Gleditsch et al. (2006) and Mirumachi and Allan (2007), wealthier

countries can afford to compensate for scarcity by technological substitution or innovation. A country with high economic diversity and strength will have options to combine factors of production to obtain resource alternatives. Examples include water desalination and wastewater recycling, water saving, better irrigation efficiency, water price reform, virtual water trade, and structural shifts in agriculture. A country with a highly developed political economy can adapt to the factors that shape international relations. Therefore, as China progresses from a low level of political economy to a diversified and global economic power, it could shift from resource *capturing* to resource *sharing*, and then to resource *alternatives*, which could eventually pave the way for greater cooperation on transboundary water.

Changes in the domestic political economy will also affect the roles and interests of the non-state actors in transboundary water governance. Since 2013, Chinese premier Li Keqiang has been pushing for the acceleration of the country's administrative reform. Over-centralization of power has long been held to be a major problem in the country's administrative system. Therefore, China's administrative reform has focused on three main areas: the decentralization of power and delegation of rights; the simplification and rationalization of administrative power; and the building of a government ruled by law (Guo, 2017). In the water management sector, one key point in the decentralization of power and delegation of rights is that approval of small-scale reservoirs and hydro projects on transboundary rivers has been delegated to the provincial governments (State Council, P.R. China, 2016). This means a greater role for provincial governments in shaping China's behaviour in transboundary water management.

Last but not least, as the domestic market is becoming saturated, China's dam builders, such as Sinohydro China, China International Water & Electric and China Gezhouba Group Company, have been expanding their presence overseas (Freeman, 2017; Kattelus et al., 2015; Kirchherr, 2017; Urban et al., 2017). In 2016, the business revenue of the new overseas hydropower contracts won by these three companies was over USD 25 billion, accounting for over 10% of the combined business revenue from contracted projects overseas by all Chinese contractors (Ministry of Commerce, P.R. China, 2017). This new trend has led to interesting changes in the role of Chinese dam builders in transboundary water governance. Previously, owing to their interest in the hydro projects within Chinese borders, they strongly advocated unilateral utilization of shared waters. Now they are more interested in joint development and transboundary water cooperation.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A. Mapping the Chinese approach to transboundary water issues

River basin	River type	Vulnerability, conflict	Proactive or reactive	Overall relations	Non-state actors	Outcome
Indus River (China, India)	Cross-border, China upstream	Low, low	Reactive	Strategic rivalry with unsettled borders	Tibet Dam builders PLA	Little interaction
Brahmaputra River (China, India, Bangladesh)	Cross-border, China upstream	Low, medium	Reactive	Strategic rivalry with unsettled borders	Tibet Dam builders PLA	Medium conflict, low cooperation
Mekong River (China, Five South-East Countries)	Cross-border, China upstream	Low, medium	Reactive	Strategic partners, close ties	Yunnan Dam builders NGOs	Medium conflict, medium cooperation
Salween River (China, Myanmar, Thailand)	Cross-border, China upstream	Low, low	Reactive	Strategic partners, close ties	Yunnan Dam builders NGO	Little interaction
Irrawaddy (China, Myanmar)	Cross-border, China upstream	Low, low	Reactive	Strategic partners, close ties	Yunnan Dam builders NGO	Little interaction
Ili River (China, Kazakhstan)	Hybrid	Medium, medium	Both	Strategic partners, close ties	Xinjiang XPCC	Medium conflict, medium cooperation
Aksu River (China, Kyrgyzstan)	Cross-border, China Xinjiang XPCC	Joint		downstream development	Medium, low Irtysh River (China, Xinjiang XPCC)	Both
Cross-border, China upstream	Low, medium	Reactive	Strategic	partners, close ties	Xinjiang XPCC	Kazakhstan, Russia) Medium conflict, low cooperation
Amur River (China, Russia, Mongolia)	Hybrid	Medium, medium, navigation	Both	Most important strategic partner, very close ties	Heilongjiang Jilin	Medium conflict, medium cooperation
Tumen River (China, North Korea, Russia) development	Border river	Medium, low, navigation	Both	Strategic partners, close ties	Jilin	Joint
Kherlen River (China, Mongolia)	Cross-border, China			downstream	Medium, low	Proactive
Strategic partners, close ties	Inner Mongolia	Little interaction				

PLA: People's Liberation Army; XPCC: Xinjiang Production and Construction Corps